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Table of Contents i

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Clinical Review and Management of Oral Potentially Malignant Disorders with Epithelial Dysplasia

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Abstract

Background: Oral potentially malignant disorders (OPMDs) comprise any disorders, tumors, in addition to any microscopic alterations that have a risk of malignant development of cancers of the mouth. When epithelial dysplasia is detected in an oral lesion, it is termed as a precancerous lesion. Finding: Several changes in the color or thickness of normal oral mucosa might be detected during the clinical diagnosis of the oral lesions. Leukoplakia of the oral cavity is a clinical name for one of the most predominant OPMDs of the oral mucosa. When comparing oral examination with naked eyes to planning to apply staining with special stain or using an image of optical fluorescence, the incidence of patients with oral epithelial dysplasia may rise, as well as the clearing of the lesion boundary. Increased size of more than 2cm2, the presence of colored regions with a red hue, the presence of lichenoid process characteristics, and severe epithelial dysplasia are all considered risk factors. One-third of premalignant lesions may progress to cancer, whereas the other two-thirds may stay stable or regress without progressing to malignancy. Conclusion: It is critical to research the patients' unique characteristics, which include psychological, genetic, dietary, and dental problems. When epithelial dysplasia is present in an oral lesion, it is termed a precancerous lesion. Oral potential malignant diseases with epithelial dysplasia may or may not develop into carcinoma and may or may not be recurrent.

Keywords: Malignant Lesions, Premalignancy, Epithelial Dysplasia, Carcinoma, Risk Factors

Introduction

Many authors have not confirmed the link between oral epithelial dysplasia with an elevated chance of carcinoma progression and the clinical assessment of premalignant lesions, despite the fact that grading systems of epithelial dysplasia in the oral cavity can be considered as predictors for the malignant transformation of premalignant lesions (Speight, 2007; Van der Waal, 2009).

Several studies stated that high grades of epithelial dysplasia of oral mucosa are related to a high tendency for the progression of carcinoma, and the oral epithelial dysplasia grading system is considered a good predictor for cancer (Warnakulasuriya et al., 2011; Cowan et al., 2001; and Mehanna et al., 2009).

There are studies showed that the malignant transformation rate is not related to the grading of oral epithelial dysplasia (Arduino et al., 2009; Holmstrup et al., 2006).

The most crucial consideration in detecting the presence of oral epithelial dysplasia with premalignant lesions is to define the possibility of cancer development. While in previous years, many researchers studied and interpreted possible factors that are related to the malignant transformation rate of some cases of oral leukoplakia and they are not focused on the relation with epithelial dysplasia. The clinical risk factors were included in patients with oral leukoplakia like persistent leukoplakia, nonsmokers, and female patients, site and size of the lesions, homogeneity of the lesion surface, presence of candida, and dysplasia of the oral epithelium (Van der Waal, 2009).

Some authors showed different opinions about the risk factors and their relationship to malignant transformation, and they considered the oral epithelial dysplasia of leukoplakia lesions to not risk indicators, in addition to other variables such as smoking, alcohol use, age, gender, and others that were considered to be independent risk factors for malignant transformation (Liu et al., 2012; Dost et al., 2014).

In 2006, Holmstrup et al stated in their study that only the nonhomogeneous surface of oral leukoplakia factor and the increased size of the lesions were related to malignant transformation (Holmstrup et al., 2006).

Other researchers presented that leukoplakia lesions with nonhomogeneous surfaces have an increased malignant development and nonsmoking patients with lesions on the lateral surface of the tongue are highly predisposed to malignant transformation (Ho et al., 2012).

Several researchers have shown that oral leukoplakia lesions on the floor of the mouth and the lateral surface of the tongue have a high incidence of epithelial dysplasia and malignant transformation (Warnakulasuriya et al., 2011; Jeong et al., 2012; Ho et al., 2012; Dost et al., 2014).

In the South Asian areas, there is a higher incidence of cancer development of the lesions of oral leukoplakia on the buccal mucosa in general than in other areas due to the chewing of betel/areca nuts as a widespread habit in these countries (Shiu et al., 2000).

Discussion

Malignancy is a series of complex process, but not only changes in the epithelial cells. In terms of dysplasia of the oral mucosal epithelium and its relationship to the risk of carcinoma progression, several studies have concluded that the severity of oral epithelial dysplasia cannot be utilized as a predictor factor for the carcinoma (Holmstrup et al., 2006; Edwards, 2014; Mogedas-Vegara et al., 2015; Speight et al., 2018). While other authors state that the malignant transformation of premalignant disorders can be detected by studying the severity of epithelial dysplasia (Bouquot et al., 2006; Wang et al., 2014).

The lesion with a different histological grade of dysplasia may or may not progress to carcinoma, or may regress or remain stable without any changes (Edwards, 2014; Holmstrup et al., 2007).

The malignant transformation can occur as a result of the invasion of the connective tissue without any confirmation of dysplasia in the superficial oral epithelial mucosa (Edwards, 2014).

Many studies have shown that different components can be predisposed factors that result in malignant transformation in the lesion with dysplasia, such as hereditary changes or behavioral components (Garnis et al., 2009; Zhang et al., 2012), nutritional deficiencies (Güneri et al., 2005; Chainani et al., 2011), state of bad oral hygiene (Güneri et al., 2005; Rosenquist et al., 2005), presence of candida (Gorsky and Epstein, 2011; Khanal et al., 2018), inflammatory factors of the body (Sun et al., 2016; Sano et al., 2018), using of certain drugs which have

an effect on the functional processes of the epithelial cells and the immune response of the host or systemic diseases (Hirai et al., 2017; Zamoiski et al., 2017) and consumption of tobacco and alcohol (Hashibe et al., 2018) Therefore, the malignant changes that may be occurred within the epithelial cells and their neighboring areas lead to changes in connective tissue in addition to immunity disturbances that can be considered as critical predisposing factors in the etiology of malignancy (Raj et al., 2019).

It is more important to define and study which patients have precancerous conditions rather than to define and study the lesion itself, as carcinogenesis is a multistep process in which more than one etiology is shared in these malignant changes, and the transformative nature of the oral epithelial cells is also complicated and unpredictable. After defining and studying these different steps of the oral epithelial cells from the normal to malignant condition, this will help us define the status of patients with precancerous lesions in detail in addition to the correct pathway of management (Edwards, 2014; Speight et al., 2018; Rosenquist et al., 2005; Mello et al., 2018; Epstein et al., 2007; and Zhang et al., 2016).

The size and location of lesions can be defined according to the severity of oral epithelial dysplasia in potentially malignant disorders (Edwards, 2014; Speight et al., 2018; Epstein et al., 2007), as well as other clinical characteristics such as age (Speight et al., 2018), the state of the patients' general health, and aspects that can complicate the patients' follow-up. Advances in malignancy may occur in moderate dysplastic lesions or even non-dysplastic lesions, according to Speight et al. Therefore, any abnormality in the oral cavity should be followed up on so that the proper intervention can be established to prevent the malignant mutation (Gong et al, 2015).

These factors include the function of the risk of malignant transformation and the determination of effective treatments. These factors include the function of the host immune system, the microenvironment of the tissue and the patient's habits, and nutritional deficiencies. So, it is important to change the usual attention to the malignant transformation of the lesion toward studying the characteristic features of the patients, which include psychological, genetic, and nutritional conditions (Gong et al, 2015).

The term "high-risk patient" can be used to refer to patients with a family history of carcinogenesis, different systemic diseases, tobacco use and alcohol consumption, nutritional deficiencies, and poor oral hygiene who need to be examined with all these characteristics completely. Some biomarkers can be used to detect different grades of dysplasia within the lesion that help us in the evaluation of malignant transformation, such as (LOR, EGFR, and mTOR) with repeated follow-up of the patients.

The high-risk patients may have lesions with mild dysplasia that may be treated with treatment approaches for moderate or severe dysplastic lesions when compared to similar lesions which are presented in a "low-risk patient". To determine the appropriate treatments and controlling of oral potentially malignant disorders in the future, new approaches that depend on the molecular changes of epithelial cells should be established.

Conclusion

It is very important to study the characteristic features of the patients which are including psychological, genetic, nutritional, and oral conditions. The existence of oral epithelial dysplasia in the lesion is considered a precancerous lesion. The possibly malignant lesions with oral epithelial dysplasia may or may not progress to carcinoma or may regress or remains stable without any changes.

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Ultrasound Guided Brachiocephalic Vein Cannulation using Supraclavicular Approach

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Abstract
The need of central vein cannulation has been increased since the increased case of critical patients and patients underwent high-risk patients. Supraclavicular approach of central vein cannulation is an alternative approach to central vein cannulation due to fewer anatomical variance, good longitudinal vein view, better visualization of needle during procedure, clear demarcation of landmarks, larger target area, better patient comfort, and fewer complications. This case study presents an ultrasound guided central vein cannulation using supraclavicular approach in 30 year old male patient diagnosed with septic shock, anemia, trombcytopenia, and electrolyte imbalance post laparotomy. The indication of central vein cannulation in the patient was to deliver volume resuscitation, to provide emergency vein access, to provide nutritional support, to deliver chemically caustic agents, and central vein pressure monitoring.

Keywords: Central Vein Cannulation, Complication, Critical Care, Supraclavicular Approach, Brachiocephalic Vein

1. Introduction

Fast and secure access to central vein circulation is one of the most essential interventions in critical care. The need of central vein cannulation has been increasing steadily as patients in critical state or patients whom underwent high risk operastion rise. Central vein cannulation has several goals: (1) to perform fluid resuscitation, (2) to monitor central vein pressure, (3) to collect routine blood sampling, (4) to provide access for transvenous pacing, (5) to provide hemodyalisis access route, (6) to deliver continuous administration of inotropes and hypertonic fluids.

Central vein cannulation is routinely performed in internal juguar vein, subclavian vein, femoralis vein, or peripherally from basilic vein. Choosing the site of insertion had direct correlation with cannulation success rate. Various catheter placement has been developed with both risk and benefit, and varying success rates. (Turcotte et al., 2006; *Colomb Med*, n.d.)

Percutaneous cannulation to subclavian vein using subclavian approach has been described throroughly, as the approach is associated with several complications such as unintended arterial puncture, pneumothorax, and hemothorax which contributes to morbidity and mortality. Supraclavicular approach was first reported in 1965 with more notifiable benefit compared to infraclavicular approach. Supraclavicular approach was less often performed due to concern of unintended injury and complication such as unintended puncture to thoracic cavity, direct puncture damage to important structure, and several barriers making it harder to identify anatomical landmarks, predict angle of insertion, and expected needle track contributing to failure rate. (Hind et al., 2003; Tomar et al., 2013)

In this case study, we presented a case of central vein cannulation through brachiocephalic vein using supraclavicular approach and literature review which covered indication, contraindication, and its comparison to other approaches.

2. Case Report

A 30-year-old male was admitted to emergency department diagnosed with septic shock, anemia, thrombocytopenia, hypoalbuminemia. He had history of ileal resection, double barrel ileostoma, and adhesiolysis due to complete ileal obstruction. He was in critical state and was given midazolam 3mg/hour for sedation. Blood pressure was 118/65 mmHg supported by norepinephrine 0,1mcg/kg/min, heart rate of 108 times/minute and respiratory rate of 20-24 times/min. He was on ventilator. Peripheral oxygen saturation was 99%. He was anemic and thrombocytopenic, with normal coagulation factors (table 1). His chest x-ray was clear with cardiomegaly without signs of congestion (figure 1).

Table 1: Routine blood panel result

Parameter	Result
Hemoglobin	10,3 gr/dL
Thrombocyte	51.000 cell/dL
PT / APTT	14"/ 38,3"
INR	1,28
Albumin	1,63 gr/dL
Kalium	5,1 mEq/L
Lactate	5,0mg/dL
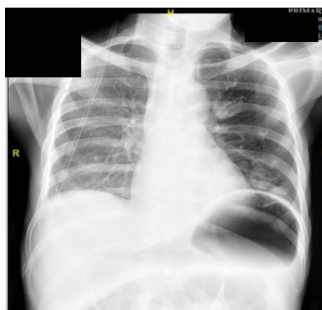
Figure 1: Chest X-ray

Cannulation of brachiocephalic venin using supraclavicular approach was performed due to collapsed internal jugular vein. Indication of central vein cannulation in the patient was: (1) to provide emergency vein access, volume resuscitates, and blood transfusion (2) to provide access for albumin correction using 100 ml of 20% albumin fluid, (3) to provide access for nutritional support, and (4) to monitor central vein pressure.

3. Discussion

Central vein cannulation in patient with a critical state is a life-saving procedure to provide access for volume resuscitate, drug deliver, rapid electrolyte correction, and monitoring central vein pressure. Central vein cannulation can be performed throug internal jugularis vein (IJV), femoral vein (FV), dan subclavian vein (SV).

Percutaneous puncture to the IJV can be performed anteriorly, centrally, or posteriorly. Central approach is the most common. Cannulation was performed with a percutaneous puncture in the superior triangular area, 45o from the coronal plane, aimed to the sagital plane. (Hind et al., 2003; *Colomb Med*, n.d.)

FV cannulation is an alternative in intubated and when chest compression is performed to provide fast venous access. Cannulation was performed in the superior anterior aspect of the thigh, directly under the inguinal ligament. Anatomically, femoral artery divides the inguinal ligament into two segments, medially and laterally. Vein puncture was performed 1 cm medially from the maximal palpable impulse of the femoral artery (*Colomb Med*, n.d.).

SV cannulation was performed commonly using subclavicular and supraclavicular approaches. Supraclavicular approach uses junction of lateral clavicle to the strenocleidomastoid muscle clavicular head. The puncture was performed 1 cm superolaterally from the junction. The needle was inserted at 5-15o angle and proceeded to an imaginary line that divided the claviculosternomastoid angle into two. Central vein puncture was perfomed between the clavicle and the anterior scalene muscle (*Colomb Med*, n.d.). Supraclavicular approach in brachiocephalic cannulation was performed in sterial manner using seldinger technique. The patient was put into trendelenburg (-30o) using blanket rolls and the head was tilted to the opposite side of the cannulation. (figure 2). Portable ultrasound was used with 12Hz linear and 8 Hz microconvex probe. 2D doppler study showed color/flow in IJV, SV, and brachiocephalic vein to assess anatomical features, size of the vein, and its permeability.

To visualize brachiocephalic vein, IJV and carotid artery were first found and identified, and the probe was advanced caudally alongside with IJV into the supraclavicular fossa. The probe may be tilted anteriorly to better provide visualization of SV and brachiocephalic vein at its long axis (figure 3).

To assess safety of the needle path, subclavian artery, subclavian vein, and brachiocephalic vein must be identified using tilt manouver. Pleural line was also identified and aortic arch was important to be considered when insertion of brachiocephalic vein was performed from the left side. Skin was punctured using introducer and a wire was placed carefully after confirmed central vein cannulation has been established. Placement of cannulation alongside the wire path can be performed as routine care (MacDonnell et al., 1992).
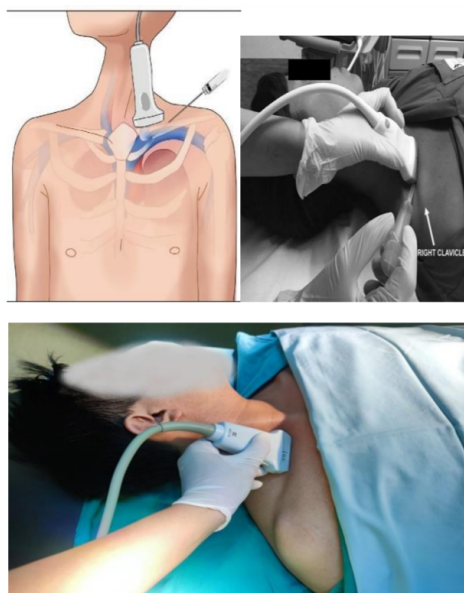
Figure 2: Ultrasound probe positioning and needle path in the supraclavicular approach.

(MacDonnell et al., 1992)
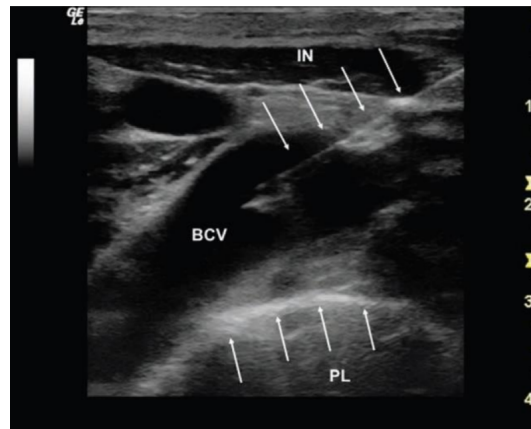
Figure 3: *longitudinal view* BCV *in-plane approach*. (IN, inserted needle, IN; pleural line, PL)

Several reason has made supraclavicular approach is more common than infaclavicular approach were a more commonly identified structure (clavi-sternocleidomastoid angle), more superficial vein location, larger target area, and more direct access to the subclavian vein. The site was lesser corelated to lung complications (table 2) with better success rate (table 3).

Table 2: Success rate and complication of central vein cannulation. (3)

	Supra-klavikula	IJV	Sub-klavikula	Femoral
Arterial puncture	0,8-3,36	6,3-9,1	3,1-4,9	9,0-15,0
Hema-toma	Not applicable	<0,1-2,2	1,2-2,1	9,0-15,0
Hemo-thorax	Not applicable	Tidak tersedia	0,1-0,6	Not applicable
Pneumo-thorax	0,48-0,56	<0,1-0,2	1,5-3,1	Not applicable
Thrombo-sis	Not applicable	7,6	1,9	21,5

Table 3: Morbidity rate and transfusion rate along with it's associated approach. (Tomar et al., 2013)

Supraklavikula (Czarnik dkk.)[6]		Supra-clavicular	Infra-clavicula	Jugular interna
Complication rate	1,7% (0,6-3,6)	0,56-2%	1-10%	1-5%
Success rate	92% (88,7-94,6)	74-98%	80-95%	90-99%

4. Conclusion

Ultrasound guidance has been reported to increase safety during IJV, FV, and SV cannulation. While ultrasound contributes directly to CVC placement, ultrasound machine is not always present. Anatomic landmark approach

is essential while inserting the central vein catheter. Supraclavicular approach is considered safe for use. Until now, there was no better approach zoom capacity in the operator room MRI.

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Anesthetic Management in Patient with Suspected Brain Abscess, Atrium Septal Defect, and Eisenmenger Syndrome

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Abstract
Introduction: Patients with congenital heart disease especially with systemic shunting between systemic and pulmonary circulation often develop pulmonary hypertension and left-to-right shunt (Eisenmenger syndrome) if left untreated. These patients are at risk of developing spontaneous brain abscess due to brain infarction caused by polycythemia, impaired immune function, and loss of lung phagocytosis. Such patients were often admitted to the emergency room with signs of increased intracranial pressure (ICP), and needed specific consideration during surgery. Case: a 31-year old female diagnosed with intracranial space occupying lesion (SOL) due to suspected brain abscess with concurrent heart defects (atrial septal defect / ASD and Eisenmenger syndrome) was consulted to the operating theatre for emergency burrhole aspiration. The surgery was performed for an hour and the postoperatively the patient was admitted to the intensive care unit (ICU). Conclusion: perioperative management of patients with brain abscess and concurrent ASD and Eisenmenger syndrome consists of preoperative management, methods of anesthesia, monitoring, and interventions to prevent the worsening of left-to-right shunt and increasing intracranial pressure. These managements consist of optimal pain management, perioperative oxygen therapy, and prevention of precipitating factor that increases left-to-right shunting.

Keywords: Neuroanesthesia, Intracranial, Space Occupying Lesion, Eisenmenger Syndrome

1. Introduction

Patients with congenital heart defects, especially heart defects with systemic and pulmonary shunts often develop pulmonary hypertension and reverse right-to-left shunts, known as Eisenmenger syndrome. Such patients have an increased risk for developing intracerebral abscesses due to infectious processes that spread hematogenically (most common from the pulmonary circulation) or trauma (Effendi, 2018).

Cyanotic congenital heart disease (CHD) has associated with more than 60% of cases of brain abscess. The incidence rate of brain abscess contributes to about 8% of intracranial masses in developing countries and 1-2%

in Western countries with varying clinical manifestations related to the size and location of the space-occupying lesion (SOL). Brain abscesses often cause increased ICP and have a significantly high morbidity and mortality rate (Atchabahian & Gupta, 2013; Bokhari & Mesfin, 2021).

Cyanotic CHD is characterized by a right-to-left intracardiac shunt that allows distribution of desaturated blood into the systemic circulation resulting in arterial hypoxemia (Raha et al., 2012). Eisenmenger syndrome is a complex pathophysiological condition that includes: (1) clinically significant cyanosis, (2) Intracardiac shunting of (ASD, ventricular septal defect / VSD, or aorticopulmonary anomaly), and (3) pulmonary hypertension due to irreversible elevation of pulmonary vascular resistance (PVR) (Arif et al., 2017). Eisenmenger syndrome occurs in more than 50% of adults with abnormal interventricular or aorticopulmonary communication, but only in 9% of patients with secundum ASD (Puri et al., 2011).

Patients with cyanotic CHD often to be at increased risk for cerebral abscess due to polycythemia-induced cerebral infarction, impaired immune function, and bypass of pulmonary phagocytosis (Hall et al., 2016). Cyanotic CHD accounts for nearly 13- 70% of all cases of brain abscess and usually, SOL with dimension >2 cm is indicated for surgical intervention (Hall et al., 2016; Raha et al., 2012). Patients with signs and symptoms of increased ICP should receive therapy to reduce ICP, and receive specific consideration when undergoing the surgery (Ozawa et al., 2018). Anesthesiologist should prevent increasing the ICP even further during preoperative, intraoperative, and postoperative periods (Pasternak & Lanier, 2018).

This case report presented a 31-year-old female diagnosed with supratentorial intracranial SOL at right frontoparietal region due to suspected brain abscess concurrent with ASD and Eisenmenger syndrome underwent burrhole aspiration.

2. Case Report

A 31-year-old female with body weight of 48 kg, diagnosed with supratentorial intracranial SOL at right frontoparietal region due to suspected brain abscess concurrent with ASD and Eisenmenger syndrome was consulted to the operating theatre for burrhole aspiration. She had history of left-sided hemiparesis, seizures, and fever. She had coexisting disease of CHD 2 years ago and history of laparotomy 3 years ago. She had received ceftriaxone 2x1gr IV, metronidazole 3x500mg IV, and gentamycin 2x100mg IV preoperatively.

Before the surgery, she was completely awake and aware with slight tachycardia and otherwise stable vital signs (blood pressure 122/87 mmHg, heart rate 110 beats per minute, respiration rate 24-28 breaths per minute, temperature 36,7°C, and oxygen saturation (SaO2) of 63-65% with oxygen 3 liter per minute via binasal cannula). Her lung examination was clear without additional abnormal breath sound, and a grade II cardiac murmur at atrial region. Her abdomen was normal with cool extremities, peripheral cyanosis, clubbing finger, and left-sided hemiparesis (motoric function one over five).

Her blood lab result was unremarkable with hemoglobin 16.1 g/dL, hematocrit 48.6%, leukocytes 8,540 cells/dL, platelets 221,000, normal PT, APTT, and INR. Urea 21 mg/dL, creatinine 0.55 mg/dL, normal liver function, blood sugar and electrolytes. Her blood gas analysis was acidotic (pH 7.327) with pO2 52.2 mmHg, pCO2 29.2 mmHg, HCO3 15.4, base excess -8.4, and SaO2 81.5.

Her echocardiography was performed preoperatively with signs of ASD and right-to left shunt. Her head CT scan showed hypodense lesion at right frontoparietal region with dimension of 3x3x3 cm, with perifocal edema and minimal midline shift (<5 mm to the left side).

Anesthetic risk assessment was considered an ASA III case. General anesthesia was planned for the patient. She has fasted for 6 hours preoperative, and monitoring was performed with ECG, blood pressure, heart rate, temperature, SaO2, and arterial line. Intravenous maintenance was given Ringer Lactate 100ml/hour. Preparation of vasoconstrictor agents was done to prevent worsening left-to-right shunt. Postoperatively, patient was planned to be admitted to the ICU.

Preinduction vital signs were normal (blood pressure 118/76 mmHg, heart rate 107 beats per minute, respiration rate 24 breaths per minute, temperature 36.8°C, and SaO2 65-68% with non-rebreathing mask and oxygen 10 liters per minute. The patient was positioned supine and preoxygenated with 100% oxygen. Induction achieved by administration of fentanyl 150 mcg, midazolam 5 mg, and rocuronium 50 mg. intubation was performed smoothly with a spiral ETT size 7.0 in one attempt. Anesthetic maintenance was achieved with sevoflurane 0.5-1 vol% in 50% inspired oxygen fraction.

Intraoperatively, the patient was stable vital signs of systolic blood pressure varying from 92-125 mmHg, diastolic blood pressure from 68-86 mmHg, heart rate varying 92-116 beats per minute, and SaO2 from 63-78%. The operation lasted for one hour, and her urine output was 50 ml per hour, with hemodynamic support norepinephrine 0.05-0.1 mcg/kgbw/minute. Postoperatively she regains complete consciousness with blood pressure 116/74 mmHg, heart rate 94 beats per minute, respiration 22 breaths per minute, and SaO2 68% with non-rebreathing mask and oxygen 10 liters per minute. Postoperative monitoring included vital signs, urine output, and signs of increased intracranial pressure. Postoperative analgesia was achieved with fentanyl 25 mcg/hour IV and paracetamol 1gr/6 hour IV. The patient was admitted to the ICU postoperatively.

Discussion

CHD is an acquired heart defect with varying clinical manifestations (mild to severe). Patients with mild CHD may exhibit no symptom and no abnormalities are found on clinical examination whereas in severe CHD, symptoms often appeared immediately since birth. CHD is divided into 2 groups, namely cyanotic CHD and non-cyanotic CHD, characterized by central cyanosis due to right-to-left shunts (for example tetralogy of Fallot, transposition of the great arteries, tricuspid atresia). Noncyanotic CHD were often found as a leakage of the heart septum accompanied by a left to right shunt including ventricular septal defects, atrial septal defects, or persistent patent blood vessel such as in persistent ductus arteriosus. In addition, non-cyanotic CHD was also found in ventricular outflow tract obstruction such as aortic stenosis, pulmonary stenosis and coarctation of the aorta.

Eisenmenger syndrome is a complication often occurs in non-cyanotic CHD marked by increased blood flow to the lungs. As a result, the pulmonary capillaries will react by increasing their resistance so that the pressure in the pulmonary artery and in the right ventricle may increase. If the pressure in the right ventricle exceeds the pressure in the left ventricle, an inverted shunt occurs from right-to-left so that the patient begins to be cyanotic (Djer & Madiyono, 2016). In patients with cyanotic CHD, veno-arterial blood flow in the heart causes recirculation of desaturated venous blood into the systemic circulation. This condition causes hypoxia in the systemic circulation and body tissues including the brain which may form necrotic areas that predispose to brain infection. Hypoxia also causes reactive polycythemia, increases blood viscosity and decreases cerebral blood flow which may worsen necrosis in the brain. Cerebral abscess formation in cyanotic CHD patients is also influenced by brain exposure to bacteremia often originated from pulmonary circulation due to bypassed pulmonary circulatory system. In addition, the heart defect itself predisposes to the formation of heart valve vegetation. Vegetative embolus may form which may enter the systemic circulation and embolize certain brain regions creating necrotic areas of the brain that can develop into a cerebral abscess (Ontoseno, 2004).

Anesthetic consideration in patients with cyanotic CHD begins with a thorough pre-anesthesia examination that documents their current cardiac and neurological status, previous surgeries, previous anesthetic management, complications, as well as current treatment. Consultation with the cardiology department, 2-dimensional (2D) echocardiography and assessment of the coagulation profile are required for the patient. Vomiting, fever, poor oral intake, and diuretics can lead to dehydration and a pre-existing increase in blood hyper viscosity. Prolonged preoperative fasting should be avoided and consumption of clear fluids up to 2 hours before surgery is recommended. Severe cyanotic patients with hematocrit 60% are at risk for coagulopathy, so phlebotomy can be performed before surgery (Lei, 2015).

Right-to-left shunt will cause poor pulmonary perfusion resulting in chronic hypoxemia and cyanosis. Compensatory mechanisms that follow include polycythemia, vasodilation, hyperventilation, and chronic respiratory alkalosis. Anesthesia problems that arise include perioperative hemodynamic instability, cyanotic spells, coagulation disorders due to polycythemia, paradoxical air embolism, fluid and acid-base imbalances,

congestive heart failure, prophylaxis of infective endocarditis (IE), and maintaining intracranial dynamics. Adequate hydration can help reduce increased blood viscosity, sludging and thromboembolic events.

Anesthesia management in patients with Eisenmenger syndrome undergoing noncardiac surgery is similar to anesthetic management in patients with other forms of severe pulmonary hypertension (Steppan & Maxwell, 2021). The two main principles of perioperative risk management are prevention of systemic hypotension and avoidance of increased PVR (PH crisis) (Nashat et al., 2017). By maintaining systemic vascular resistance (SVR) which is relatively higher to PVR, right-to-left shunts will be minimal. A sudden drop in oxygen saturation without a change in ventilation is considered an early sign of decreased systemic vascular resistance. Hypoxia, hypercarbia and acidosis can cause a significant increase in PVR. Therefore, hyper ventilation with 100% O2 without PEEP may reduce PVR.(Raha et al., 2012; Wajekar et al., 2015) Norepinephrine can help maintain systemic vascular resistance and epinephrine and/or vasopressin may also be used (Bennett, 2021; Lei, 2015). Ketamine as sole anesthetic induction is contraindicated in intracranial surgery and total intravenous anesthesia (TIVA) with fentanyl may be chosen for its cardiostability and short duration of action.

Early extubation can prevent an increase in PVR due to prolonged ventilation (Lei, 2015). Postoperative management includes intensive cardiac monitoring, oxygenation, appropriate analgesia, fluid management, and prophylaxis of vomiting and seizures (Raha et al., 2012; Wajekar et al., 2015). Patients should be normovolemic in the postoperative period and oral intake should be resumed as soon as possible. Pain control is essential to maintain adequate ventilation, but opioids must be administered with caution to avoid oversedation and hypoxia (Lei, 2015). Hypoventilation and hypoxemia, arrhythmias, and inadequate postoperative pain control can lead to exacerbation of the patient's shunt, which can lead to heart decompensation (Bennett, 2021).

Conclusion

The main goals of anesthetic management in patients with cerebral abscess with congenital heart disease with Eisenmenger syndrome are as follows: Maintaining adequate SVR. Good maintenance of intravascular volume, venous return, pain prevention, hypoxaemia, hypercarbia, and acidosis which can lead to an increase in pulmonary vascular resistance (PVR). Anesthesiologists should also prevent myocardial depression during general anesthesia and prevent increasing the ICP.

A well-executed general anesthetic with hemodynamic maintenance aimed at preventing the occurrence of worsening right-to-left heart shunts, and maintaining good intracranial pressure has a fairly good outcome in patients with suspected cerebral abscess with congenital heart disease ASD with Eisenmenger syndrome. Preparation for emergency events is always needed and done to reduce the morbidity and mortality of these cases.

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Chemical Compound of *Terminalia Catappa L.* as Hemostatic Agents in Post Tooth Extraction

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Abstract

Terminalia catappa L. is one of the herbal plants that contain flavonoids that play a role in wound healing including to bleeding after tooth extraction. The aim of our study was to identify the chemical compounds contained in *Terminalia catappa L.* leaves. This type of research was experimental. The sample in this study was the leaves of *Terminalia catappa* number 3-6 from the base, at a tree height of 6 meters picked as much as 6 kilograms. Data analysis qualitatively and quantitatively. The highest content in ethanol extract of *Terminalia catappa L* of *saponins* and *alkaloids* were fractioned with distilled water and the lowest content were fractioned with hexane. Meanwhile distilled water is also used to fractioned the highest content of *tannins* and *phenol.* While *ethyl acetate* was used to fractioned the lowest content of tannins and the highest content of *flavonoi*d. The lowest *flavonoid* in distilled water extract was fractioned using hexane. For the lowest content of phenol was fractioned using hexane. The results show the highest content of saponins is 3,787.80 mg/100g, the lowest is 166.67 mg/100g. The highest content of Alkaloids is 1,798.57 mg/100g, and the lowest is 576.80 mg/100g. The highest content of tannins is 53,140.72 mg/100g, the lowest is 8,391,803 mg/100g. The highest content of flavonoids is 2,5964.14 mg/100g, the lowest flavonoid is 462.84 mg/100g. The highest content of phenol 29,968.05 mg/100g, the lowest is 225.46 mg/100g. The highest antioxidant activity with AAI (Antioxidant Activity Index) obtains value of 0.36. This shows the moderate antioxidant ability. *Terminalia catappa L.* contain *saponins, alkaloids, tannins*, *flavonoids*, and *triterpenoids.* The active compound of *Terminalia catappa L* will generally be produced optimally if a polar solvent is used.

Keywords: *Terminalia Catappa L.*, Hemostatic, Tooth Extraction

1. Introduction

Tooth extraction is a common practice in dentistry. The act of tooth extraction can interfere with various complications, such as bleeding or also recognized as post-extraction bleeding (PEB). Post-extraction bleeding happens beyond 8 – 12 hours after dental extraction(Nagraj et al., 2018). Bleeding is indicated by broken blood vessels (arteries, veins or capillaries) due to trauma, which can occur in external or internal blood vessels. Complications that may occur during tooth extraction are bleeding, fracture (crown, root, mandible), dry socket,

swelling, mandibular dislocation, shock, and several other complications. Wound healing is a complex process because there are many different cell interactions with cytokine mediators and the extracellular matrix. The wound healing process is divided into 4 continuous and overlapping phases, namely hemostasis, inflammation, proliferation, and remodeling or maturation phases(Gonzalez et al., 2016).

Traditional medicine is one of the alternative treatments that people choose to treat wounds. Herbal medicine has attracted interest from 80% people worldwide by using it as part of primary healthcare(Ekor, 2014). The reasons for safety and originated from nature become the consideration of people using herbal medicine. In line with the global use of herbal medicine, the concerns of its safety have come into account. The safety of the medicine includes the content inside the herbal medicine itself. However, herbal medicine has become common in its lacking quality control and insufficient knowledge of the herbal medicine towards people. So it is essential to study the information of the herbal medicine for a better understanding of the risks that may associate with the herbal medicine used(Raynor et al., 2011).

One natural ingredient that is often used for healing wounds is the extracts from *Terminalia catappa L.* as they contain flavonoid compounds that can accelerate wound healing. *Terminalia catappa L.* or Indian almonds has become the alternative for the healing of a wound. *Terminalia catappa L.* is proven 97% succeed in reducing the wound area of a mice compared to betadine which is only 81%(Khan et al., 2014) and confirmed by (Nugroho et al., 2019) that reveals *Terminalia catappa L.* is working better than Povidone-iodine in wound healing. Our aim of research was to identify the chemical compounds in *Terminalia catappa L.* with quantitative and qualitative analysis based on the experimental work.

2. Method

The type of research is an experiment in a laboratory with qualitative and quantitative measurement designs. This research has obtained ethical clearance from the Health Research Ethics Commission, Poltekkes Kemenkes Denpasar, Bali, number LB.02.03/EA/KEPK/0598/2021. The experimental steps in this research are as follows:

1 Making Simplisia

Terminalia catappa L. taken were mature leaves because the older the leaves affect the content of secondary metabolites. The leaves are dark green, then the leaves were washed under running water. Next, *Terminalia catappa L.* was chopped into smaller pieces. In this study, drying was carried out using an oven at 50ºC for 24 hours. After the leaves are dry, the *Terminalia catappa L.*simplisia is made by blending the dried *Terminalia catappa L. Terminalia catappa L.*that have been blended were sieved through a 60 mesh sieve.

2. Preparation of Ethanol and Distilled Water/Aquades Extract

The powder of *Terminalia catappa L.* leaves was then macerated with ethanol and aquades (with a ratio of 1:5) for 3 days (72 hours) at room temperature (20–25) ºC. Maceration is an extraction step, which a process of soaking the ingredients (sample) is using a solvent that is suitable for the active compound to be taken with low heating or without a heating process. Maceration is a process of extracting or withdrawing active compounds based on differences in the polarity of the active compounds in the extract.

The filtrate was obtained by filtering with Whatman No.1 filter paper (Muhammad & Mudi, 2011; Filho et al., 2017). The pulp obtained was then macerated again with 1000 ml of ethanol 2 times. The obtained filtrate was combined and then evaporated using a vacuum fotary evaporator (Iwaki, Japan) at a temperature of 40ºC. The evaporation results obtained crude extract of *Terminalia catappa L.* ethanol and crude extract of distilled water of *Terminalia catappa L.* The crude extract obtained in the form of a paste is assumed to be at a concentration of 100%.

Ethanol is a universal solvent that can attract polar compounds (polar -OH group) and non-polar (CH_2-CH_3) groups so that it can attract some of the active compounds contained in both polar and non-polar plants. The macerate obtained was filtered and the solvent was evaporated using a rotary evaporator(Bahrin et al., 2018). The purpose

of using a rotary evaporator is that to evaporate the solvent at low temperatures with the help of a vacuum so that the extract is not damaged by high temperatures(Santoso et al., 2021).

3. Extract Fractionation

The extraction process may use three types of solvents with different polarity levels. Polarity or polarity is the separation of electric charges leading to molecules or chemical groups having an electric moment. Polar molecules contain polar chemical bonds based on the electronegativity between the bonded atoms. Atoms have the power to attract electrons. Electronegativity is the amount of "pull" an atom exerts on an electron. With regard to the polarity of the solvent, there are three classes of solvents (Kopeliovich, 2017; Abarca-vargas et al., 2016):

a. Polar

Polar solvent has a high degree of polarity, suitable for extracting polar compounds from plants. Polar solvents tend to be universally used because though they are polar, they can still extract compounds with lower polarity levels. Examples of polar solvents are: water, methanol, ethanol, acetic acid.

b. Semi-polar

Semi-polar solvents have a lower level of polarity than polar solvents. This solvent is good for obtaining semi-polar compounds from plants. Some of semi-polar solvents are: acetone, ethyl acetate, chloroform

c. Non-polar

Non-polar solvent is almost completely non-polar. This solvent is good for extracting compounds that are completely insoluble in polar solvent. This compound is good for extracting various types of oil. Some of the examples are hexane and ether.

Fractionation is the process of separating the components in an extract based on their level of polarity i.e. separating the fractions for polar, semi-polar and nonpolar compounds. The purpose of fractionation is to separate the components of the active compound from the resulting extract (Purwaningsih et al., 2020). In this study, the polar solvent for the fractionation used water, while for semi-polar solvent used ethyl acetate; and a non-polar solvent with hexane.

The thick ethanol extract or distilled water extract (coarse extract) of *Terminalia catappa L.* was then partitioned using methanol, ethyl acetate, and hexane, with a composition of 4 mg crude extract and 200 ml ethanol and 200 ml hexane. First, the mixture was shaken in a separating funnel so that it was evenly mixed. Then it was allowed to stand for a while until the separation between the ethanol phase and the hexane phase was seen. The two phases were separated and the solvent in each phase was evaporated in a vacuum rotary evaporator to obtain an extract of the ethanol phase and the hexane phase. The ethanol extract, hexane fraction and ethyl acetate fraction of *Terminalia catappa L.* leaves obtained were then examined. (Herli & Wardaniati, 2019).

4. Phytochemical Testing

The phytochemical testing was conducted following the testing and color change in (Herli & Wardaniati, 2019).

a. Alkaloid

The sample was added with chloroform and ammonia, left for ± 5 minutes. Subsequently, H_2SO_4 2M was added. Then, it was shaked until 2 layers of acid are formed. The acid layer was put in 3 test tubes and each of the Mayer, Wagner and Dragendrof reagents was added. Positive results were indicated by the formation of a white precipitate on the Mayer reagent, a brown precipitate on the Wagner reagent and an orange precipitate on the Dragendrof reagent.

b. Flavonoid Test

In flavonoid test, the samples were heated for ± 5 minutes and added concentrated HCl and 2 small pieces of Mg. The reaction is said to be positive if there is a red color change to orange. A few isolates were dissolved in ethanol then added 10% NaOH reagent, the reaction is positive if there is a specific color change.

c. Triterpenoid and steroid testing

The samples were added with chloroform, anhydrous acetic acid and concentrated sulfuric acid. Positive results formed orange/purple color for triterpenoids and green color for steroids.

d. Saponin Test

Samples were heated for ± 5 minutes, cooled and shaken. A positive result for the formation of stable foam/foam that does not disappear for 2-3 minutes indicates the presence of saponins.

e. Tannins Testing

The samples have added a solution of $FeCl_3$ 1% and HCl 2 M. With a solution of $FeCl_3$ 1%, there will be a color change to green-black, whereas with HCl 2 M will be indicated by a color change to red.

5. Quantitative Examination

Measurement of chemical substances contained in *Terminalia catappa L.* leaves was carried out in the laboratory of the Faculty of Food Technology, Udayana University and the Laboratory of Agricultural Analysis, Faculty of Agriculture, Warmadewa University. The phytochemical test procedure was as follows:

a. Total phenol

Determination of total phenol was performed using the Folin–Ciocalteau method. A total of 0.01 g of extract was diluted into 5 ml of citrate phosphate buffer according to treatment. A sample of 0.1 ml was pipetted and 0.3 ml of 70% ethanol was added. After that, 0.4 ml of Folinciaocalteau was added and incubated for 6 minutes. After the incubation process, 4.2 ml of 5% Na_2CO_3 was added and then vortexed and incubated for 90 minutes. The absorbance was read at a wavelength of 760 nm. The readings are compared with a standard curve made using gallic acid. Calculation of total phenol is calculated using the following equation (1).

$$\text{Total phenol} \left(\frac{\text{mg GAE}}{\text{g extract}}\right) = \frac{C \times V \times FP}{W} \tag{1}$$

Where C is the sample concentration from linear regression (mg/L); FP is Dilution factor; V is sample volume (L) and W is sample weight (g).

b. Total flavonoids

Determination of total flavonoids using a spectrophotometer with the $AlCl_3$ method refers to (Singh, Verma, & Singh, 2012). A total of 0.01 g of extract was diluted into 5 ml of citrate phosphate buffer according to treatment. A total of 1 ml of sample was mixed with 4 ml of distilled water and added 0.3 ml of NaNO2 solution (10%). After that, it was incubated for 5 minutes and added 0.3 ml of AlCl3 solution (10%) and 2 ml of NaOH solution (1%), then immediately tested with a spectrophotometer at a wavelength of 510 nm. The flavonoid concentration in the test sample was calculated as C x V x FP W 37 from the calibration standard prepared using the quercetin standard and expressed as quercetin equivalents in mg QE/g extract. The total flavonoid calculation is calculated using the equation (2).

$$\text{Total phenol} \left(\frac{\text{mg QE}}{\text{g extract}}\right) = \frac{C \times V \times FP}{W} \tag{2}$$

c. Total tannin

Determination of total tannin extract was analyzed using the Folin-Denis method. A total of 0.01 g of extract was diluted into 5 ml of citrate phosphate buffer according to treatment. The sample that has been diluted in a pipette is 0.25 ml, then 0.25 ml of Folin-Denis reagent is added, then vortexed and 2 ml of 5% Na_2CO_3 is added. The solution was vortexed and then incubated for 30 minutes. The absorbance was measured using a spectrophotometer at a wavelength of 725 nm. The readings were compared with a standard curve using tannic acid. The total tannin in the sample was expressed as the equivalent of tannic acid in mg TAE/g extract. Total tannins were calculated using equation (3).

$$\text{Total phenol} \left(\frac{\text{mg TAE}}{\text{g extract}} \right) = \frac{C \times V \times FP}{W} \tag{3}$$

d. Test for saponin content

The test for saponin content was weighed 100 mg of the sample and added 2 ml of 25% H_2SO_4. Then it was autoclaved for 120 minutes, at 110°C. Next, it was extracted with ether and then dried the filtrate. Then 1 ml of water was added and vortex extraction for 5 minutes. Add 50 µl of anisaldehyde, shake and let stand for 10 minutes. Add 2 ml of 50% sulfuric acid and heat with a water bath at 60°C for 10 minutes. Then add water to a volume of 10 ml with a measuring flask. It was diluted 10 times and read the absorption at a wavelength of 435 nm.

e. Determination of total alkaloid content

The total crude alkaloids were carried out by liquid-liquid extraction (LLE) method. The filtered extract was concentrated on a hotplate with constant stirring at a temperature of 50°C. The concentrated extract was added with 25 mL of 2% HCl and 25 mL of n-hexane. Then extracted in a 250 mL separating funnel (Pyrex). The hydrochloric acid extract was added with 35% w/w ammonium hydroxide to pH 9, added 25 mL of chloroform and extracted in a 250 mL separating funnel (Pyrex). The chloroform was given twice and evaporated to obtain total crude alkaloid solids.

f. Determination of antioxidant activity

The antioxidant activity was carried out using the DPPH method (1,1-diphenyl-2-picrylhydrazyl) in accordance to research by (Shah & Modi, 2016). A total of 1 ml of 0.1 mM DPPH solution in ethanol was dissolved with 2 ml of extract in a test tube. The solution was vortexed and incubated for 30 minutes in the dark at room temperature. The absorbance was read at a wavelength of 517 nm using a spectrophotometer. The blank used was ethanol. Controls were made according to the treatment given in the sample testing process but without adding a sample. The percentage of free radical scavenging ability (antioxidant activity) is calculated by equation (4).

$$\text{Antioxidant activity (\%)} = \frac{\text{Control absorbance} - \text{sample absorbance}}{\text{Control absorbance}} \times 100 \tag{4}$$

After testing the antioxidant activity, the IC_{50} testing was performed. IC_{50} is the sample concentration required to inhibit 50% of DPPH free radicals. The sample used is extract. The sample concentrations were varied from 0, 100, 200, 300, 400, and 500 mg/L, then the antioxidant activity was measured. IC_{50} value can be obtained by linear regression equation.

3. Results

1. Qualitative Analysis

The qualitative checks performed on all six chemical compounds of *Terminalia catappa L.* leaves that has been purified (fractionation). Based on the examination carried out in the laboratory, all *Terminalia catappa L.* leaves

can be identified as containing: saponins, alkaloids, tannins, flavonoids, and triterpenoids as shown in the Table 1.

Table 1: Results of Qualitative Analysis

Code Sample	Saponins	Alkaloid	Tannins	Flavonoid	Triter-penoid
Aquadest fraction of *Terminalia catappa L.* ethanol	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Aquadest fraction of *Terminalia catappa L.* aquadest	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Hexane fraction of *Terminalia catappa L.* ethanol	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Hexane fraction of *Terminalia catappa L.* aquadest	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	Positive (+)	Positive (+)	Positive (+)	Positive (+)	Positive (+)

2. Quantitative Analysis

Quantitative analysis of the chemical compounds of *Terminalia catappa L.* carried out in the laboratory were saponins, alkaloids, tannins, flavonoids, total phenols, and activity antioxidant. Quantitative examination was repeated three times *(Triplo).*

Table 2: Quantitative Analysis of Saponins (mg/100g)

Code Sample	Examination			Average
	1	2	3	
Aquadest fraction of *Terminalia catappa L.* aquadest	4.411.76	4.112.35	4.261.76	4.261.96
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	2.980.77	2,892.36	2,936.26	2,936.46
Hexane fraction of *Terminalia catappa L.* aquadest	190.48	143.06	166.47	**166.67**
Aquadest fraction of *Terminalia catappa L.* ethanol	4,117.65	3,458.14	3.787.60	**3,787.80**
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	1,137,44	2,105,46	1,621,15	1,621,35
Hexane fraction of *Terminalia catappa L.* ethanol	406,50	388,55	397,23	397,43

Table 2 shows the highest content of saponins is found in the ethanol extract of *Terminalia catappa L.*which is fractionated with aquadest/distilled water, i.e. 3,787.80 mg/100g. The lowest saponins were found in aquadest extract of *Terminalia catappa L* leaves which were fractionated with hexane, which was 166.67 mg/100g.

Table 3: Quantitative Analysis of Alkaloids (mg/100g)

Code	Examination			Average
Sample	1	2	3	
Aquadest fraction of *Terminalia catappa L.* aquadest	1,346.15	1,481.98	1,413.32	1,413.82
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	1,284.40	1,311.98	1,297.44	1,297.94
Hexane fraction of *Terminalia catappa L.* aquadest	636.36	517.74	576.30	**576.80**
Aquadest fraction of *Terminalia catappa L.* ethanol	1,636.36	1,961.28	1,798.07	**1,798.57**
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	1,203.70	1,346.65	1,274.43	1,274.93
Hexane fraction of *Terminalia catappa L.* ethanol	614.04	708.46	660.50	661.00

Table 3 shows the highest content of alkaloids is found in the ethanol extract of *Terminalia catappa L* leaves which is fractionated with aquadest, i.e. 1,798.57 mg/100g. While the lowest content of alkaloids is found in aquadest extract of *Terminalia catappa L* leaves which were fractionated with hexane, which was 576.80 mg/100g.

Table 4: Quantitative Analysis of Tannins (mg/100g)

Code	Examination			Average
Sample	1	2	3	
Aquadest fraction of *Terminalia catappa L.* aquadest	12,524.59	12,524.69	12,524.49	12,524.59
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	8,481,97	8,301,74	8,391,703	**8,391,803**
Hexane fraction of *Terminalia catappa L.* aquadest	10,711.48	10,154.20	10,432.69	10,432.79
Aquadest fraction of *Terminalia catappa L.* ethanol	53.303.04	52,978.51	53,140.62	**53,140.72**
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	17,795.81	17,682.29	17,738.90	17,739.0
Hexane fraction of *Terminalia catappa L.* ethanol	3,237.31	3,507.98	3,372.493	3,372.593

Table 4 indicates the highest content of tannins is in the ethanol extract of *Terminalia catappa L* leaves fractionated with aquadest, namely 53,140.72 mg/100g. Meanwhile, the lowest tannin content is found in aquadest extract of *Terminalia catappa L* leaves which were fractionated with ethyl acetate, which was 8,391,803 mg/100g.

Table 5: Quantitative Analysis of Flavonoids (mg/100g)

Code	Examination			Average
Sample	1	2	3	
Aquadest fraction of *Terminalia catappa L.* aquadest	789.17	826.77	820.31	812.08
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	1122.45	1,413,27	1,357,14	1,297,62
Hexane fraction of *Terminalia catappa L.* aquadest	417,38	440,00	531,14	**462,84**
Aquadest fraction of *Terminalia catappa L.* ethanol	13,390,11	12,651.18	12,764.82	1,2935,37
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	24,751.55	26,614.91	26,525.97	**2,5964.14**

| Hexane fraction of *Terminalia catappa L.* ethanol | 13,768.32 | 14,363.55 | 13,024,96 | 1,3718.94 |

Table 5 shows the highest content of flavonoids is in the ethanol extract of *Terminalia catappa L.* leaves which was fractionated with ethyl acetate, i.e. 2,5964.14 mg/100g. While the lowest content of flavonoids is aquadest extract of *Terminalia catappa L* leaves which was fractionated with hexane, in amount of 462.84 mg/100g.

Table 6: Quantitative Analysis of Total Phenol (mg/100g)

Code Sample	Examination			Average
	1	2	3	
Aquadest fraction of *Terminalia catappa L.* aquadest	895.84	850.96	961.97	902.92
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	351, 32	272.81	326.23	316.79
Hexane fraction of *Terminalia catappa L.* aquadest	197.42	209.16	269.8	**225.46**
Aquadest fraction of *Terminalia catappa L.* ethanol	31.706.51	28.232.18	29.965.46	**29.968.05**
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	7,422.73	6,401.26	8,499.45	7,441.15
Hexane fraction of *Terminalia catappa L.* ethanol	1,291.32	1,345.38	1,122.80	1,253.17

Table 6 shows the highest content of total phenol is in the ethanol extract of *Terminalia catappa L.* leaves which was fractionated with distilled water. , which is 29,968.05 mg/100g. Meanwhile, the lowest content of total phenol is found in distilled water extract of *Terminalia catappa L.* leaves which was fractionated with hexane, in as much as 225.46 mg/100g.

Table 7: Antioxidant Activity

Code Sample	Activity (%) ppm				IC50		
	1	2	3	Average	ppm	AAI	Information
Aquadest fraction of *Terminalia catappa L.* aquadest	14.47	14.44	14.51	14.47	1.987.01	0.02	Very weak
Ethyl acetate fraction of *Terminalia catappa L.* aquadest	10.59	10.44	10.57	10.53	2.605.49	0.02	Very weak
Hexane fraction of *Terminalia catappa L.* aquadest	11.76	11.86	11.86	11.81	2,531.11	0, 02	Very weak
Aquadest fraction of *Terminalia catappa L.* ethanol	95.74	95.71	95.77	95.74	110.37	0.36	Moderate
Ethyl acetate fraction of *Terminalia catappa L.* ethanol	25.18	25.99	25.64	25.60	2.115.16	0.02	Very weak
Hexane fraction of *Terminalia catappa L.* ethanol	25.18	25.99	25.64	25.60	2.115.16	0.02	Very weak

Table 7 shows the highest antioxidant activity with AAI (Antioxidant Activity Index) value is 0.36. It is derived from the ethanol extract of *Terminalia catappa L.* leaves which is fractionated with aquadest. The number shows moderate antioxidant ability.

4. Discussion

Our study shows that the whole extract fraction of *Terminalia catappa L*. leaves could be identified as containing: saponins, alkaloids, tannins, flavonoids, triterpenoids, and phenols. The results of this study are in accordance with the opinion of (Muthulakshmi & Neelanarayanan, 2021) that *Terminalia catappa L*. leaves are known to contain chemical compounds such as flavonoids, alkaloids, tannins, triterpenoids, steroids, resins, saponins, quinones, and phenolics(Etienne et al., 2017).. *Terminalia catappa L.* is known to contain medicinal compounds such as flavonoids (Lin et al., 2000; Tampemawa et al., 2016), triterpenoids (Gao et al., 2004; Mininel et al., 2014), tannins (Ola et al., 2020), alkaloids (Katiki et al., 2017), steroids (Babayi et al., 2004) and fatty acids (Janporn et al., 2014). The phytochemical test of crude extract of *Terminalia catappa L* leaves in this study was positive for the presence of saponins, tannins, terpenoids, alkaloids and flavonoids.

Table 2 shows the highest content is saponin contained in the ethanol extract of leaves of *Terminalia catappa L* that fractionated with aquadest, in 3787.80 mg/100g (3.78%). While the lowest content of saponins was found in distilled water extract of *Terminalia catappa L* leaves which was fractionated with hexane, which is 166.67 mg/100g (0.017%). The results of this study indicate that saponins in *Terminalia catappa L*. leaves can be produced optimally when using a polar solvent. Based on their polarity, ethanol and water are polar solvents(Abarca-vargas et al., 2016).

Table 3 shows the highest content of alkaloids found in the ethanol extract of ketapang leaves which were fractionated with aquadest, is 1,798.57 mg/100g (1.79%). While the lowest content of alkaloids is found in aquadest extract of *Terminalia catappa L.* leaves which were fractionated with hexane, in as much as 576.80 mg/100g (0.058%). The results of this study indicate that the alkaloids in the leaves of *Terminalia catappa L.* is able to be created optimally when using a polar solvent.

Table 4 shows the highest content of tannins in the ethanol extract of *Terminalia catappa L*. leaves which were fractionated with aquadest is 53,140.72 mg/100g (53.14%). While the lowest content of tannin was found in aquadest extract of *Terminalia catappa L.* leaves which were fractionated with ethyl acetate, which is 8,391,803 mg/100g (8,39%). The results of this study indicate that the tannins in *Terminalia catappa L*. leaves can be produced optimally when using a polar solvent. Meanwhile, the results of research by (Irawati & Nita, 2012) showed that the best tannin extraction was 12.45% with 85% ethanol as solvent. In this study no fractionation was carried out.

Table 5 shows the highest content of flavonoids is in the ethanol extract of *Terminalia catappa L.* leaves fractionated with ethyl acetate, namely 25,964.14 mg/100g (25.96%). While the lowest content of flavonoids is found in aquadest extract of *Terminalia catappa L.* leaves which was fractionated with hexane, resulting in 462.84 mg/100g (0.046%). The results of this study indicate that the flavonoids in *Terminalia catappa L.* leaves can be produced optimally when using a semi-polar solvent. Based on the polarity, ethyl acetate is a semi-polar solvent (Rahardjo et al., 2019). Tannins and flavonoids are thought to have effects as hemostatic agents/bleeding cessation(Sutopo et al., 2016; Nabavizadeh et al., 2016).

Table 6 shows that the highest content of total phenol is in the ethanol extract of *Terminalia catappa L*.leaves which was fractionated with aquadest, in amount of 29,968.05 mg/100g (29.96%). While the lowest content of total phenol is found in distilled water extract of *Terminalia catappa L*. leaves which was fractionated with hexane, in 225.46 mg/100g (0.022%). The results of this study indicate that the phenol in *Terminalia catappa L*. leaves can be produced optimally when using a polar solvent. Based on their polarity, ethanol and water are polar solvents(Abarca-vargas et al., 2016).

Based on the examination, the highest antioxidant activity with AAI value is 0.36. It is from the ethanol extract of *Terminalia catappa L*. leaves which was fractionated with aquadest. The number indicates a weak antioxidant ability (Punniyakotti et al., 2019). Likewise for the other fractions showed weak antioxidant ability. The antioxidant activity of *Terminalia catappa L*. leaves is greater than vitamin E. The AAI value was obtained from the concentration of DPPH used in the test (ppm) divided by the IC_{50} obtained (ppm). The value of AAI < 0.5 is

weak antioxidant, AAI > 0.5-1 is moderate antioxidant, AAI > 1-2 are strong antioxidants and AAI > 2 are very strong antioxidant (Vasi, 2012).

Conclusion

The evidences from this study points towards the idea that the leaves *Terminalia catappa L.* has proven contain saponins, alkaloids, tannins, flavonoids, and triterpenoids. The active compound of *Terminalia catappa L.* leaves will generally be produced optimally if a polar solvent is used. Besides, it is noted that *Terminalia catappa L.* leaves have weak antioxidant abilities.

Examination of chemical compounds in the laboratory requires special reagents. It is recommended for similar research to conduct a wider assessment to various universities and other laboratories.

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Sentul Fruit (*Sandoricum koetjape*) Peel as Anti-Inflammation for Gingivitis after Scaling

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Abstract

Various herbs are used as analgesic, anti-inflammatory, anti-bacterial, anti-fungal, expectorant, anti-plaque and odorant. Sentul is an edible fruit and is also used in traditional medicinal herbs which can treat diarrhea, relieve fever, and as an anthelmintic. Sentul bark methanol extract can inhibit the growth of fungus *Candida albican* by 39.65%. In addition, the ethyl acetate extract of the sentul leaves also has anti-bacterial activity. The aim of this study is to determine the effect of fractionation with different types of solvents on the phytochemical compounds of Sentul fruit peel in Bali province. This research is an experimental study in a laboratory with qualitative and quantitative analysis models of chemical compounds. This research was carried out from March to August 2021. The research location was carried out in the laboratory of the Faculty of Food Technology, Udayana University. Sample criteria was old Sentul peel, about 30 kilograms. Data was collected based on the results of examinations from the Laboratory of the Faculty of Food Technology, Udayana University which subsequently analyzed qualitatively and descriptively. From several phytochemical compounds, flavonoids, saponins and tannins are aromatic hydroxyl groups that act as antibacterial. Therefore, seen from the highest levels of flavonoids, saponins and tannins, aqua fraction of Sentul ethanol extract is the best treatment with flavanoid levels of 11476.16 mg/100g QE, tannins 88.605 mg/g and saponins 6.862 mg/g.

Keywords: Sentul Peel, Anti-Inflammation, Gingivitis

1. Introduction

The results of a national socio-economic survey in 2001 as many as 57.7% of the Indonesian population did self-medication without medical assistance, 31.2% of them used traditional medicinal plants 9.8% chose other traditional medicine methods (Agustiningsih et al., 2010). The advantages of herbal medicines compared to modern medicines are relatively low side effects and one plant has more than one pharmacological effect (Karimi, et al., 2015). Many types of herbs have been used and their use has been developed as analgesic, anti-inflammatory, anti-bacterial, anti-fungal, expectorant, anti-plaque and odor medicine. To increase the benefits of herbal medicines, selective purified extracts by observing effective compounds should be conducted and limit as small as possible the ballast substances involved (Zhang et al., 2018).

World Health Organization (WHO) reports that 10-15% of the world's population suffers from periodontal, 80% of teenagers suffer from gingivitis, while almost all of the adult population has suffered from gingivitis (Tanjaya & Auerkari, 2011). Gingivitis is an inflammation of the gingiva with swelling, redness, exudate and changes in the normal contour of the gingiva. Gingivitis is caused by the accumulation of bacteria in plaque, and plaque that accumulates in the mouth will mineralize to form tartar (Murakami et al., 2018). Tartar is a medium for the growth and proliferation of bacteria that can cause inflammation of the gums.

Several studies have shown that mouthwash can inhibit plaque formation and has been shown to reduce the severity of gingivitis (Hodge, 2016; Moein et al., 2020; Grover et al., 2021). In general, mouthwash has the same way of working, namely destroying bacterial cells, breaking down enzymes in the plaque matrix, inhibiting bacterial aggression or inhibiting the attachment of bacteria to the tooth surface(Prasanth, 2011).

Sentul fruit is known edible and used as traditional medicinal herbs such as its roots can treat diarrhea, the leaves can relieve fever, and the powdered part of the stem can be used as an anthelmintic (Diansari et al., 2018; Aria, et al., 2013). Several researchers have proven the efficacy of the sentul plant as a white discharge medicine as stated in (Warsinah et al., 2011) that reports the methanol extract of sentul bark can inhibit the growth of fungus *Candida albican* by 39.65%. In addition, the ethyl acetate extract of the leaves of the sentul also has anti-bacterial activity (Toobpeng et al., 2017). The results of the phytochemical screening of sentul fruit peel simplicia powder showed the presence of groups of alkaloids, flavonoids, tannins, saponins, glycosides, anthraquinone glycosides and steroids (Heliawati et al., 2017).

The objective of our study is to observe sentul fruit peel in Bali province in determining its effect of fractionation with different types of solvents on the phytochemical compounds.

2. Method

2.1 Research Design

This research is an experimental study in a laboratory with qualitative and quantitative analysis models for chemical compounds. This research was carried out from March to August 2021, on samples of old sentul fruit peels, about 30 kilograms. The experiment includes laboratory examination of the extracts of aquadest, ethanol, the fractions of aquadest, hexane and Ethyl Acetate at the Laboratory of the Faculty of Food Technology, Udayana University. Then the data were analyzed qualitatively and descriptively.

2.2 Experimental Procedure

The peel of sentul fruit was collected and then washed, and dried in an oven to obtain simplicia for about 72 hours. After drying, the sample was powdered using a blander, then extracted/separated biochemical compounds by maceration/soaking method with distilled water and ethanol for 24 hours. The maceration method was chosen in this study because it is an easy method and uses simple tools, which just need to soak the sample in a solvent. After the extraction process, the next was to proceed with liquid-liquid fractionation, using a separating funnel according to the solvent applying hexane, ethyl acetate and aquadest as solvents. The fractionation solvent is based on the level of polarity of the solvent, polar aquadest, non-polar hexane, semi-polar ethyl acetate.

After obtaining the extract, phytochemical screening was carried out to determine the class of active compounds. Phytochemical screening is a simple way to perform qualitative analysis of compound content in plants. In this study, the screening carried out was the alkaloids test, flavonoids test, saponins test, tannins test, and triterpenoid test because these tests already represented several groups of compounds contained in plants. Afterwards, the extract was further tested for the levels of several phytochemical compounds such as phenol, flavanoid, tannins, alkaloids, and saponins levels to know which fractionation had the highest phytochemical content. In addition, antioxidant activity tests were also carried out to determine which type of solvent fractionated extract had the highest antioxidant activity.

3. Results

3.1 Phytochemical Screening

Table 1 shows the results of phytochemical screening tests with the fractionation of aqua, ethyl acetate and hexane from sentul fruit peel extract. Based on the test results, the sentul fruit peel extract contain alkaloids, triterpenoids, tannins, flavonoids and saponins, except for the hexane fraction which is declared negative to contain saponins. This is presumably due to the small content of saponins in the hexane fraction of sentul fruit peel extract so that qualitative compounds were not detected.

Table 1: Phytochemical screening of sentul extract

Sample Code	Variable				
	Saponins	Alkaloids	Triterpenoids	Tannins	Flavonoids
Aqua fraction of sentul aqua extract	positive	positive	positive	positive	positive
Ethyl acetate fraction of sentul aqua extract	positive	positive	positive	positive	positive
Hexane fraction of sentul aqua extract	negative	positive	positive	positive	positive
Aqua fraction of sentul ethanol extract	positive	positive	positive	positive	positive
Ethyl acetate fraction of sentul ethanol extract	positive	positive	positive	positive	positive
Hexane fraction of sentul ethanol extract	negative	positive	positive	positive	positive

3.2 Quantitative Test

Table 2 shows the results of quantitative test of saponins, alkaloids, and tannins while table 3 shows the quantitative results on phenol, flavonoids and antioxidant activity. The average value followed by the same letter in the same column shows a non-significant difference (Duncan 5%). As seen from the tables, the liquid-liquid fractionation of the two extracts using aquadest, ethyl acetate and hexane, the aqua and ethyl acetate fractions tend to contain higher chemical compounds than the hexane fraction. Aquadest is polar solvent so they can attract polar compounds such as tannins, alkaloids, saponins and phenolics, while ethyl acetate is a semi-polar solvent so that it can still dissolve polar and non-polar components (Abarca-vargas et al., 2016), but hexane is a non-polar solvent so that only few components of the extract are soluble.

Table 2: Quantitative results of saponins, alkaloids, tannins of sentul extract

Code Sample	Alkaloids (mg/g)		Tannins (mg/g)		Saponins (mg/g)	
Aqua fraction of sentul aqua extract	16.978	b	85.439	a	8.639	a
Ethyl acetate fraction of sentul aqua extract	12.110	c	77.807	b	4.120	c
Hexane fraction of sentul aqua extract	7.120	d	23.465	c	1.388	d
Aqua fraction of sentul ethanol extract	36.412	a	88.605	a	6.862	b
Ethyl acetate fraction of sentul ethanol extract	16.673	b	6.512	d	4.232	c
Hexane fraction of sentul ethanol extract	5.957	d	4.085	d	1.090	d

Table 3: Quantitave results of phenol, flavonoids and antioxidant activity of sentul extract

Code Sample	Phenol (mg/100g GAE)		Flavonoids (mg/100g QE)		Antioxidant activity (%) 100 ppm	
Aqua fraction sentul aqua extract	7657.96	a	9560.23	c	23.684	a
Ethyl acetate fraction sentul aqua extract	944.99	c	19672.96	a	13.727	b
Hexane fraction aqua extract sentul	626.28	c	13928.07	b	6.117	c
Faction aqua ethanol extract sentul	1444.49	bc	11476.16	c	26.529	a
Fraction of the ethyl acetate extract of ethanol sentul	1772.12	b	17380.43	a	16.429	b
Fraction hexane extract ethanol sentul	1337.18	bc	10436.92	c	8.606	c

3.2.1 Alkaloids

Figure 1 shows the alkaloids content in sentul peel extract. According to the results of the ANOVA test, the fractionation treatment with hexane, ethyl acetate and aqua solvents on the ethanol extract and aquades of sentul fruit peel gave a significant effect (sig<0.005) on the alkaloids content.

Figure 1: Alkaloids in sentul fruit peel

The highest alkaloids content is obtained in the aqua fraction of the ethanol extract with a concentration of 36.412 mg/g which is significantly different from other treatments. The lowest alkaloids content is obtained in the hexane fraction of ethanol extract with a concentration of 5.957 mg/g which is not significantly different from the treatment with the hexane fraction aqua extract with a concentration of 7.120 mg/g.

3.2.2 Tannins

Figure 2 shows the tannins content in sentul peel extract. Based on the results of ANOVA test, fractionation treatment with solvent hexane, ethyl acetate and ethanol extract and aqua in ethanol and aquadest extract achieves a significant influence (sig <0.005) on levels of tannins.

Figure 2. Tannins in sentul fruit peel

The figure indicates the highest tannins content was obtained in the aqua fraction of ethanol extract with a concentration of 88.605 mg/g which is not significantly different from the treatment with the aqua fraction of aqua extract with a concentration of 85.439 mg/g and significantly different from other treatments. The lowest tannins content is obtained in the hexane fraction of ethanol extract with a concentration of 4.085 mg/g which is not significantly different from the treatment of the ethyl acetate fraction of ethanol extract with a concentration of 6.512 mg/g.

3.2.3 Saponins

Figure 3 shows the saponins content in sentul peel extract. Based on the ANOVA test results, fractionation treatment with hexane, ethyl acetate and aqua solvents on ethanol and aquadest extracts of sentul fruit peel obtain a significant effect (sig<0.005) on saponins levels.
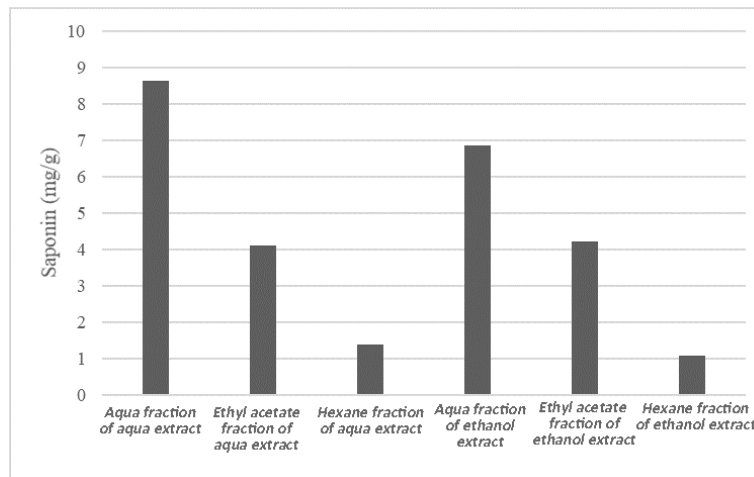
Figure 3: Saponins in sentul fruit peel

The highest levels of saponins is obtained in the aqua fraction of aqua extract with a concentration of 8.639 mg/g which is significantly different from other treatments. The lowest levels of saponins is obtained from the hexane fraction of ethanol extract with a concentration of 1.090 mg/g which was not significantly different from the treatment with the hexane fraction of aqua extract with a concentration of 1.388 mg/g.

3.2.4 Phenol

Figure 4 shows the phenol content in sentul peel extract. According to the results of the ANOVA test, the fractionation treatment with hexane, ethyl acetate and aqua solvents on the ethanol extract and aquades of Sentul fruit peel gave a significant effect (sig<0.005) on the phenol content.
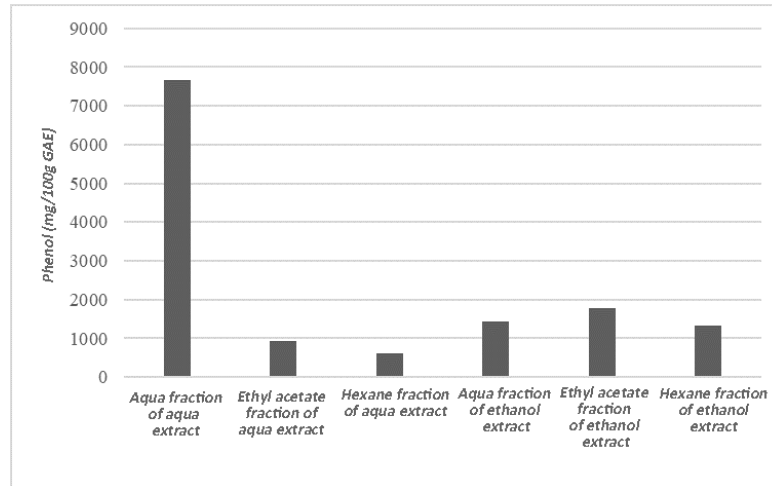
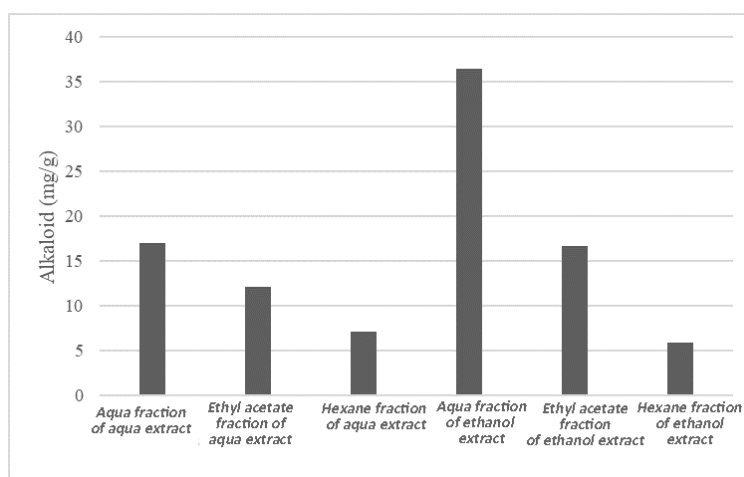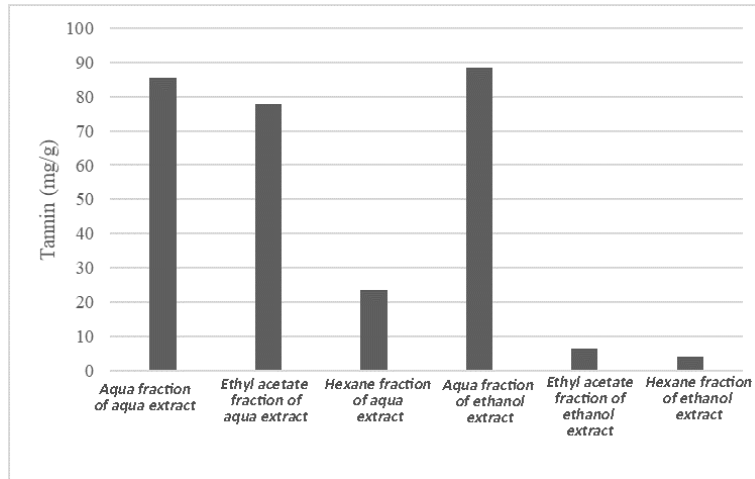Figure 4: Phenol in sentul fruit peel

The highest phenol content is obtained in the aqua fraction of aqua extract with levels of 7657.96 mg/100g GAE (Galat Acid Equivalent) which is significantly different from other treatments. The lowest phenol content is achieved in the hexane fraction of aqua extract with a concentration of 626.28 mg/100g GAE.

3.2.5 Flavonoids

Figure 5 indicates the flavonoids content in sentul peel extract. Based on the ANOVA test results, fractionation treatment with hexane, ethyl acetate and aqua solvents on ethanol and aquades extracts of sentul fruit peel gave a significant effect (sig < 0.005) on flavonoids levels.


Figure 5: Flavonoids in sentul fruit peel

The highest flavonoids content is obtained in the ethyl acetate fraction of aquadest extract of with levels of 19672.96 mg/100g QE (Quersetin Equivalent) which is not significantly different from the treatment of the ethyl acetate fraction of ethanol extract with levels of 17380.43 mg/100g QE and is significantly different from other

treatments. The lowest flavonoids content is obtained in the hexane fraction of the ethanol extract with a concentration of 10436.92 mg/100g QE.

3.2.6 Antioxidant activity

Figure 6 is the antioxidant activity of sentul peel extract. Based on the results of the ANOVA test, fractionation treatment with hexane, ethyl acetate and aqua solvents on ethanol and aquades extracts of sentul fruit peel holds a significant effect (sig < 0.005) on the antioxidant activity of 100 ppm extract.
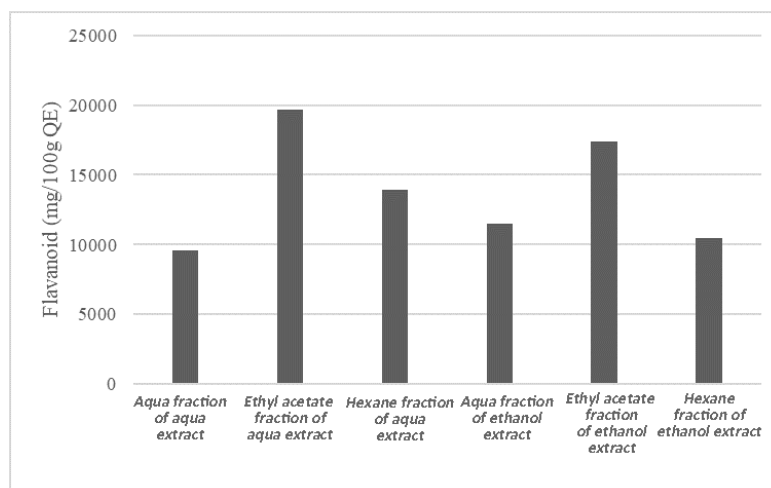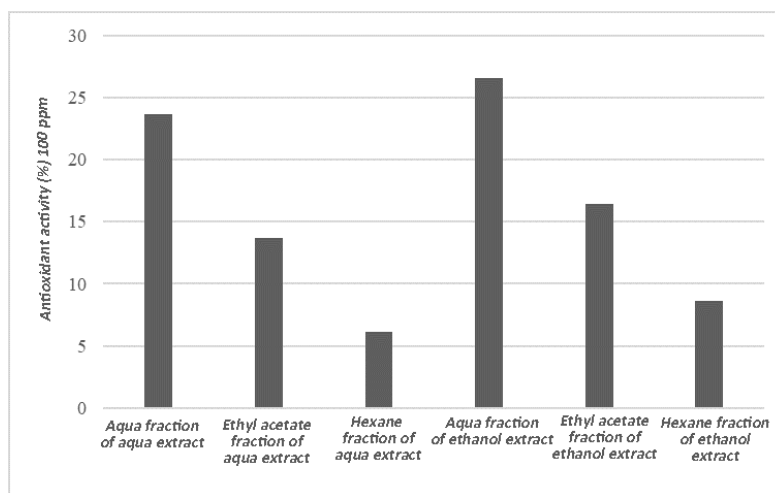

Figure 6: Antioxidant activity in sentul fruit peel

The highest antioxidant activity is from aqua fraction of ethanol extract with antioxidant activity of 26.529%, in which it is not significantly different from the treatment of the aqua fraction of aqua extract with antioxidant activity of 23.684% and significantly different from other treatments. The lowest antioxidant activity is obtained in the hexane fraction of aqua extract of with an antioxidant activity of 6.117%.

3.2.7 IC50 results of sentul peel extract

In addition, the antioxidant activity of the extract was tested at a concentration of 100 ppm against DPPH. (2,2-diphenyl-1-picrylhydrazyl. We also tested IC 50 (Inhibition Concentration 50%) of sentul fruit extract. Table 4 shows the results of sentul extract tested with IC50.

Table 4: Results of IC50 testing on sentul fruit

Treatment	IC50(ppm)	AAI (Antioxidant Activity Index)	Description
Aqua fraction sentul aqua extract	299.96	0.135	Weakest
Ethyl acetate fraction sentul aqua extract	365.63	0.110	Weakest
Hexane fraction aqua extract sentul	753.79	0.053	Weakest
Faction aqua ethanol extract sentul	189.54	0.211	Weak
Fraction of the ethyl acetate extract of ethanol sentul	340.98	0.117	Very weak
Fraction hexane extract ethanol sentul	608.78	0.066	Very Weak

According to table 4, the results of research, Sentul fruit extract has weak to very weak antioxidant activity with the value of Antioxidant Activity Index (AAI) ranging from 0.066 -0.211. The aqua fraction of sentul fruit peel ethanol extract has the highest AAI value of 0.211 (weak).

4. Discussion

Sentul fruit (Sandoricum koetjape) is known for its ability as traditional medicine. Our research evaluate the compounds in sentul fruit concerning as its use in gingivitis. On the quantitative test results i.e. table 2, based on the ANOVA test, fractionation treatment with hexane, ethyl acetate and aqua solvents on the ethanol and aquadest extract hold a significant effect (sig<0.005) on the content of saponins, alkaloids, tannins, phenols, flavonoids and antioxidant activity. This shows that the type of solvent affects the content of phytochemical compounds in sentul fruit peel. Based on the test results, the ethanol extract has a higher content of alkaloids, tannins and flavonoids than the aquadest extract. The polarity of ethanol is lower than aquadest so that it can dissolve alkaloids, diglycosides, phenolics, flavonoids, and a small amount of essential oils (Agustiningsih et al., 2010; Widyawati et al., 2014).

Alkaloids are generally non-polar compounds, while the pseudoalkaloids and protoalkaloids are soluble in water (Petruczynik, 2012). Alkaloids are more commonly found in polar solvents because the class of alkaloids compounds that have the potential as antioxidants are polar compounds that will be extracted in polar solvents (Gan et al., 2017).

Many tannins compounds are found in the use of aquadest as solvent. This is because tannins are more soluble in water solvents. This component is found in the hexane fraction, because hexane is a non-polar solvent, so there are fewer soluble components. The results of our study are in accordance with the research of (Aini & Mardiyaningsih, 2016) which reported that tannins compounds are found in the aquadest fraction in the ethanol extract of pandan leaves. According to (Yuliana et al., 2014) tannins are polar compounds with hydroxyl groups, so to extract them, polar solvents such as methanol, ethanol, acetone and water are needed.

Saponins compounds tend to be polar soluble. Saponins are detected in polar and semi-polar solvents (Yusnawan, 2013; Robinson, 1995), but the smallest detected in non-polar solvents even on phytochemical screening, saponins are not detected in hexane fractionation which is because of the very small amount extracted. The results of this study are in accordance with the research of (Supriyanto et al., 2017) which stated that saponins compounds are found in neem leaf extract in polar solvents.

Based on the results of the study, the highest phenolic compounds were obtained in the fractionation of aquadest of sentul fruit peel extract. Phenol compounds have many hydroxyl functional groups or in free conditions (aglycones) will produce high levels of total phenol (Juan Moreno, 2012). The total phenol test is non-specific only on polyphenols. Phenolic components are known as polar antioxidants (Minatel et al., 2017). Aquadest has a polar nature so that it is able to dissolve polyphenol compounds well.

The graph of the flavonoids content of sentul fruit peel extract can be seen in Figure 5. Flavonoids are compounds that can be soluble in polar to non-polar solvents (Ferreira & Pinho, 2012). This statement is comparable to the results of the study where the highest flavonoid content is obtained in the ethyl acetate fractionation of Sentul fruit peel aquadest extract and the lowest is found in the hexane fraction.

Regarding figure 6 about antioxidant activity of sentul fruit peel extract, the highest antioxidant activity is held in the aqua fractionation of ethanol extract since ethanol solvent is semi polar so it is able to extract flavonoids compounds, phenols, tannins and alkaloids which have antioxidant properties.

Referring to table 4, the difference in IC50 value can be caused by the number of antioxidant compounds such as flavonoids, phenols, tannins and alkaloids contained in the extract (Supriyanto et al., 2017). The higher the concentration of bioactive compounds in the extract, the more antioxidants extracted. Ethanol is a semi-polar solvent so that it has the ability to dissolve polar and non-polar compounds so that a lot of bioactive compounds with antioxidant properties are extracted. Based on the results of the research, the ethanol fraction of sentul fruit peel aqua extract contains high tannins, flavonoids, phenol and alkaloids content.

Conclusion

We have conducted a study regarding the chemical content in sentul fruit (*Sandoricum koetjape*). From several phytochemical compounds, flavonoids, saponins and tannins are aromatic hydroxyl groups that act as antibacterial. Therefore, observing from the highest levels of flavonoids, saponins and tannins, the aqua fraction of sentul ethanol extract is the best treatment with flavonoids content of 11476.16 mg/100g QE, tannins 88.605 mg/g and saponins 6.862 mg/g.

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Measuring Air Quality Over Denpasar City Indonesia in 2021

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Abstract

The imbalance number of rapid vehicles with transportation facilities has become the problem. In Denpasar, Indonesia, the congestion during peak hours happens so often. Based on the department of transportation in Denpasar, Indonesia, the number of vehicle ownership in Bali is 4.1 million in condition with a ratio of one resident to one vehicle with the current population of Bali Province approximately 4.2 million. Our study aim to measure the air chemical parameters of CO, O_3, SO_2, NO_2 and the physical parameters of the noise level. The research population is the atmosphere environment in the Denpasar City area. The research sample points were taken in the city center and the outskirts of Denpasar, with a total of 27 sample points. We employed impinge to get the airborne chemical gases and it is all analyzed with a spectrophotometer. We used a sound level meter to measure the ambient noise level. The data analysis was performed with free sample t test. The average ambient air chemistry obtained CO 517.34 µgr/Nm3, O3 0.17 µgr/Nm3, SO2 61.46 µgr/Nm^3 and NO_2 2.51 µgr/Nm3 and an average noise level 67.66 dBA. The number has found below the requirements Environmental Quality Standards and Environmental Damage Standard Criteria by Bali Governor. There is a difference in the mean parameters of CO, SO_2, NO_2 and ambient noise level in the downtown area. The average CO is 757.15 µgr/Nm^3, SO2 67.60 µgr/Nm^3, NO_2 3.77 µgr/Nm^3 and the noise level is 68.53 dBA with Denpasar outskirts mean CO 217.57 µgr/Nm^3, SO2 53.79 µgr/Nm^3, NO_2 0.95 µgr/Nm^3 and noise level 66.57 dBA. There is no difference in the average ambient O_3 in the city center area with an average of 0.22 µgr/Nm^3 with the outskirts of Denpasar an average of 0.11 µgr/Nm^3.

Keywords: CO, O_3, SO_2, NO_2, Noise

1. Introduction

Environment as a resource is an asset e needed to prosper the community (Supriadi, 2010; Wali et al., 2017). Government policy arrangements in creating environmental balance were actualized with the promulgation of the first regulations governing the environment, namely Law no. 4 of 1982 concerning Basic Provisions for Environmental Management, which was later replaced by Law no. 23 of 1997 concerning Environmental Management, which was subsequently replaced by Law no. 32 of 2009 concerning Environmental Protection and Management. Thus this law functions as a framework law to protect the environment and does not specifically regulate the prevention of air pollution (Sukanda, 2009).

According to (Hsia, et al. 2014) the air is the atmosphere that surrounds the earth whose function is essential to life. In the air, there is oxygen (O_2) to breathe, carbon dioxide (CO_2) for the process of photosynthesis by the chlorophyll of leaves, and ozone (O_3) to block ultraviolet from the sun. In big cities, the contribution of motor vehicle exhaust gases as a source of air pollution reaches 60-70%. Important factors that cause the dominant influence of the transportation sector on urban air pollution in Indonesia are rapid (exponential) growth in the number of vehicles; unbalanced transportation infrastructure with the number of existing vehicles; concentration-oriented urban traffic patterns, due to the centralization of economic activities and offices in the city center; derivative problems resulting from the implementation of existing urban development policies, such as residential areas moving away from the city center; equality of traffic flow time; type, age and characteristics of motorized vehicles; vehicle maintenance factor; type of fuel used; type of road surface; cycles and driving patterns (Nurdjanah, 2015).

A mixture of various gases and particles on the surface and surround the earth from the atmosphere. The composition of the air in the atmosphere that sustains human life consists of nitrogen (N_2) of 78.8% of dry air volume, oxygen (O_2) of 20.94%, argon (Ar) of 0.02%, and other gases as well as particles produced by human and natural activities (Nara et al., 2012). Regarding primary air pollutants, its composition will not change in the atmosphere both chemically and physically in a relatively long period of time (daily to yearly and will remain the same composition as the time emitted by the source). These pollutants include CO, CO_2, NO_2, N_2O, TSP, SO_2, methane, halogen compounds, metal particles and others. This pollutant has a long residence time in the atmosphere because it is stable to the physical chemical reactions of the atmosphere. According to (Nara et al., 2012; Sario et al., 2012), the concentration of pollutants in the air depends on weather conditions. Wind speed and direction, vertical temperature distribution, and humidity are the elements that play a role in this weather change(Balasubramanian, 2017). Wind speed affects the distribution of pollutants. Concentration of pollutant will be reduced if the wind is strong and distribute this pollutant horizontally or vertically. Land surface also affects wind speed, whether hilly or valley. Narrows are for wind can increase the speed of wind. Air that is polluted with particles and gases can cause health problems, especially in the physiological functions of organs such as the lungs and blood vessels or cause irritation to the eyes and skin(Ünver et al., 2019; Kim et al., 2018). Pollution due to particles and dust usually causes chronic respiratory diseases such as bronchitis chronic, pulmonary emphysema, asthma bronchial and lung cancer. Gaseous pollutants dissolved in the air can directly disturb the body to the lungs that absorbed by the blood vessel system(Hamanaka & Mutlu, 2018).

Motor vehicles and poor public transport systems contribute to the value of the exhaust gases produced. Sources of air pollution caused by human activities (anthropogenic) come from the burning of fossil fuels which generally contain carbon or hydrocarbon elements. Fossil fuels commonly used are octane which is a fuel with complex hydrocarbon compounds (Brimblecombe & Shooter, 1986).

Based on preliminary observations in Denpasar city during rush hour traffic jams, this is in accordance with data from the Bali Provincial Transportation Service that the number of vehicle ownership in Bali is 4.1 million. With a ratio of one resident to one vehicle, the current population of Bali Province is approximately 4.2 million. This study aims to measure air chemical parameters (CO, O_3, SO_2 and NO_2) and physical parameters, namely noise levels and analyze differences in air chemical parameters and noise levels between the outskirts and the center of Denpasar City.

2. Method

2.1 Research Design

This type of research is observational with Cross Sectional approach. The location of research was in Denpasar City. The research was carried out from March to October 2021. Regarding the population of research, it was the atmosphere environment in the Denpasar City area.

2.2 Sampling Procedure

Measurement of the chemical and physical quality of air is carried out in the Denpasar City area, which is divided into two areas. The first area with the sample point is in the city center and the second area the sample point is on the outskirts of Denpasar City. The location of sample points can be presented as shown in figure 1.
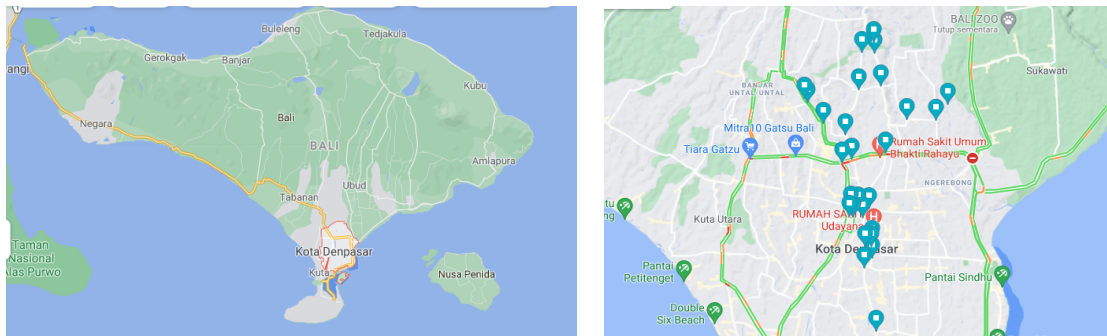

Figure 1: Location of sample points for measurement of chemical and physical air quality

The measurement locations for the downtown area were taken on Jalan Diponogoro, Jalan Sudirman, Jalan Hasanudin, Jalan Gajahmada, and Jalan Gatot Subroto where each path was taken 3 sample points. For the outskirts of Denpasar City, measurements were taken on Jalan Cokroaminoto, Jalan Ayani Utara, Jalan Antasura and Jalan Trenggana, each road taken 3 sample points, so the total number of samples was 27 samples.

Catching the levels of CO, O_3, SO_2 and NO_2 gases in the atmosphere was performed using air sampling with an impinger, by testing the O_3 parameter with the neutral buffer kalium iodide (NBKI) method using a spectrophotometer (7119-8:2017 SNI 2017), SO_2 parameter with the pararosaniline method using a spectrophotometer (7119-7:2017 SNI 2017) and the NO_2 parameter using Griess Zaltzman method with a spectrophotometer (7119-2:2017 SNI 2017). SNI stands for Standard Nasional Indonesia or Indonesia National Standardization. The measurement of carbon monoxide (CO) concentration in ambient air was performed by direct reading (real time sampling). This method uses a measuring instrument to directly determine the concentration carbon monoxide. This tool uses a sensor system based on the chemical and physical properties of the contaminants. The tool used in this research is CO Analyzer Kimo HQ 210, a carbon monoxide (CO) analyzer portable handheld used to detect and display CO gas concentrations between 0 and 2000 ppm. A sound level meter was used to measure the noise levels in ambient air. Differences in air quality in the outskirts and downtown Denpasar were analyzed using free sample t test at a 95% confidence level.

3. Results

3.1 Weather Description

The weather conditions at the time of sampling were quite sunny with the average air temperature during sampling 28.16 °C ± 1.36 °C, the air temperature during the study was at minimum 25 °C and maximum 30 °C. Air humidity during the study ranged from 70% to 97%, with an average humidity during the study 79.63% ± 7.50%. The wind speed during the research ranged from 11 km/hour to 19 km/hour with an average wind speed of 15.96 km/hour ± 1.93 km/hour.

Meteorology that has a big influence on changes in pollutant concentrations is wind speed. Pollution spread in an area is inseparable from the influence of strong wind speeds(Cichowicz et al., 2020). In addition to wind speed, mixing height also affects the dispersion of pollutants. The level of mixing height is affected by the inversion layer in which it will reduce the level of mixing height, therefore it limits the dispersion of pollutant in the atmosphere vertically. The higher the level of the inversion layer approaches the earth's surface, the smaller the area of mixing height. Thus, it results in a minimum pollutant dispersion process and poor ambient air quality (Salcido et al., 2020).

3.2 Air Chemical Parameters and Noise Levels

Measurement of air quality in Denpasar city area with air chemistry parameters CO, O_3, SO_2 and NO_2 obtained average results as shown in figure 2.

Figure 2: Average air chemical quality parameters CO, O_3, SO_2, NO_2 and noise levels in Denpasar City in 2021

Figure 2 shows that the air chemical quality parameters of CO, O_3, SO_2 and NO_2 in Denpasar city area are still far below the requirements of the Bali Government Regulation number 16 of 2016 concerning Environmental Quality Standards and Environmental Damage Standard Criteria. The noise level in the Denpasar city area exceeds the maximum noise level for residential area activities of 55 dBA. For the downtown and outskirts areas of Denpasar, the results of air chemistry parameters and noise levels can be seen in Table 1.

Table 1: Air chemical quality parameters (CO, O3, SO2 and NO2) and noise levels in the downtown and outskirts of Denpasar in 2021

Location	Coordinate of Sample	CO µgr/Nm^3	O3 µgr/Nm^3	SO2 µgr/Nm^3	NO2 µgr/Nm^3	Noise Level
Downtown of Denpasar						
Jalan Diponogoro,	-8.669586, 115.215508	624.65	0.12	60.37	2.02	65.80
	-8.700396, 115.219393	591.78	0.67	71.31	4.05	74.30
	-8.677388, 115.215233	629.03	0.46	58.48	1.97	72.20
Jalan Sudirman,	-8.667628, 115.218006	857.70	0.13	66.97	6.70	66.40
	-8.669612, 115.217922	778.73	0.07	73.76	3.05	68.80
	-8.673754, 115.218045	680.02	0.46	60.37	4.02	66.70
Jalan Hasannudin,	-8.659124, 115.214823	710.73	0.48	77.54	3.08	69.20
	-8.658600, 115.211279	684.41	0.14	83.95	3.05	72.40
	-8.658483, 115.209874	680.02	0.09	66.03	8.18	65.30

Jalan Gajah Mada,	-8.655099, 115.210614	916.16	0.07	66.10	0.34	66.70
	-8.655478, 115.213040	679.45	0.10	62.25	2.08	65.20
	-8.655721, 115.216906	696.98	0.10	65.65	6.70	68.30
Jalan Gatotsubroto	-8.639111, 115.207539	1184.55	0.10	63.90	0.93	70.20
	-8.635348, 115.222969	936.67	0.16	73.76	5.20	67.30
	-8.637759, 115.210760	706.34	0.15	63.49	5.11	69.10
Average		757.15	0.22	67.60	3.77	68,53
Outskirts of Denpasar						
Jalan Cokroaminoto	-8.624477, 115.200819	297.75	0.15	58.63	1.65	66.40
	-8.616998, 115.195011	285.80	0.08	59.97	0.85	67.30
	-8.615357, 115.193843	210.12	0.07	48.47	0.31	64.90
Jalan A Yani Utara,	-8.612301, 115.213214	116.51	0.14	65.14	2.24	67.80
	-8.628682, 115.208676	112.53	0.20	59.20	0.62	68.20
	-8.598862, 115.214529	174.27	0.09	48.47	1.23	64.80
Jalan Antasura,	-8.611111, 115.221281	355.01	0.15	65.34	0.59	68.30
	-8.599041, 115.218905	223.06	0.14	66.10	0.93	67.20
	-8.595131, 115.218767	317.67	0.11	42.15	0.31	65.60
Jalan Trenggana	-8.623135, 115.230410	284.14	0.11	25.29	1.09	65.20
	-8.623485, 115.240942	119.50	0.09	65.14	0.93	66.70
	-8.617563, 115.245095	114.52	0.06	41.58	0.62	66.40
Average		217.57	0.11	53.79	0.95	66.57

According to Table 1, the chemical parameters of air CO, O_3, SO_2, NO_2 and the noise level for outskirts areas are smaller than the area of downtown. This shows that the level of vehicle density and congestion in the outskirts of Denpasar is lower than the center of Denpasar City.

3.3 Differences in Chemical and Physical Air Quality

Table 2 is the results of independent t-test and Mann Whitney for air chemical parameters (CO, O_3, SO_2, NO_2) and noise levels.

Table 2: Independent t test results and Mann Whitney for air chemical parameters (CO , O_3, SO_2, NO_2) and noise level

Variables	Mean Downtown µgr/Nm³	Mean Outskirts µgr/Nm³	Sign independent t test / Mann Whitney
CO	757,15	217.57	0.000
O3	0.22	0.11	0.260
SO2	67.60	53.79	0.004
NO2	3.77	0.95	0.000
Noise	68.53 dB	66.57 dB	0.023

Based on Table 2, it shows the significance value of air chemical parameters (CO, SO_2, NO_2) and the noise level is less than 0.05, which means that there is a difference in the results of the average measurement of air chemical parameters (CO, O_3, SO_2, NO_2) and the noise level between the downtown and outskirts areas of Denpasar. Meanwhile, for parameter O_3, a significance value of 0.260 is greater than 0.05, indicating that there is no difference in the average O_3 parameter between the downtown and outskirts areas of Denpasar.

4. Discussion

Exposure to high concentrations of CO can have significant effects harmful to the human body. Harmful effects on human health have been observed with CO exposure at concentrations of 12,000 to 17,000 µg/Nm³. This health effect consists of physiological stress, especially in patients with heart disease, blood poisoning, and so on (Manisalidis et al., 2020; Munfarida, 2015). According to (Rozante et al., 2017) stated that high concentrations of carbon monoxide are considered very toxic to humans because they can cause acute poisoning, and death due to suffocation. The interaction of hemoglobin with CO is 240 times greater than with oxygen (O_2). So,

carboxyhemoglobin will be formed which that should be formed oxyhemoglobin. When the atmosphere is overwhelmed with CO, O_2, human will suffer suffocation and causing death (Rose et al., 2017).

Carbon monoxide (CO) is produced by chemical reactions in the atmosphere between hydroxyl radicals (OH) and methane (CH_4) and other hydrocarbons, in addition to reactions between alkenes and ozone (O_3), and reactions of isoprene and terpenes with OH and O_3 (Rozante et al., 2017). In addition, other meteorological factors besides air temperature can also affect the concentration of CO in the atmosphere. These meteorological factors include air pressure, and the structure of the boundary layer. Air pressure will affect the diffusion of CO gas in the horizontal and vertical directions in the air, and the boundary layer structure plays an important role in the diffusion of CO gas in the vertical direction (Zeng & Zhang, 2017).

Ozone at a concentration of 0.3 ppm can cause irritation to the nose and throat (J. J. Zhang et al., 2019). Contact with ozone at concentrations of 1.0 – 3.0 ppm for 2 hours causes severe dizziness and loss of coordination in some sensitive persons. While contact with a concentration of 9.0 ppm for some time can cause pulmonary edema in most people. The combination of ozone with SO_2 is very dangerous as it causes a decrease in the ventilation function when exposed to large amounts. Impaired ventilation function may return to nearly normal lung function in people exposed to low levels. Photochemical oxidants are atmospheric components produced by the photochemical process, a chemical process that requires light, which will oxidize components that cannot be oxidized immediately by oxygen gas. The compounds formed are secondary pollutants produced due to the interaction between primary pollutants and sunlight. Hydrocarbons are components that play a role in the production of photochemical oxidants. This reaction also involves the NO_2 photolytic cycle. The most dangerous secondary pollutants produced by the hydrocarbon reactions in the cycle are ozone (O_3) and peroxyacetylnitrate, which is one of the simplest components of the peroxyacylnitrate (PAN) group. The main oxidants are ozone (O_3), nitrogen dioxide (NO_2) and peroxyacylnitrate (PAN). NO_2 comes from the photochemical reaction of NO with oxygen in the air. Meanwhile, ozone and PAN come from photochemical reactions of NO, NO_2, SO_2 and hydrocarbon radicals.

Ozone is not a hydrocarbon but O_3 concentrations in the atmosphere rise as a direct result of the reaction of hydrocarbons, while PAN is derived hydrocarbons. The product of the reaction between O and hydrocarbons is a highly reactive intermediate product called free radical hydrocarbon (RO_2). Such free radicals can further react with various components including NO, NO_2, O_2, O_3, and other hydrocarbons (Petersen, 2017).

Sulfur dioxide gas is formed when the golden yellow powdered sulfur present in coal and fuel burns. Other sources of sulfur dioxide gas besides motor vehicle fumes are from heating in households and burning waste/wood charcoal. After hours or days mixed in the air, this sulfur dioxide forms very fine particles called sulfates and can penetrate the deepest parts of the lungs and mix with water in the lungs to form sulfuric acid, but when in the air this sulfate will react with water in the atmosphere and will cause acid rain. In addition to its effects on humans, sulfur dioxide also affects plants and animals. The effect of SO_2 on animals is almost similar to the effect of SO_2 on humans. In plants, sulfur dioxide affects the discoloration of the leaves from green to yellow or the occurrence of white spots on the leaves of plants.

The presence of nitrogen dioxide gas in the air is not only caused by motor vehicle/transportation fumes (39.3%) but also from the burning of waste, wood charcoal and natural gas combustion. The concentration of NO_2 in the air in a place varies throughout the day depending on the sunlight and the mobility of vehicles as well as the activities of the inhabitants(K. Zhang & Batterman, 2014). From the calculation of the velocity of NO_2 emission, it is known that the average residence time of NO_2 in the atmosphere is approximately 3 days, while the retain time of NO is 4 days, and this gas is accumulated in the air which when mixed with water causes acid rain.

Traffic noise arises from the sound produced by motorized vehicles, especially from vehicle engines, exhausts, and the interaction between the wheels and the road. Heavy vehicles (trucks, buses) and passenger cars are the main noise sources on the highway. In general, control strategies Noise is divided into three elements, namely control of noise sources, control of noise paths and control of noise receivers (Djalante, 2010). Impact noise can have an effect; 1) physical effects: damage that occurs to the hearing apparatus (auditory effect), 2) psychological effects: damage to parts of body functions such as increased blood pressure, insomnia, digestion becomes nauseous

and restless, 3) emotional effects: changes in emotional as an expression of noise in the form of annoyance or feeling disturbed, it can even cause mental disabilities, and 4) operational effects: noise can reduce work power both physically and mentally in the form of communication disorders and decreased sharpness of mind (Sugiarta, 2008; Anees et al., 2014).

According to table 2, the results of the measurement of air chemistry parameters are still below the requirements of the Bali Governor Regulation number 16 of 2016 concerning Environmental Quality Standards and Environmental Damage Standard Criteria for 1 hour measurement, the maximum level requirement for CO parameters is 30,000 µgr/Nm^3, O$_3$ is 235 µgr/Nm^3, SO2 of 900 µgr/Nm^3, NO2 of 400 µgr/Nm^3. The results of this study were obtained during the Covid-19 pandemic with government policies in the form of implementing restrictions on community activities (PPKM) so that population mobility by using vehicles was limited to access Denpasar city. The results of this study illustrate that the level of density or congestion between the outskirts and the downtown area is also different. There are differences in the values of air chemistry parameters CO, O$_3$, SO$_2$, NO$_2$ and noise levels in each location due to the contribution of busy motorized vehicles during peak hours and office activities.

Conclusion

Our work has led us to conclude that gas concentrations in Denpasar city regarding air chemistry such as CO, is in average of 517.34 µgr/Nm^3, O$_3$ with average 0.17 µgr/Nm^3, SO$_2$ with average 61.46 µgr/Nm^3 and NO$_2$ average 2.51 µgr/Nm^3 . These concentrations are still below the requirements of Bali Governor regulation number 16 of 2016 concerning Environmental Quality Standards and Environmental Damage Standard Criteria. The average noise level in the Denpasar City area is 67.66 dBA, exceeding the maximum noise level for residential area activities of 55 dBA. There is a difference in the average concentration of CO gas in the city center area with an average of 757.15 µgr/Nm^3 with an average of 217.57 µgr/Nm^3 in outskirts of Denpasar on the significance level of 0.000. There is a difference in the average concentration of SO$_2$ gas in downtown area with an average of 67.60 µgr/Nm^3 compared to the outskirts of Denpasar with an average of 53.79 µgr/Nm^{3}at a significance of 0.004. Besides, there is a difference in the average concentration of ambient NO$_2$ gas in the downtown area with an average of 3.77 µgr/Nm^3 compared to the outskirts area with an average of 0.95 µgr/Nm^3 at a significance of 0.000. However, there is no difference in the average of O$_3$ gas in the downtown in amount of 0.22 µgr/Nm^{3}with the outskirts of Denpasar at average of 0.11 µgr/Nm^3 at a significance of 0.260. At last, there is a difference in the average noise level in downtown area with an average of 68.53 dBA as opposed to outskirts area with an average of 66.57 dBA on the significance of 0.023.

The evidence from this study suggests to the related agency to monitor air quality regularly, regulate traffic flow, build pedestrians lane, arrangements for different working hours, educate groups and schools to participate in carrying out a vehicle-free day, conducting strict smoke testing on all public and private vehicles as well as limiting the age of vehicles that are operationally not roadworthy and carrying out mass reforestation.

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Perioperative Anesthetic Management in Preterm 12 Days Infants with Giant Meningoencephalocele at Mid Occipital and Secondary Trigonocephaly

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Abstract

Introduction: A meningoencephalocele is herniation of neural element along with meninges through a congenital defect in cranium. The incidence of encephalocele is approximately 1/5000 live births; occipital encephalocele is more common in females than males. It is called as giant meningoencephalocele when the head is smaller than the meningoencephalocele. These giant meningoencephaloceles harbor a large amount of cerebrospinal fluid (CSF) and brain tissue, so there occur various surgical challenges and anesthetic challenges in positioning and intubation. Case: A 12 days neonate was consulted to the neurosurgery department with complaints of large swelling over the back of head and difficulty in feeding. She was diagnosed with ventriculomegaly and meningoencephalocele since 32-33 pregnancy. The swelling was small at the time of birth, but it gradually increased in size. The child was born by section caesarean because of fetal distress and meningoenchepalocele. The neonate current weight was 3.195 grams with Post Conceptional Age (PCA) 35-36 weeks. On examination, the patient large spherical swelling was present over occipital region and there was no head control. The patient was active, conscious with no impression of focal neurological deficit. Systemic examination was unremarkable. The head circumference was 30 cm and circumference of occipital swelling was 40 cm. Potential problems in this patient include preoperative preparation and optimization of general condition, difficulty in positioning the patient, difficult airway (intubation), periodic apnea and potential hemodynamic disturbances and a sudden decrease in intracranial pressure during cele resection. Conclusion: Perioperative management in this case started from preoperative to postoperative evaluation. Preoperative preparation in anticipation of airway difficulties and communication with the operator is very important. Appropriate anesthetic techniques should aim to maintain stable hemodynamics and oxygenation and prevent a sudden increase or decrease in intracranial pressure.

Keywords: Airway, Infants, Intracranial Pressure, Meningoenchepalocele, Perioperative Management

1. Introduction

Encephalocele is a rare lesion, being an embryological mesodermal anomaly which results in a defect in the cranium and dura, associated with herniation of meninges, cerebrospinal fluid, or brain tissues through a defect

usually covered by scalp. Surgical management of children with giant occipital encephalocele requires careful attention to pediatric anesthetic and surgical principles (Ganeriwal et al., 2019). Meningoencephalocele is a type of Encephalocele. It's an abnormal leakage of cerebrospinal fluid (CSF) and herniation of brain tissue and meningeal membranes through a defect in the bony skull. It's a rare congenital condition and occurs approximately in 1 per 5000 live births (Senapathi et al., 2021). It is categorized into two types according to the sac's locations: occipital and frontoethmoidal. Multiple theories have been proposed to explain the exact cause of Meningoencephalocele. Many observations and associations have been found to be co-occurring with Meningoencephalocele. Despite that, there is no single theory that clearly explains the pathogenesis of this anomaly. Therefore, it's believed to be due interaction between genetic background and environmental factors. Meningoencephalocele is diagnosed antenatally using sonography. It can achieve diagnostic accuracy in 80% of cases. Other imaging modalities including: CT scan, MRI, and MRA can also be used for further detailed evaluation but their use has been limited due to the rarity of this anomaly. Several factors influence the prognosis of patients with Meningoencephalocele. The sac size and the amount of herniated brain tissue determine the prognosis. In addition, hydrocephaly, infections, and other anomalies accompanying the condition determine the prognosis as well. The mortality rate approaches 30% despite the applied appropriate treatments (Senapathi et al., 2021). We present a case of a giant occipital encephalocele in 12 days neonates highlighting the anesthetic problems encountered in its perioperative management.

2. Case Report

A preterm 12 days neonate with 3,195 gram bodyweight was consulted for elective cele – resection surgery. She was admitted to the High Care Neonatal Unit (Neonates HCU) following a section caesarean labor because of fetal distress and meningoenchepalocele. His Apgar score at 1 min was 5, and 9 at 5 min. She had 43 cm body length and 31 cm of head circumference, within normal parameters. Since he was born, his parents noticed that there was a lump on the back of his head. The lump is big as Takraw ball which could be bigger when he was crying. At HCU, the patient was kept in a prone position and nil per oral. Examination showed an active baby moving all limbs normally with no neurological deficit. There is no periodical apnea although he was preterm neonates with 35 weeks of PCA. Neurosurgical team was consulted and they recommended Computerized Tomography (CT) scan and Magnetic Resonance Imaging (MRI). They also recommended intubation should any problem arises. A provisional diagnosis of Giant Meningoencephalocele was made.

Upon taking a detailed history from the mother, she was 34 years old, Gravida 3 Para 2+ 1. The mother attended once in the last trimester of her Antenatal Care visits for throughout this pregnancy because of traveling a lot due to personal reasons. Her past obstetrical history was a spontaneous abortion one and half years back. Her other children are all healthy and were delivered vaginally with no similar complaint. When his mother at 32-33 weeks of pregnancy, she was brought to Fetomaternal Department at Hasan Sadikin Hospital, underwent Fetomaternal USG, diagnosed with ventriculomegaly and meningoencephalocele, she was hospitalized for 10 days and plan to do caesarean section. Upon reviewing the CT scan and MRI reports, the neurosurgical team recommended surgery because The sac has the potential to rupture and cause significant CSF leakage and a sudden decrease in intracranial pressure. This has the potential to cause death, although there was no brain tissue within the herniated sac.

On physical examination, the neonate consciousness was fully alert with Children Coma Scale (CCS) 11, pulse rate 145-150 beats per minute, respiratory rate 43-45 times per minute without periodic apnea, temperature 36.9ºC and oxygen saturation 98% with free air. On examination of the head, there was a mass in the occipital area measuring 40 cm in diameter, soft consistency, with the impression of fluid content. The conjunctiva was not anemic, the sclera was not icteric, the pupil is diameter of 3 mm both eyes with the both light reflexes were positive. On examination the airway was difficult to assess. Neck examination revealed limited range of movement (ROM). Neurological examination revealed no motor weakness, visual impairment was difficult to assess. On thoracic examination, the shape and motion were symmetrical, the first and second heart sounds were regular, murmurs and gallops were absent, the both lungs had the same breath sounds, and there were no additional breath sounds in both lungs. Abdominal examination revealed a flat abdomen, not tense, normal palpable liver/spleen, normal bowel sounds. On examination of the extremities found warm sensation with capillary refill time less than 2 seconds.

On the laboratory findings, We found the results of: Haemoglobin: 12.6 g/dl, Haematocrit: 37.7 %, Leukosit count 16.5300 /μL, Platelets: 757.000 /μL, Albumin: 3,09, Sodium 128 mEq/L, Potassium: 4,9 mEq/L, the others parameters of laboratory and chest x-ray were in normal range. An MRI examination revealed a meningoenchepalocele with a defect in the right occipital bone with suggestive of corpus callosum colpocephaly. On head ultrasound there was the fluid structure with cerebral parenchyma appears in the occipital area. There is no hyperechoic appearance of the subarachnoid. No calcification was seen in the lateral periventricular white matter or in the cerebral cortex with the impression of meningoencephalocele. Other investigations were within normal limits.

The Diagnosis was Meningoencephalocele at Mid Occipital with Ventriculomegaly, Secondary Trigonocephaly synostosis and Preterm Infant 33-34 weeks.
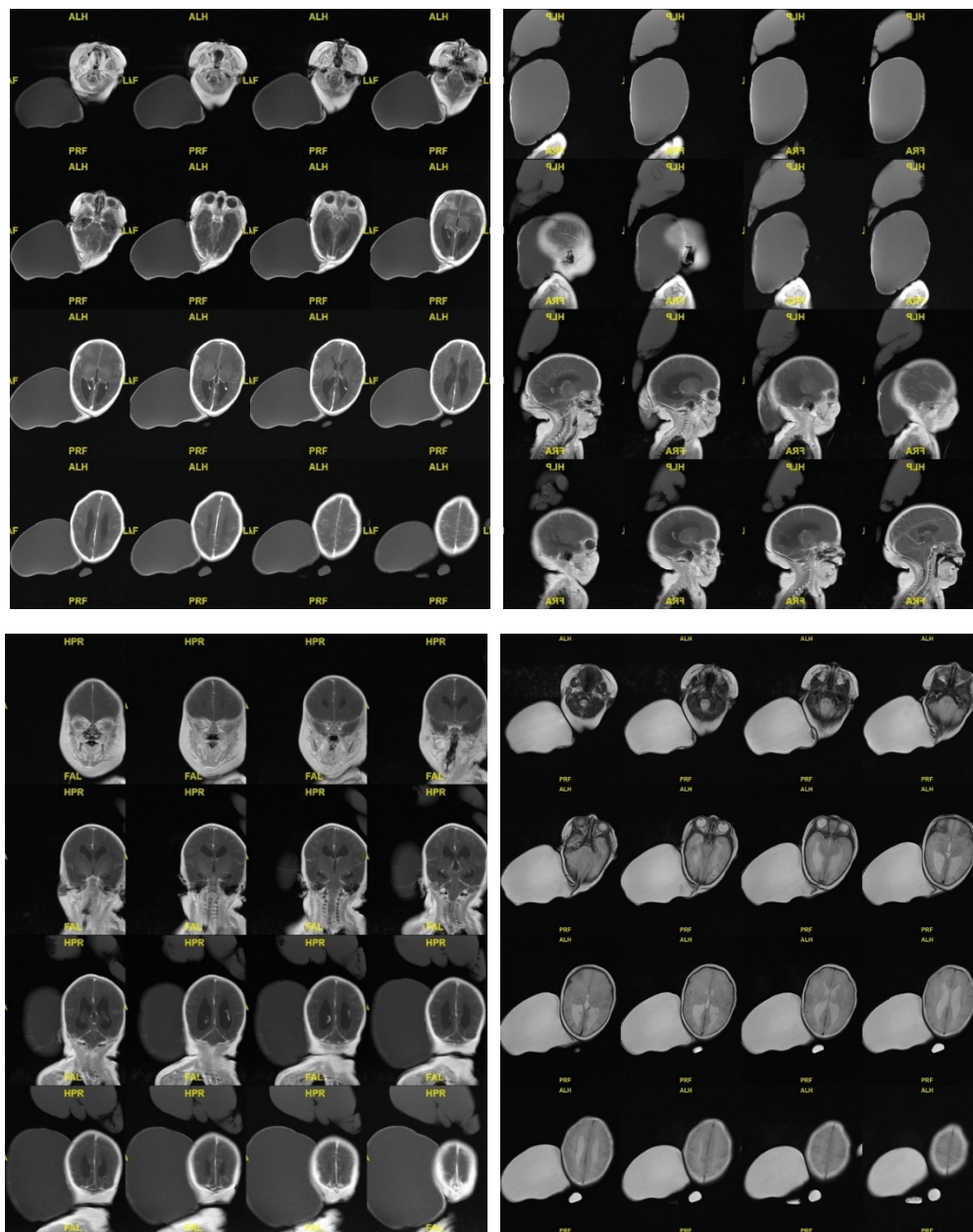
Picture 1: Head CT Scan and MRI Images
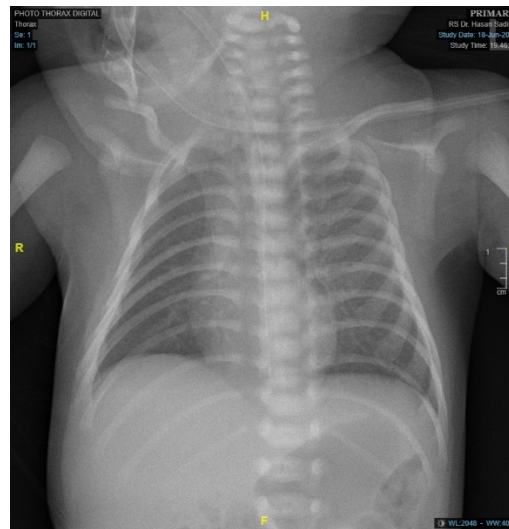
Picture 2: Chest X-Ray Image
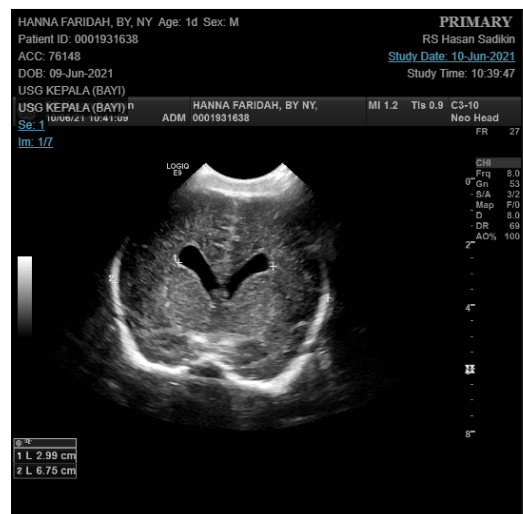
Picture 3: Head USG Image

3. Anaesthetic management

A day before surgery the patient was planned to fast 6 hours before surgery. Maintenance fluid was given with 0.9% NaCl 12 ml/hour. Pre Surgery, the patient was in active movement, alert and hemodynamic was within normal limits. During Surgery, hemodynamic monitoring using Non Invasive Blood Pressure (NIBP) measurement, pulse oximeter, capnography monitor and thermometer. The patient is positioned on his side with a circular support pad for the meningocele segment. The patient was preoxygenated with 100% O2. Then performed induction with spontaneous breathing technique using volatile gas sevoflurane. After the patient was asleep, the patient's position was changed to lie flat with a back cushion so that the head and body form a straight axis.

Picture 4: Clinical picture during pre-induction with modified support pad (lateral position)

Picture 5: Clinical picture during induction with modified support pad (supine position)

Picture 6: Clinical picture after induction with lateral position

Intubation was performed using a video laryngoscope with a 2.5 non-cuff endotreacheal tube (ETT). After intubation, fentanyl 15 mcg and atracurium 2 mg were given. The ETT was fixed and an intraoral packing gauze was applied. The depth of anesthesia was maintained with sevoflurane 3-4 vol% with 50% oxygen. Breathing support was fully controlled by manual ventilation with Jackson reese neonate circuit. The surgery taken were cele resection and dura mater suturing. Total blood loss was 25 cc and being replaced by transfusion of 20 cc of Packed Red Cell (PRC). During intraoperative hemodynamic was in stable condition.

After the surgery was over, hemodynamic and respiratory assessments were performed. The patient was extubated. Then the patient was transferred to the semi intensive-neonatology care unit.

4. Discussion

Anesthesia management in neurosurgery cases begins with the principles of neuroanaesthesia that have been applied during perioperative anesthetic management. Management of the patient's airway is kept securely at all times, by doing pre-induction positioning during surgery, breathing is controlled by manual bagging with the installation of a capnograph with the aim of maintaining EtCO2 levels of 25-30 mmHg and preventing hypoxia starting from preoperative with oxygen use, preoxygenation for 5 minutes prior to single-step intubation. The patient's hemodynamics was maintained by close observation of the pulse, intraoperative bleeding and communication with the operator regarding CSF drainage. The depth of intraoperative anesthesia is maintained so that the patient does not wake up because it will cause secondary brain injury. PaO2 levels during surgery are maintained at 100-200 mmHg to prevent cerebral vasodilation at PaO2 levels < 50 mmHg.

In cases of occipital meningoencephalocele; herniation of meninges, occipital lobes, and/or ventricles are common. Other contents of meningoencephalocele may be cerebellum, brainstem, or rarely, torcula. Torcula as one of the contents of encephalocele poses a greater challenge as its injury may lead to cerebral deep venous system thrombosis and its associated consequences of assault to the already compromised brain (Pahuja et al., 2015). In this case, the sac wasn't contained brain at all, its composed of liquor cerebrospinalis and also segment of duramater. But its also have a significant risk of being drop of volume of LCS because of leak and rapid aspiration. The rapid decrease of LCS may cause herniation of brain and hemodynamic disturbances (Bisri et al., 2019; Jacob et al., 2008).

Preoperatively, preparation for significant blood loss should be made because of potential bleeding from the suboccipital bone and the dural sinus. The ultimate prognosis, however, depends on various factors. Proper positioning of the patient is required for successful endotracheal intubation. Although, usually, patients with an occipital meningoencephalocele are operated in prone position, a giant size prevents this positioning and the patient has to be kept in lateral position as seen in the present case. Endotracheal intubation may be difficult due to large swelling and short neck, so alternative airway management options should be kept ready before starting anaesthetic induction. In this case we use support bearing on the back and round support pillow below the meningocele. This support aimed to make horizontal line between body and head during supine position just before intubation. For emergency alternate way we prepared laryngeal mask airway of appropriate size, with high-frequency jet ventilation, fibre optic bronchoscope, a cricothyroid cannula, and preparations for tracheostomy should be made. Due to a low functional reserve volume, neonates are more prone to develop hypoxia, hypotension, and bradycardia and even cardiac arrest. Therefore, very close monitoring is required. Elective surgery provides the time to patients to gain weight and strength and offers the surgeon for selection of the best technique. However in this case , giant meningoencephaloceles require urgent surgical treatment to avoid damage to sac. The leak of sac was avoided because it may cause rapid drainage of LCS and being life threatening. In this surgery, communication with neurosurgeon is important to make sure there was a slow drainage of LCS to avoid rapid decrease of intracranial pressure. There was aspiration of the CSF before skin incision in large meningoencephalocele helps in dissection of the sac. In this case of circular meningoencephalocele with a small occipital bone defect, a transverse incision was made. Care should be taken to identify the contents of the sac. Rarely, the sagittal sinus torcula and the transverse sinus are seen in the vicinity of the sac. It is desirable to preserve the neural tissue. The dura has to be repaired meticulously to get a water-tight closure to prevent CSF leak. Many factors affect the outcome of patients with occipital meningoencephaloceles which include site, size, amount of brain herniated into the sac, presence of brainstem or occipital lobe with or without the dural sinuses in the sac,

and presence of hydrocephalus. The presence of gross brain tissue in sac, associated hydrocephalus, or congenital anomalies is unfavorable prognostic factors. In this case we found no brain segment in the sac and also there was no sinus involvement in the sac. This is very beneficial because it avoids secondary brain damage, herniation, massive and uncontrolled and bleeding.

Conclusion

The management of occipital meningoencephalocele can be complicated and should be individualized. In a tense, giant occipital meningoencephalocele problems encountered are essentially because of the large size and induced neonate handling, positioning in operation theatre, intubation, and blood loss during resection of the large amount of redundant skin. we must always carry out close observation with communication with the operator being the key to safety in this surgery.

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Mask Using Practice among Bangladeshi Population During COVID-19 Pandemic: A Video-Based Observational Study

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Abstract
Background: Although the government of Bangladesh made the use of masks mandatory in public settings during COVID-19, individuals have been reluctant to follow. We intended to know how many people used face masks in public settings during COVID-19. Methodology: This study was conducted in several public settings in Shahbag, an urban sub-district of Dhaka; and Sirajdikhan, a rural sub-district of Munshiganj in Bangladesh on November 2020. A total of 4011 people were identified from the video-graphic data captured from 20 public places for monitoring the use of masks. Finding: More than two-thirds of those observed had no face masks or did not utilize them properly. People in urban regions (43%) used mask more in an appropriate manner than those in rural areas (26%). Females wore masks comparatively more than males (53% vs. 35%, p-value <0.001). People used masks more in the morning than in the afternoon (39% vs. 34%, p-value <0.001). People were seen to use a mask more in hospital areas (60%) than in other places. However, in public transportation stands only one-fourth (25%) of the people wore a mask in an appropriate manner. In binary logistic regression male sex, rural area, public places and time of observation (afternoon) were found as risk factors for not wearing a mask. Interpretation: The general population of both rural and urban areas of Bangladesh is reluctant to wear face masks. Along with the ongoing vaccination campaign, people of Bangladesh need to wear masks for the prevention of COVID-19. Funding: This research has been partially supported by Bangabandhu Sheikh Mujib Medical University.

Keywords: COVID-19, Face Mask, Mask Usage, Video Footage, Bangladesh

1. Introduction

COVID-19 has already infected more than 231 million people across the globe with approximately five million fatalities as of September 2021 (Worldometer, 2021). Till September 2020, Bangladesh ranked second after India among South East Asian countries with cases and fatalities from COVID-19 (Worldometre, 2021). Even

after a year of COVID-19, Bangladesh is still the second worst-affected country in South Asia (Antara, 2021). COVID -19 transmits through respiratory droplets and can spread to a nearby person when an infected person sneezes, coughs or talks (World Health Organization, 2020b). As no suggested medication or vaccination has been proved to entirely protect a person from COVID-19, only non-pharmaceutical measures such as wearing a mask, social distancing, and hand washing are the major strategies to flatten the disease transmission curve (Garcia, 2020).

Research so far has shown the effectiveness in preventing COVID-19 transmission by using masks (Howard et al., 2021). In a study conducted by Bundgard et al., the infection rate of COVID-19 was found lower (1.8%) in individuals wearing masks in comparison to individuals who did not (2.1%) in Denmark(Bundgaard et al., 2021). A mathematical model revealed that wearing a face mask reduces community transmission and mortality rates by 24-65% (Eikenberry et al., 2020). According to Van Dyke *et al.* COVID-19 incidence decreased when mandatory mask use was imposed in some counties in Kansas of USA, but increased in other counties where this measure was not adopted (Dyke, 2020).

According to recent studies, asymptomatic carriers of COVID-19 are highly prevalent in the community (Goh et al., 2020). Furthermore, an infected person can shed respiratory droplets 2 to 3 days prior to developing symptoms(Kremer et al., 2020). More so, evidence implies that infected asymptomatic individuals continue shedding viruses for an extended period (Feng et al., 2020). As a result, asymptomatic carriers pose a higher risk of community transmission. Sometimes people wear face masks incorrectly, which may not protect them against infection and thereby increase the chance of transmission (Machida et al., 2020). As the viral load of asymptomatic carriers is comparable to that of symptomatic patients (Zou et al., 2020), maintaining respiratory hygiene is a key precondition to preventing COVID-19. In this regard, many countries have made it mandatory for their citizens to wear masks during this pandemic (Directorate General of Health Services, 2020b).

Bangladesh is the seventh most populous country in the world, where a significant number of individuals rely on daily wages (income US$2 per day) to meet their basic needs (Paul et al., 2021; UFPA Bangladesh, 2017). Maintaining hand hygiene and social distance in public places in such circumstances can be quite challenging. The government of Bangladesh has encouraged its citizens to wear masks since the beginning of the pandemic from April 2020 (Mobarak, 2021). The government further made wearing masks mandatory in outdoor settings since late May 2020(Directorate General of Health Services, 2020a). There have been reports in mass media regarding the reluctance of people with wearing masks, but no study has been conducted to estimate the proportion of the population wearing masks during their stay in outdoor settings. So, we aimed to find out the proportion of the Bangladeshi population wearing masks in different public places of both urban and rural areas during COVID-19.

2. Methods

2.1 Study sites and sample

Data comprised video footage of real-life public behavior in selected rural and urban areas of Bangladesh regarding mask usage. This non-participatory observational study was carried out at Shahbag, an urban metropolitan area of Dhaka, and Sirajdikhan Upazila (sub-district) of Munshiganj, a southern rural district of Bangladesh. Shahbag is a densely populated area with around 6,500 persons living per square kilometer, while Sirajdikhan has a population density of 1,600 people per square kilometer (Bangladesh Bureau of Statistics, 2013). Twenty public places, ten from Shahbag and ten from Sirajdikhan were selected purposively. Wet markets, outpatient departments of hospitals, transportation stands, recreational areas (e.g. children's parks), public squares, and religious sites such as mosques, temples, and Mazars (shrines) were considered as public places.

Individuals entering or departing the observing locations through the entry and exit points and passers-by were included in this study. In the case of people appearing multiple times in single video footage, were counted once. All the people appearing in the video footage during the observation time were included for this study except those crossing the area in vehicles. We also excluded veiled women and children carried on the lap.

2.2 Data collection procedure

The video footage was taken from a convenient angle to cover most of the people passing through the designated area by an experienced trained data collector. The footage was captured with a mobile phone camera (Model no. Redmi Note 5, model name M1803E7SG, Xiaomi Communications Co., Ltd., China) during the COVID-19 pandemic in November 2020. Each location was observed for ten minutes both in the morning (9 am to 11 am) and afternoon (3 pm to 5 pm). We placed an easily visible warning notice at the area of data collection to inform people that we were recording video for research purposes so that people were aware of the situation ahead of time. The total duration of the video record was 400 hours in independent 10 minute footage. The first author of this paper accompanied the data collector in every observation site. We obtained approval from local government representatives and police stations prior to the data collection.

2.3 Coding procedure

A code list was developed based on WHO recommendations for "Advice on the Use of Masks in the Context of COVID-19"(World Health Organization, 2020a). This code list includes descriptive classifications of the observed people's sex, observation site and time, and usage of mask (yes/no). Observational sites were categorized into six groups: hospital area, public square, religious place, market area, transportation stand, and recreational area. Pre-tested video footage helped to construct the code list for data collection. Use of mask was deemed if a person completely covered their mouth, chin, and nose using respirators, surgical masks, fabric masks, or other masks. Persons who put the mask on or took it off or changed the mask's placement in the face (e.g., from covering both the nose and mouth to only covering the mouth), and improvised the masks (e.g., bandana, scarf) were all regarded as not using mask appropriately. No use of mask and not using mask appropriately were categorized as 'no use of mask.' Data were extracted from the video footage by employing a quantitative content analysis method using the structured code list. To reduce bias, two authors coded the video footage. The motion data were extracted using a laptop (Dell Inspiron15R-5521 Notebook, Made in China, 2013). We observed all footage to extract data using pause and play effects.

Ethical permission was obtained from the Institutional Review Broad of Bangabandhu Sheikh Mujib Medical University (Memo no. 2020/9155).

2.4 Statistical analysis

All categorical variables were expressed in frequency and percentage. The Chi-square test was used to compare categorical variables. Independent variables that showed a significant risk factor (reported in crude odds ratio) in the univariate model were chosen for further analysis in a binary logistic regression to find independent risk factors (expressed in adjusted odds ratio). Data were analyzed by using Statistical Package for Social Science (SPSS) version 23. A *p*-value <0.05 was considered statistically significant.

3. Results

A total of 4,011 people were identified from the video footage, where 62% belonged to urban areas and nine among ten of the total people observed were male. About 36% of people wore masks according to WHO guidance, while 15% wore masks inappropriately and 49% did not wear a mask. Among the observed females, 53% wore masks appropriately, while it was 35% in males.

In rural area only 26% of people appropriately wore a mask. Mask using practice was found most in hospital areas (60%) and least in public transportation stands (25%). Demographic characteristic of the observed people has been presented in Table 1.

Table 1: Demographic characteristics and association between mask usage and all the variables (n=4011)

| Variables | All (N=4011) | Usages of mask | | p-value* |
		Yes (n=1461)	No * (n=2550)	
Sex, n (%)				
Male	3604 (89.9)	1244 (34.5)	2360 (65.5)	<0.001
Female	407 (10.1)	217 (53.3)	190 (46.7)	
Study area, n (%)				
Urban	2471 (61.6)	1069 (43.3)	1402 (56.7)	<0.001
Rural	1540 (38.4)	392 (25.5)	1148 (74.5)	
Place of observation, n (%)				
Hospital areas	511 (12.7)	307 (60.1)	204 (39.9)	<0.001
Market areas	1083 (27.0)	332 (30.7)	751 (69.3)	
Religious places	598 (14.9)	183 (30.6)	415 (69.4)	
Public transport station	429 (10.7)	107 (24.9)	322 (75.1)	
Recreational areas	815 (20.3)	252 (30.9)	563 (69.1)	
Public squares	575 (14.3)	280 (48.7)	295 (51.3)	
Time of observation, n (%)				
Morning (9-11am)	1910 (47.6)	742 (38.8)	1168 (61.2)	0.002
Afternoon (3-5pm)	2101 (52.4)	719 (34.2)	1382 (65.8)	

*No usage of mask comprises both inappropriate use and no use of mask
*p-values used in this table were obtained from by chi-square test.

Table 2: Distribution of the no mask users (n=2550)

Variables	Inappropriate use (n=600)	No mask (n=1950)
Sex, n (%)		
Male	551 (15.3)	1809 (50.2)
Female	49 (12.0)	141 (34.6)
Study area, n (%)		
Urban	372 (15.1)	1030 (41.7)
Rural	228 (14.8)	920 (59.7)
Place of observation, n (%)		
Hospital areas	100 (19.6)	104 (20.4)
Market areas	160 (14.8)	591 (54.6)
Religious places	95 (15.9)	320 (53.5)
Public transportation stands	51 (11.9)	171 (63.2)
Recreational areas	101 (12.4)	462 (56.7)
Public squares	94 (16.3)	201 (35.0)
Time of observation, n (%)		
Morning (9-11am)	262 (13.7)	906 (47.4)
Afternoon (3-5pm)	338 (16.1)	1044 (49.7)

In table 3 logistics regression model showed that males were 1.8 times more likely to not wear a mask than females (adjusted odds ratio (AOR) =1.79, 95% confidence interval (CI), 1.44 -2.23: p-value <.001), and people of rural areas were 2.4 times more likely to not wear masks than urban people (AOR =2.39, 95% CI, 2.01- 2.84:

p-value <.001). People in religious places, public transportation stands, and public squares, recreational areas, public squares were found significantly higher in not wearing masks. The odds of not wearing masks in the afternoon were 1.3 times higher than that of the morning (AOR =1.31, 95% CI (1.14-1.50); *p*-value, <.001).

Table 3: Factors associated with not using masks

Variables	Crude Odds Ratio (95% Confidence Interval)	Adjusted[&] Odds Ratio (95% Confidence Interval)
Sex		
Female	Reference	Reference
Male	2 (1.76 -2.66)***	1.79 (1.44-2.23) ***
Study area		
Urban	Reference	Reference
Rural	2.23 (1.94 -2.57)***	2.39 (2.01- 2.84)***
Place of observation		
Hospital areas	Reference	Reference
Market areas	0.63 (0.50-0.80)***	0.72 (0.56-0.92)*
Religious places	2.15 (1.74 -2.64)***	1.93 (1.60-2.40)***
Public transportation stands	2.15 (1.70 -2.73)***	1.68 (1.31-2.15)***
Recreational areas	2.86 (2.17-3.75) ***	1.52 (1.12-2.05)***
Public squares	2.12 (1.70-2.65)***	2.65 (2.10-3.35)***
Time of observation		
Morning (9-11am)	Reference	Reference
Afternoon (3-5pm)	1.22 (1.07 - 1.39) **	1.31 (1.14-1.50) ***

[&]Here adjusted factors are the variables mentioned in the table.
**p*- value< 0.05
** *p*-value< 0.01
****p*-value < 0.001

4. Discussion

Our study findings of using face masks appropriately (36%) are comparable to the findings from an Iranian study where 35% of people wore masks correctly (Rahimi et al., 2021). However, approximately 87% of pedestrians in Hong Kong wore masks correctly (Tam et al., 2020). Ferdous et al. showed that 99% of respondents in their study agreed that wearing a mask in crowded places helps to prevent COVID-19 transmission (Ferdous et al., 2020). Our study findings of lower mask usage reflect the fact that there is a clear gap between knowledge and practice of wearing masks in the Bangladeshi population. The reason behind this gap can be explained by the socio-demographic and cultural factors of Bangladeshi people, like low level of awareness of disease transmission, low literacy rate, poverty, unavailability of mask, and lack of fear regarding COVID-19 transmission (Begum, 2021; Islam, 2020; The Financial Express, 2020b) Lack of social acceptability and reduced perceived susceptibility can be the other reasons for the reluctance of wearing a mask. A study in China during the SARS outbreak demonstrated that people with a high level of perceived susceptibility are 2.5 times more likely to wear a mask (Tang & Wong, 2004). On the other hand, a study conducted in Uganda showed that people with higher educational qualifications have 1.5 times better understanding of the necessity of wearing masks in preventing COVID-19 (Sikakulya et al., 2021).

In the present study, we found that people of urban areas wear masks more than that of rural areas. Similar findings have been observed in a survey conducted in eight divisions of Bangladesh, where around 64% of urban people wore masks, while it was only 49% among rural people (Tithila, 2020).

Female participants in our study were found to wear masks more than males. Gender gaps in mask practices may be due to the risk-taking behavior of males and their perception of not getting sick (Finucane et al., 2000). On

the other hand, females having more protective adaptability than males might have played a role in this regard (Duarte, 2020).

In November 2020, the Road Transport Owners Association of Bangladesh asked its members to ensure all people wear masks in public transportation and stations. However, the lowest mask practice was observed in public transportation stations in our study. In contrast, a study in Paris found 94% of people wore mask in public transportation stations (Guellich et al., 2021). People in our study were found to wear masks more in the morning than in the afternoon. Rahimi et al. in their study stated that the hot and humid climate makes Iranian people reluctant to use masks (Rahimi et al., 2021). Bangladesh is a tropical country with hot and humid weather which might be a cause of people not being able to wear masks throughout the day.

During the pandemic, not wearing a mask in public places is a punishable offense with a monetary fine according to Communicable Disease Act 2018, Bangladesh (Directorate General of Health Services, 2020a). On July 21, 2020, the government of Bangladesh announced compulsory use of masks in public places after the death toll from COVID-19 complications sore in June 2020(The Financial Express, 2020a). The unwillingness of people to follow the mask-wearing protocols despite legal obligation is an indication that people, in general, are not aware of the severity of COVID-19 and also not respectful to law.

4.1 Limitations of the study

The age of the participants could not be identified by observing the video footage. So, we could not exclude people who are not recommended for wearing masks, like children under the age of five. We conducted our study in selected rural and urban areas. So, the result might not be generalized for all over Bangladesh.

5. Conclusion

The majority of the people of Bangladesh do not wear a mask in public places, although it has been made compulsory. So, it can be difficult to curb the rate of transmission if people do not strictly wear masks in public places as a safety measure against COVID-19. Health education and awareness program are needed to encourage the mask-wearing practice of people.

6. Author's contribution

All of the authors have made significant contributions to this paper and have given their approval for its submission. The concept came from CF, MAH, MMHK, and MTI; data extraction from video footage was handled by CF, SM, AA, AT, and MIIT; and statistical analysis was handled by MAH, MMHK, CF, SM. Data analysis and interpretation were carried out by CF, MAH, MMHK, AA, and SM. The revisions were led by CF, MIIT, and MAH. During the article's drafting or editing, each author contributed essential intellectual content and acknowledges responsibility for the entire project.

7. Data sharing statement

The data will be available as per request (mail to atiqulm26@bsmmu.edu.bd).

8. Funding

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9. Declaration of Competing Interest

All authors declare no competing interests.

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COVID-19 Testing: Perceived Barriers Among the Urban Slum Dwellers of Dhaka, Bangladesh

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Abstract

Background: Urban slum dwellers are unduly affected by COVID-19, and low testing rates among them are worsening their situation. This study aimed to explore the perceived barriers to COVID-19 testing in the slums, which is crucial to its surveillance, tracking, and allocating resources to combat the pandemic. Methods: A quantitative study with a cross-sectional design was conducted among 149 urban slum dwellers (≥11 years of age), who had previously experienced COVID-19 like symptoms. They were identified from an existing slum cohort at Bauniabadh, Dhaka. Information related to their testing status and perceived barriers was acquired by a telephone survey from October to November 2020. Results: The mean age of the respondents was 34.4±15.6 years, and 58.4% of them were female. Fever (79.2%) and cough (74.5%) were the most common symptoms mentioned. Only 6.7% of the respondents had undergone COVID-19 testing. Fast relief (within 1-3 days) from symptoms (87.6%) was the most prevailing barrier to testing, seen across all age and education groups. Negative advocacy regarding the testing from family and friends (46.7%), participants uncertainty about the guidelines, site, cost, and schedule of testing (15.3%), and a general belief that 'COVID-19 is not a disease of slum people instead, it is an affliction of the rich folk' (20.4%), were the other cited barriers. Conclusions: The COVID-19 testing rate remained very low among the urban slum dwellers. To remove the barriers to testing, tailored behavioral change communication and augmenting the resources for testing are necessary to curb the spread in the slums.

Keywords: COVID-19 Testing, Bangladesh, Urban Slum Dwellers

1. Introduction

The World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) outbreak a pandemic in March 2020, and it has spread to more than 200 countries, with severe public health and economic consequences (Tilford et al., 2020). The effective management of COVID-19 outbreak primarily relies on constant surveillance by testing (Tandel et al., 2021), as it plays a vital role in mapping the spatial distribution of the virus and taking measures to contain the contagion (Rahaman et al., 2020). Amid the estimated 90% of all reported COVID-19 cases, urban areas have become the epicenter of the pandemic (United Nations Policy Brief, 2020). Within the cities, COVID-19 has disproportionately affected the urban slum dwellers, since the slums are recognized hotspots for the transmission (Lau et al., 2020). Dhaka, the capital city of Bangladesh, has listed 3394 slums, with over six hundred thousand people inhabiting them (The Daily Star, 2019). In a recent study conducted by Islam et al., (2020) revealed that majority of the slum dwellers in Bangladesh had very limited knowledge of COVID-19, but it was intriguing to observe that they exhibited positive attitudes and favorable preventive practices towards COVID-19 (Islam et al., 2020). In spite of such reassuring results, Hossain et. al., (2020) reported that none of the participants of his study went for COVID-19 testing, despite having experienced symptoms for COVID-19 (Hossain et al., 2020). Among the few reasons assumed by the experts for the possible low testing rates in Bangladesh, included the unequal distribution of test centers across the country to the population density, charging a fee for testing, multiple testing scams, loss of confidence in the health care systems, delay in receiving results, and the loss of jobs, leading to economic difficulties especially for the poor (Cousins, 2020). While reviewing to date, no studies have been conducted to understand the barriers towards testing, targeting vulnerable populations. Therefore, this study was designed to explore the barriers to COVID-19 testing among the urban slum dwellers of Bangladesh.

2. Materials and methods

The cross-sectional study was conducted among the urban slum dwellers of Bauniabadh, Mirpur in Dhaka city, Bangladesh. The socio-demographic profile of this urban slum has been described elsewhere (Khalequzzaman et al., 2017). The study participants were recruited from an ongoing cohort study titled Bangladesh Longitudinal Investigation of Emerging Vascular and Nonvascular Events in an urban slum setting (BELIEVE Slum study) conducted at Bauniabadh, since 2019 by the Department of Public Health and Informatics, Bangabandhu Sheikh Mujib Medical University (BSMMU). In this cohort, a total of 5200 participants have been recruited, among which 3700 participants were under telephone-based review for any presenting COVID-19 infection symptoms since June 2020. Among those inquired previously, 200 participants were identified as potential participants for this study, who were more than 11 years of age, and had previously experienced any of the five common COVID-19 infection like symptoms - fever, sore throat, cough, difficulty in breathing, and loss of sense of smell and taste. From this, an estimated sample size of 150 participants was calculated. The respondents for this study were selected from the sampling frame by a computer-generated simple random sampling technique. A pretested semi-structured questionnaire was used for data collection. The questionnaire included questions regarding basic demographics, awareness of COVID-19, knowledge of symptoms, perceived risk, practicing current preventive measures such as handwashing, quarantine, social distancing, testing if symptoms arise, and barriers to undertaking COVID-19 testing. In order to minimize the risk of COVID-19 transmission, in-person interviews were avoided, and the interview was done over the telephone. Survey responses were collected from October 2020 to November 2020. The interviews, consent and assent of the participants were all audio recorded. Informed verbal consent was taken from each participant above the age of 18 years. For respondents between the age of 11 to 17 years, verbal assent was taken from the adolescent and informed verbal consent from their parents before commencing the interview. This study received ethical clearance from the Institutional Review Board of BSMMU (Reference No. BSMMU/2020/3214).

All the survey responses were analyzed initially by using frequency distribution, mean and standard deviation. They were then tabulated by gender, age and education level to generate basic descriptive tables. Intergroup differences were assessed for statistical significance within each category using chi-square tests with a significance level of ≤0.05.

3. Results

A total of 198 telephone calls were placed. Out of them, 24 (12%) of the respondents reached on the phone refused to participate in the study, 22 (11%) phone numbers were found to be either switched off or did not respond to the calls, and 3 (1.5%) of the respondents were excluded from the interviews as they did not fulfill our inclusion criteria. Therefore, a total of 149 interviews were completed. Descriptive statistics of the participants are presented in Table 1, where females (58.4%) represented over half of the respondents. The mean age of the respondents was 34.4±15.6 years, and the highest proportion (23.5%) belonged to the age group of 35-44 years. The majority (56.5%) of the respondents had completed their education only up to the primary level, and almost half (48.4%) of the subjects were homemakers. Fever (79.2%) and cough (74.5%) were mentioned as the most common COVID-19 like symptoms present among the respondents preceding the study. A substantial proportion (93.3%) of them did not go for COVID-19 testing even though they had COVID-19 like symptoms previously.

Table 1: Study participant characteristics (N=149)

Variables	n (%)
Age (in years)	
11-17	21 (14.1)
18-24	31 (20.8)
25-34	25 (16.8)
35-44	35 (23.5)
45-54	18 (12.1)
>55	19 (12.8)
Age (Mean ± SD)	34.4 ± 15.6
Gender	
Male	62 (41.6)
Female	87 (58.4)
Religion	
Islam	147 (98.7)
Hindu	2 (1.3)
Marital status	
Married	101 (73.2)
Unmarried	30 (21.7)
Widow/Widower	7 (5.1)
Educational attainment	
No formal education	25 (19.6)
Up to primary	78 (56.5)
Secondary and above	31 (23.2)
Occupation	
Service	33 (27.6)
Small trade	29 (23.3)
Student	27 (22.6)
Homemaker	60 (48.4)
Reported COVID-19 infection like symptoms in the last 3 months (Multiple responses)	
Fever	118 (79.2)
Cough	111 (74.5)
Sore throat	53 (35.6)
Difficulty in breathing	4 (2.7)
Loss of sense of taste and smell	1 (0.7)
COVID-19 testing status	
No	139 (93.3)
Yes	10 (6.7)

Table 2 reveals the mentioned barriers towards COVID-19 testing. Relief from symptoms within 1-3 days (87.6%), negative counseling regards testing from family and friends (46.7%), the belief that COVID-19 is not a disease of slum people, instead it is an affliction of the rich people (20.4%), and not knowing when, how and where to get tested (15.3%) were the most common barriers to COVID-19 testing. There was no significant difference observed

between the male and female respondents considering the drawbacks of testing. Fast relief from symptoms within 1-3 days and negative counseling from family and friends were the significant barriers among the relatively younger respondents (11-34 years). Among the respondents with secondary and above education levels, 93.5% mentioned fast relief from symptoms was the common cause for not undertaking COVID-19 testing. On the other hand, respondents who are ≥35 years and with no formal education, significantly did not go for testing as they believed that COVID-19 is not a disease of slum people, and even if they were infected, they would be cured by the Almighty. Other significant reasons also included the respondents not knowing when, how and where to get tested and being too weak or ill to go for COVID-19 testing.

4. Discussion

This study was designed to identify the barriers for COVID-19 testing among the urban slum residents who had previously experienced COVID-19 infection-like symptoms. The top two clinical symptoms experienced by the respondents of this study were fever (79.2%) and cough (74.5%). Many previous COVID-19 related studies also had mentioned fever and cough as the most reported symptoms experienced by their respondents (Abdelhafiz et al., 2020; Ahdab, 2020; Austrian et al., 2020; Clements, 2020; Lau et al., 2020). In this study, a very small fraction of the respondents (6.7%) went for testing when they had experienced symptoms. This finding is complementary to another study conducted previously in Bangladesh, where the respondents who had experienced COVID-19 like symptoms, none underwent testing (Hossain et al., 2020). This slight difference in the testing rate might be explained by the time lapse between the two studies, where possibly, there might have been an increase in the number of testing facilities, reduction in the appointment related complexities, and reduced fear related to testing, which might account for this small increase in the number of testings.

The most voiced barriers towards COVID-19 testing identified in this study were, fast relief (within 1-3 days) from symptoms (87.6%), negative advocacy regarding the testing from family members, relatives or friends (46.7%), confusion about when, how and where to get tested (15.3%) and general belief that COVID-19 is not a disease of slum people, instead it is an affliction of the rich people (20.4%). Avoiding testing due to fast relief from symptoms was a unique barrier found in this study, which was seen highest among all age groups and education levels. Among the few literatures describing the barriers to COVID-19 testing, none mentioned this particular barrier. Comparable reasons with regards to 'symptoms' to avoid testing were cited by Bonner et al. (2020), where the participants mentioned they were unsure if their symptoms were bad enough, unsure if the symptom needs testing, symptoms were due to something else and will wait for the symptoms to get worse before doing COVID-19 testing (Bonner et al., 2020). Discouragement and negative advocacy from family and/or friends, played another prominent role in avoiding COVID-19 testing among the participants and was significantly seen in the younger age groups. This negative counseling possibly rises from insufficient knowledge about the importance of the testing, lack of credibility of the testing, mistrust on the health care workers, multiple testing scams (Cousins, 2020) and existing misinformation about COVID-19 (Barua et al., 2020). Such discouragement and negative advocacy were reported previously as barriers to testing for other infectious diseases such as in human immunodeficiency virus infection (Denison et al., 2008). Furthermore, not knowing when and where to get tested, thinking that the test is expensive, added to their confusion about testing. A study conducted in the United States reported similar confusion about testing, where frequent changes to the Centers for Disease Control and Prevention guidelines during the COVID-19 pandemic prevented people from clearly knowing when and where to test (McElfish et al., 2021). Similarly, a study conducted in Australia reported that 7.1% of their respondents were unaware of how, when, and where to get tested, 11% thought that testing was painful and 5.0% were concerned about getting infected in the testing center (Bonner et al., 2020). To overcome these obstacles, some possible solutions include using community non-governmental organizations, schools, and community centers as mobile testing centers for easy access, developing community-based applications, and paying attention to systematically listing the nearest testing centers, hours of operation, testing criteria and cost (McElfish et al., 2021).

Table 2: Perceived barriers to COVID-19 testing among the respondents with gender, age category and education

Barriers	Gender		Age category							Education			
	Male	Female	11-17 years	18-24 years	25-34 years	35-44 years	45-54 years	>55 years		No education	Primary and below	Secondary and above	Overall
Relieved from symptoms within 2-3 days	50 (87.7)	70 (87.5)	21 (100.0)	24 (85.7)	23 (100.0)	29 (87.9)	12 (75.0)	11 (68.8)	*	15 (65.2)	67 (91.8)	29 (93.5)	*	120 (87.6)
Discouraged by relatives/ friends	29 (50.9)	35 (43.8)	14 (66.7)	10 (35.7)	15 (65.2)	11 (33.3)	5 (31.3)	9 (56.3)	*	8 (34.8)	41 (56.2)	12 (38.7)		64 (46.7)
It is not a disease of slum dwellers	14 (24.6)	14 (17.5)	0 (0.0)	1 (3.6)	1 (4.3)	6 (18.2)	8 (50.0)	12 (75.0)	*	12 (52.2)	13 (17.8)	1 (3.2)	*	28 (20.4)
Do not know how, when and where to get tested	9 (15.8)	12 (15.0)	1 (4.8)	2 (7.1)	1 (4.3)	7 (21.2)	3 (18.8)	7 (43.8)	*	8 (34.8)	10 (13.7)	3 (9.7)	*	21 (15.3)
Testing is expensive	6 (10.5)	5 (6.3)	2 (9.5)	0 (0.0)	0 (0.0)	4 (12.1)	3 (18.8)	2 (12.5)		4 (17.4)	7 (9.6)	0 (0.0)		11 (8.0)
Will be cured by Almighty	4 (6.5)	7 (8.0)	1 (4.8)	0 (0.0)	0 (0.0)	2 (5.7)	3 (16.7)	5 (26.3)	*	3 (11.1)	8 (10.3)	0 (0.0)		11 (7.4)
Fear of losing job	2 (3.6)	2 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (9.1)	1 (6.3)	0 (0.0)		2 (8.7)	1 (1.4)	1 (3.3)		4 (2.9)
Severely weak /ill	2 (3.5)	2 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.0)	2 (12.5)	1 (6.3)		3 (13.0)	1 (1.4)	0 (0.0)	*	4 (2.9)
Fear of social isolation	0 (0.0)	1 (1.3)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	1 (3.2)		1 (0.7)

*P-value ≤ 0.05 was considered to be significantly associated

This study also identified how individual beliefs impacted the slum dweller's approach towards testing. The most common belief iterated by people of >55 years of age and with no formal education was that COVID-19 is not a disease of the poor; instead, it is an affliction of the rich people, hence, they thought there was no need for testing if even they had COVID-19 infection-like symptoms. Additionally, a nested religious belief was also found to influence their testing behavior. They believed that even if the slum dwellers were infected with COVID-19, they will be cured by the Almighty. It is evident that, during any disaster, epidemic or pandemic, religion plays a substantial role in influencing people's behavior (Barua et al., 2020) and already religious groups in different countries are promoting their belief in the religion that will save them from COVID-19 (Graham et al., 2021). Thereupon, to reduce the impact of such beliefs on testing, it is ideal for the government to take measures to limit the propagation of false ideas or information regarding COVID-19. One such step is to promote COVID-19 facts and dispel related myths on media platforms using an authoritative and trustworthy personality. In addition to the above, they can continuously remove fact-checked false and potentially harmful information from social media (Rosenberg et al., 2020). Another initiative that can be taken up includes directing the country's religious leaders to provide people with accurate information and creating awareness among them, amid the pandemic for the safety of the society (Barua et al., 2020).

There are some limitations in this study that warrants considerations. The small sample size of this study and the larger proportion of female respondents may influence the generalizability of the results to the slum itself. Also, the study type did not allow us to explore the barriers more in-depth and its nuanced insights for COVID-19 testing.

5. Conclusions

A very low proportion of the urban slum dwellers with COVID-19 infection-like symptoms went for testing. This behavior was influenced by barriers such as fast relief (within 1-3 days) from symptoms, negative advocacy from family and friends, uncertainty of the participants with regards to the site, cost and schedule of testing, and the belief that it is not a disease of the slum people rather is a disease of the rich people. Understanding these barriers is crucial to improving the testing rates. To mitigate these barriers, expanding on the available testing resources and behavior change communication adapted for the inhabitants of urban slums is essential to curb the spread of COVID-19 in the slums.

6. Declarations

6.1 Acknowledgments

6.2 Ethics approval

This study was conducted according to the Declaration of Helsinki and performed after getting ethical clearance from the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (Reference No. BSMMU/2020/3214).

6.3 Competing interests

The authors declare that there are no competing interests.

6.4 Funding

6.5 Author Contributions

Conceptualization: RS, SER, MK. Data curation: RS, KMTR. Formal analysis: RS, SER. Funding acquisition: RS, SER, SSI. Methodology: RS, SER, MK, SSI. Project administration: SER, KMTR. Visualization: RS, SER, KMTR. Writing - original draft: SER, RS. Writing - review & editing: SER, MK, SSI.

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QEEG-based Brain Mapping of Internet Pornography Addicted Adolescents

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Abstract
The Indonesian government for many years has tried to protect the public from the dangers of pornography by blocking various sites. Although various efforts have been made to block access to pornography, a report from the Ministry of Women's Empowerment and Child Protection mentioned that 97% of Indonesian teens were exposed to pornography from the internet. In order to increase awareness, especially in the addiction phase, scientific evidences showing the bad effects of pornography addiction is needed. In this study, 15 teens addicted to internet pornography underwent brain mapping using electroencephalography (EEG) in a resting state for approximately 20 minutes. The data were processed using a quantitative EEG (QEEG) approach, especially Fast Fourrier Transform (FFT) by first removing all artifacts on the electroencephalogram during recording. The analysis focused on the delta wave in the forebrain, showing the dominance of the prefrontal cortex, which has implications for cognitive function decline, especially the braking system among these teens addicted to internet pornography. The decline in cognitive function causes teens to lose the ability to determine what is right and wrong or refrain from doing wrong. Based on the results, efforts to educate teens about the dangers of pornography addiction need to be further promoted.

Keywords: QEEG, Addiction, Pornography, Teens

1. Introduction

Advances in internet technology make it easier for various information to spread throughout the world, both positive content such as education or negative content such as pornography. In 2014, 25% of information searches

on various search engines turned out to be related to pornography (Kamaruddin *et al.,* 2019). The Indonesian government for many years has tried to protect the public from the dangers of pornography by blocking various sites (Kemkominfo, 2012). Although initially only limited to sites containing pornography specifically, now it is more widespread with the safe search mode on search engines, such as Google as a result of collaboration between the Ministry of Communication and Information and Internet Service Providers (Kemkominfo, 2018). Although various efforts have been made to block access to pornography, a report from the Ministry of Women's Empowerment and Child Protection mentioned that 97% of Indonesian teens were exposed to pornography from the internet (Kemenpppa, 2018). This is line with a study by Yayasan Kita and Buah Hati two years earlier (Prawiroharjo *et al.*, 2019). This fact is certainly worrying and there need to be prevention efforts based on scientific data through observation of brain activity.

Electroencephalography (EEG) is one of the gold standards for functional neuroimaging modalities to assess brain activity non-invasively (Wang *et al.*, 2018). Brain activity on the electroencephalogram can be interpreted in various ways, such as by direct observation for brain diseases such as epilepsy (Zhou et al., 2018) or by pre-processing the data with various techniques such as Naive Bayes (Lestari *et al.*, 2020), *random tree forest* (Lestari *et al.,* 2020), and so on. Until now, the effect of pornography on the brain, especially memory abilities or decreased function, is the same as those who experience trauma in the forebrain (Hou *et al.,* 2019). Several studies discussed pornography (Kamaruddin et al., 2019) but the scientific evidence is still not solid. Therefore, this study aimed to strengthen scientific data on internet pornography addiction. This study described qualitative EEG data on the brains of teens addicted to internet pornography.

2. Method

2.1. Subject

The data studied were secondary data from the Laboratory of Neuroscience Center Uhamka Database on 15 teens aged 14-16 years addicted to internet pornography recruited by Yayasan Kita and Buah Hati in 2019 based on the Pornography Addiction Test (Prawiroharjo et al., 2019). Exclusion criteria were left-handed, had a history of head trauma, had a history of brain disease, language disorders, psychiatric disorders, and neurological disorders.

2.2. EEG Data Record

The recording of brain signals used Cadwell EEG 16 electrodes (Fp1, Fp2, F3, F4, F7, F8, C3, C4, T3, T4, T5, T6, P3, P4, O1, and O2) and one reference electrode (CZ). The position of electrodes on the scalp follows the international 10 – 20 system (Siuly et al., 2016) as shown in Figure 1. The recording was carried out in a resting state for approximately 20 minutes where the subject was asked to open his eyes for two minutes followed by closing his eyes for two minutes, and so on alternately.
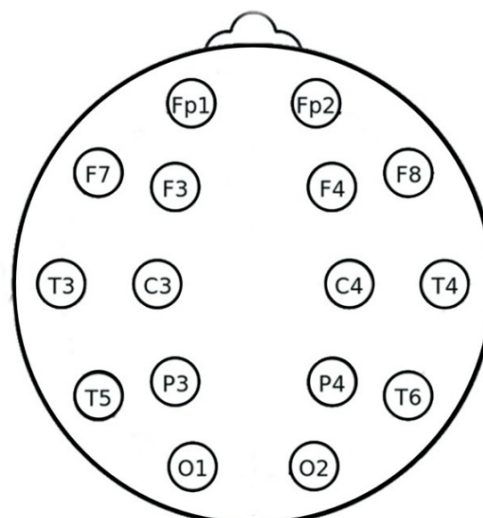

Figure 1: The position of EEG electrodes on the head based on the international system 10 - 20

2.3. Data Analysis

Data were analyzed in several stages:

1. From 20 minutes of brain activity recording data, only clean data in the form of data when closing the eyes for one minute was used as a result of filtering and rejecting noise and artifacts such as eye blinks and limb movements. This data cleaning was carried out manually and computationally with Neuroguide Deluxe 2.9.0 software with average reliability and retest value of 0.95 and 0.90.

2. After obtaining clean data, spectral analysis was carried out using Fast Fourier Transform (FFT) to calculate the absolute power value in five frequency bands namely delta (1–4Hz), theta (4–8Hz), alpha (8–12Hz), beta (12 –25Hz), and gamma (30–40Hz). The electrodes analyzed were electrodes representing the forebrain or frontal lobes in the form of FP1, FP2, F3, F4, F7, and F8.

3. In the final stage, statistical analysis was carried out with IBM SPSS Version 28 Windows software based on the mean of absolute power. The analysis was carried out to find out the wave dominance on pornography addicts.

3. Results

After conducting QEEG-based brain mapping on teens addicted to pornography in a resting state for two minutes, filtration was performed computationally and manually to obtain clean data on closed eyes for one minute. A high-pass filter of 70 Hz and a low-pass filter of 1Hz were used. In addition, in order to eliminate artifacts caused by electrical power, a sensitivity filter of 7mV/mm was used.

Furthermore, spectral analysis was carried out on the data focused on the forebrain region by the Fp1, Fp2, F3, F4, F7, and F8 electrodes as shown in Figure 2. Figure 3 shows FFT-based brain mapping visualization. The mapping was carried out in each frequency range of delta, theta, alpha, beta, and gamma.
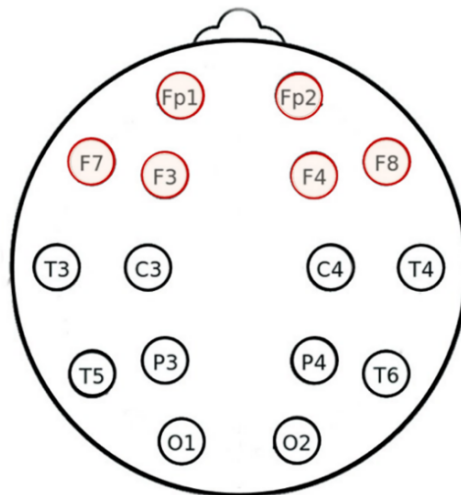

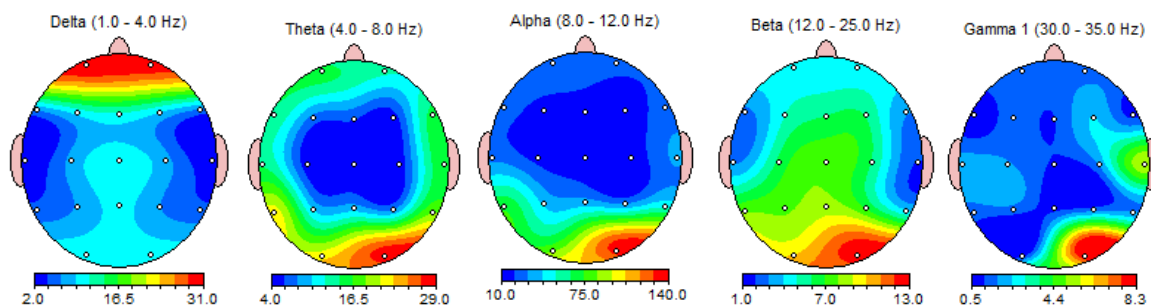Figure 2: The EEG channel represents the forebrain

Figure 3: FFT shows the dominance of each wave in the brain

The analysis focused on the forebrain region also shows similar data as shown in Figure 4, and the average results in Table 1 show an increase in the dominance of the delta wave.
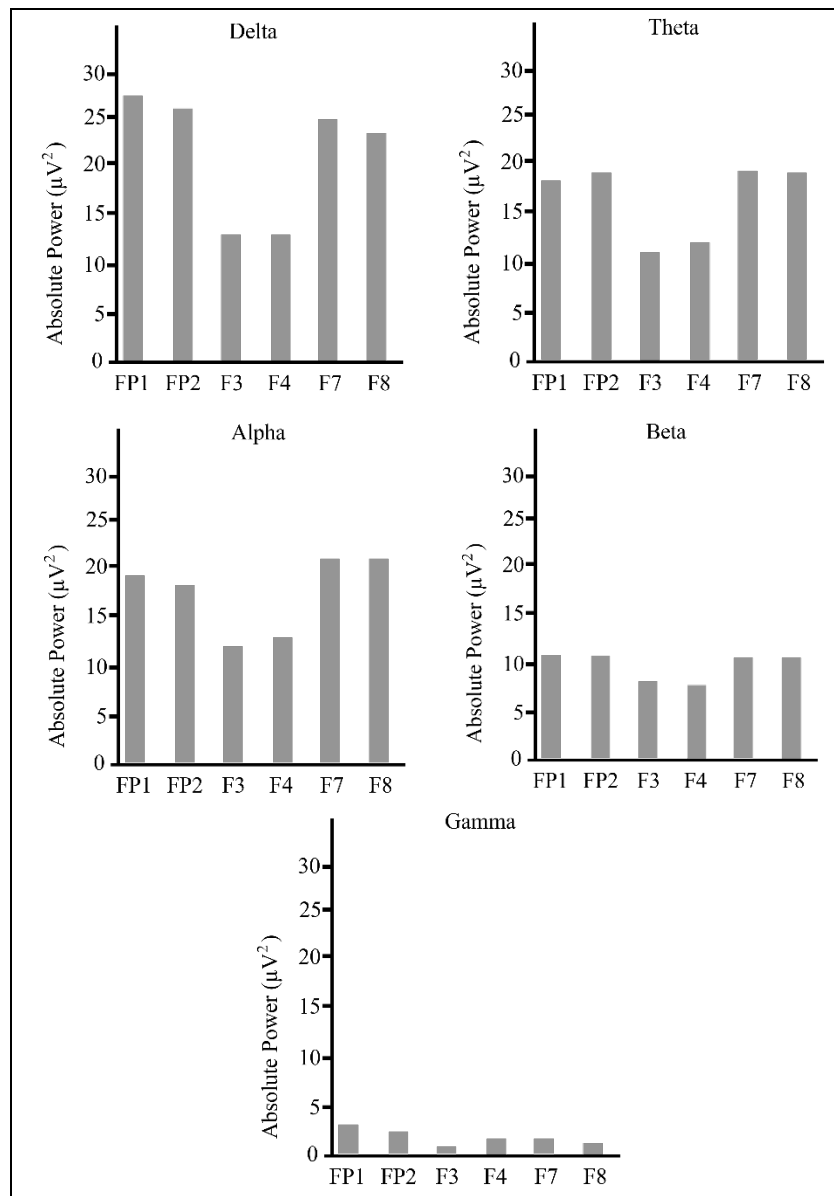

Figure 4: Average Value in Each Frequency Band

Table 1: Statistical Analysis Results of wave dominance in the forebrain

Value	Frequency Band				
	Delta	Theta	Alpha	Beta	Gamma
FP1	27.242	18.528	19.337	10.386	2.483
FP2	25.575	18.834	19.187	10.445	2.406
F3	13.131	11.773	12.088	7.771	1.264
F4	12.820	12.353	12.605	7.848	1.359
F7	24.927	19.403	20.785	10.696	1.794
F8	23.148	19.389	20.906	10.420	1.628

4. Discussion

In order to increase awareness, especially the addiction phase, a scientific evidence showing the bad effects of pornography addiction is needed. One of the worst affected human components due to pornography is the brain

(Love et al., 2015), because the brain is the place where all information is processed into the human body through sight, hearing, and so on. In addition, the brain plays an important role in the formation of behavior (Strumwasser, 1994).

To find out what will happen if someone experiences addiction, observation through interviews is a common practice. However, this method has two fundamental drawbacks from both the patient and examiner sides. For patients, it is possible to give a faking good answer as during a job interview (Levashina & Campion, 2007) to the examiner. Pornographic content is still taboo in our society. For the examiner, observation is not as objective as it is in reality because of the opportunity to experience the observer paradox (Wilner Warren, 1987) where the examiner has made a conclusion before starting the examination. These two things can cause errors in the data analysis process because of the large potential for bias. Therefore, it is necessary to think of a step to minimize the factors causing bias and increase objectivity. Thus, directly observing the brain is the best method.

In simple terms, to be able to see how the brain functions, invasive and non-invasive methods can be used. Invasive methods injure the human body, especially the head. However, although this method can provide the most accurate answer for assessing brain activity, it has a risk of infection or bleeding (Shah & Mittal, 2014). In addition, because invasive techniques to view the brain can only be performed by neurosurgeons, it is undeniable that this step cannot be the first choice. It is different with non-invasive methods where the body is not injured, so there is no risk of infection or bleeding, so all competent parties such as doctors, psychologists, or health workers can do it.

Brain activity recorded by EEG produces waves with various frequencies indicating real-time conditions in the brain. Delta waves in the relaxed forebrain are known to represent a decrease in brain activity (Sengoku & Takagi, 1998). Based on the observation, there was delta wave dominance in the prefrontal cortex of teens addicted to pornography. Previous studies found that pornography addiction shows dominance in the pre-frontal cortex (Kamaruddin et al., 2019). The process of addiction begins with the fulfillment of satisfaction. In the case of pornography addiction, pornography is captured by the five senses, especially the eyes as a triggering stimulus for the release of dopamine from the ventral tegmental area. The hormone will be delivered to the prefrontal cortex so that a sense of satisfaction appears. However, the sensation of satisfaction experienced by a person cannot last long (Malki *et al.,* 2021). In order to get back the sensation of satisfaction, teens looking for a stimulus from pornography. Similar situations can persist and can result in a dopamine rush. The impact of dopamine rush is hypofrontality syndrome where cognitive function decreases (Hilton & Watts, 2011).

5. Conclusion

Based on the results, there was delta wave dominance in the prefrontal cortex of teens addicted to pornography. Wave dominance is a characteristic of QEEG to determine the current condition of the brain. In addition, there is evidence of a decrease in the brain function of teens addicted to pornography, namely the dominance of the delta wave. Therefore, more massive educational efforts are needed to prevent the adverse effects of easy access to pornography on the internet.

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Integrated Dental Health Monitoring using Smart Tooth Brush and Application

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Abstract

Dental and oral health is the main need of people, including to children. Since, about 60 – 90% of children are suffering from dental caries. The prevention of dental caries is an important part of conducting. The digitalization era has influenced the dental and oral health education. Tooth brushing is one way to keep dental and oral health. However, the proper tooth brushing has not been achieved by children. Our objective is to conduct dental and oral health programs for children by creating a smart tooth brush named TOMON (Tooth Monster Hunter) and an application of monitoring named SIMOGI (*Sistem Monitoring Kesehatan Gigi* / Dental Health Monitoring System). We undertook this study by planning the monitoring system. The monitoring system is divided into three parties: dental therapist, parent and children. Dental therapists and parents are collaborated to handle and educate children about proper tooth brushing. Second, is the analysis of the requirement. The analysis stage consists of application program content. The last is the prototyping stage. In the prototyping stage, the smart toothbrush TOMON and application SIMOGI were made. The results of the research are the smart toothbrush TOMON and SIMOGI application can be used for health promotion for the children.

Keywords: TOMON, SIMOGI, Tooth Brushing, Children

1. Introduction

Regular plaque removal is a central part of dental and oral health prophylaxis. Without dental and oral health, there will be a high risk of caries and cavities. Therefore, the behavior of maintaining dental and oral health is very important for everyone and must be started from childhood, because the behavior of maintaining health must be applied in everyday life. Providing counseling and learning behavior to maintain dental and oral health to children is a must so that they can implement efforts to maintain dental and oral health from an early age (Gibson and Williams, 1999) (Lam, 2014) (Baginska and Stokowska, 2013).

Poor oral and dental health can lead to consequences that make children feel uncomfortable to move and inhibit growth. Toothache and loss of the integrity of a single tooth can have immediate consequences. Because teeth and gums that are damaged and not treated can cause dental and oral diseases such as pain, dental caries, and interfere with other body health. The potential for social rejection can also occur when a child is socially ostracized because of a visible disability, impaired articulation or bad breath. Thus, dental disease prevention measures not only maintain healthy teeth, gums and mouth, but also prevent children from somatic disorders, psychology and unpleasant social experiences. However, one cannot fully depend on the ability of parents to be able to provide dental health education without any assistance from those who are experts in the field of dental nursing. Lack of knowledge and skills in oral health in adults and strong social gradients suggest that society must also take responsibility. Therefore, many dental and oral disease prevention programs have been developed. Knowledge of oral health and routine application are important predictors of tooth brushing frequency. The role of parents also affects the development of health behavior in children (Craig, Baker and Rodd, 2015) (Ueno *et al.*, 2012) (Berzinski *et al.*, 2019).

The proportion of dental and oral problems in 2018 in Indonesia was recorded at 57.6% and the proportion of proper tooth brushing behavior was only 2.8% (Kementerian Kesehatan RI, 2018). Pre-school age or kindergarten is a good age to train children's motor skills. Dental caries affects 60 to 90%, including school-age children in developing countries and is common in several Asian countries, including Indonesia (World Health Organization (WHO), 2020). The risk of dental disease in children, can cause problems or difficulties in mastication, reduced nutritional intake so that body weight decreases and the end result is that the child's growth and development are not optimal (Al-Darwish, 2016). A comprehensive dental health education program for children and parents is needed to achieve the goal of maintaining dental health (Vishwanathaiah, 2016).

Toothbrush is an equipment that is always used in maintaining dental and oral health. Maintaining good and correct toothbrushing behavior can help reduce the risk of caries (Atarbashi-moghadam and Atarbashi-moghadam, 2018). Mobile apps are software programs that run on smartphones and other mobile devices. Mobile health apps can help people take care of their own health and promote useful information to others and remove time and place limits for patients and healthcare workers (Underwood, Birdsall and Kay, 2015) (Byambasuren, Beller and Glasziou, 2019) (Id, Norman and Robinson, 2020). Therefore, TOMON (Tooth Monster Hunter) which produces applications and toothbrushes based on wearable devices (Salikun *et al.*, 2021) will be developed with an Internet of Healthcare Things (IoHT) approach in terms of applications with parent, and dental therapist features. The dental therapist can monitor the progress of brushing children's teeth based on a smart toothbrush that has been integrated with motion sensors and attracts children's attention to maintain dental health, so that it can be a solution even in the conditions of the Covid-19 pandemic.

2. Method

2.1 Planning

The planning and initial requirements data collection is the phase carried out in the first year of the study. The results in this phase will obtain primary data regarding the data on the number of students, as well as the application requirements needed to be input for the analysis phase and start making monitoring features.
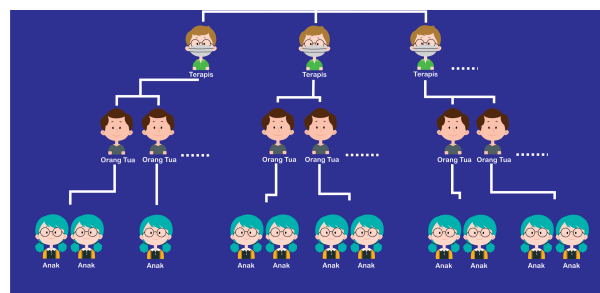

Figure 1: Monitoring System

Figure 1 shows the monitory system planning. In the first line is the dental therapist. The dental therapist handle the parent as the supervisor of the child at home. Because this is the remote monitoring, the application and the smart tooth brush named TOMON were made.

TOMON or Tooth Monster Hunter is the smart tooth brush in our research. It is a smart tooth brush with the sensor to track a tooth brushing motion on the game TOMON (Salikun *et al.*, 2021). While for monitoring system is done by creating an application according to Figure 1 model named SIMOGI.

2.2 Analysis

In the analysis phase, the researcher analyzes alternative solutions based on the initial system requirements and analyzes based on user feedback reactions. The initial needs-based analysis phase was carried out in the first year of the study. Outputs in the planning phase and initial requirements gathering are inputs in this phase. In this phase, an analysis of alternative solutions will be developed. The results of this phase are in the form of model analysis and design. The analysis phase is based on user reactions. The results of the design based on user feedback will be input in this phase. The target in the analysis stage is dental nursing practitioners, namely students of the dental and oral therapy study program Bachelor of Applied Health from Poltekkes Kemenkes Semarang.

Table 1: Menu Features of Application

Menu	Content
Home	Greeting for the user and application manual
Reminder	Dental Health Action:
	1. Brush your teeth 2 times a day after breakfast and at night before going to bed
	2. Using toothpaste the size of a corn seed
	3. Brush your teeth regularly every morning and night following the directions from the TOMON game
	4. Avoid excessive sugar consumption
	5. Brush your teeth after eating sweet foods so that sugar doesn't stick to your teeth
	6. Chewing food using the right and left sides of the teeth alternately
	7. Drink plenty of water every day at least 6-7 glasses for children aged 4-8 years, and 8-10 glasses for children aged 9-13 years
	8. Parents accompany their children to brush their teeth
	Children's Dental Dangerous Signs
	1. Child has toothache and difficulty chewing
	2. A hole appears in the child's tooth
	3. Blood appears on the child's gums or teeth
	4. There is a broken tooth
	5. Children's teeth look dull and have white spots/stains
	6. The child's teeth are black on the chewing side
Counseling	Counseling menu based on text and photo upload

2.3 Prototyping

At the prototyping stage, the researcher develops the system based on the initial requirements analysis and the system development for the next stage is based on the analysis of user feedback reactions. At this prototyping stage, implementation of the results of system development is also carried out.

The initial prototype phase was carried out in the first year of research. The output from the analysis phase based on initial needs is input for the initial prototype which will later be processed and built to produce TOMON (Tooth Monster Hunter) and SIMOGI applications. The results of this phase are the final results of the first year of research in the form of system prototypes and scientific research articles.

3. Results

The activity carried out at the beginning of the realization was to form a team of dental therapists to assist the implementation of this research activity at SD Al Azhar 14 Semarang. The dental therapists appointed were 6 students of the Bachelor of Applied Dental Therapy study program, Department of Dental Health, Poltekkes Kemenkes Semarang. The next activity is in a smart toothbrush with the TOMON application. This TOMON application stands for Tooth Monster Hunter. This application is a teaching game to brush teeth with visualization on the Android screen. In addition, there is also a toothbrush paired with an IMU (Inertia Measurement Unit) sensor and a Bluetooth module so that the toothbrush can be connected to the TOMON game on Android. Table 5.1 is the contents of the TOMON game which consists of brushing teeth from the top left, bottom left, top right, bottom right, left side, right side and front teeth. The way this TOMON game works is that the image of the monster on the TOMON game display represents germs, so that the toothbrush must be done according to the position of the germ. If it's true, the germs will disappear and if it's false, the germs will still be there. At the end of the TOMON game, a dental report will appear. The white teeth represent the correct brushing and the yellow teeth represent that the tooth brushing movement is still wrong, according to the yellow color position. If the yellow color is on the upper right tooth, then brushing the teeth is not correct in the upper right tooth.

Figure 2: TOMON Smart Tooth Brush

Figure 2 is the realization of a smart toothbrush that will be used in the implementation. The toothbrush is adjusted to the needs, namely by installing a bluetooth module, arduino nano and an IMU sensor in the toothbrush handle. The bluetooth module aims to enable the toothbrush to be connected to the TOMON game wirelessly. The IMU (Inertia Measurement Unit) sensor is a sensor that detects the movement of the toothbrush. Arduino nano is a microcontroller that regulates the work of bluetooth and IMU sensors. The handle of the toothbrush is shaped through a 3D Printer with PLA (Polylactic Acid) 3D Printer filament as raw material.

Besides TOMON, this research also creates the SIMOGI (*Sistem Monitoring Kesehatan Gigi or Dental Health Monitoring System*) application. The SIMOGI application is a Dental Health Monitoring System that is used to support monitoring of children's dental health between parents and therapists. The application has two versions for parents and dental therapists. The making of this application is based on pandemic conditions where face-to-face contact still has to be maintained and limited even. SIMOGI is divided into two login features, namely for dental therapists and parents.

Figure 3: SIMOGI Application for Dental Therapist (a) Homepage (b) Login page (c) Client page (d) Consult menu (e) Reminder menu

Figure 3 shows the application of dental health monitoring features for the dental therapist. The login page is based on the account given to the dental therapist. The client page contains the list of children handled by the dental therapist. The menu of consult has the feature to have a chat with the client, while the reminder menu contains the checklist according to table 2.

Figure 4: SIMOGI Application for Parents Handling Children at Home (a) Homepage (b) Login page (c) Dental Hygiene Video (d) Consult Menu (e) Dental Report (f) Consult menu with chat (g) Reminder menu (h) Checklist menu of dental health danger

Figure 4 shows the application for parents. The parents are given the account to connect to the dental therapist. The menu in the application consist of home menu, consult and reminder. On the home page, there is a video containing dental hygiene education. Second, the consult menu consists of chatting with dental therapist and upload dental reports. Meanwhile the reminder menu consists of checklist of dental hygiene and dental danger.

4. Discussion

Dental caries still becomes the global health challenge either in indigenous and geographically remote population. Dental caries affects 60 – 90% of children in the world. In fact, dental and oral health has an effect on children especially they under five years old because it can cause stunting (Rohanawati and Bachtiar, 2019). Thus, an integrated dental and oral health education and program are indispensable. Education to children regarding dental and oral health is important, especially to motivate them to carry out daily dental and oral hygiene. The involvement of schoolteachers can be one of solutions to educate the children. However, in the pandemic situation, the school is still closed for the activity. Thus, a dental and oral hygiene education in the pandemic situation needs an update by utilizing technology.

Industrial revolution 4.0 does impact on the daily life of people. Smartphone nowadays is used as if as primary need. The implementation of digital technology has spread in the world, including in health sector. Digitalization is proven great to offer dental education better in helping the dentist and patient (Zitzmann *et al.*, 2020). The interactive and intuitive learning can also impact on stimulation towards the patient, especially for the children. One of the biggest challenges in digital education is that to adapt and adjust to the development in technology and implement it in dental practice(Fernandez, Nimmo and Behar-Horenstein, 2016).

Our research has created TOMON (Tooth Monster Hunter) as the media to promote dental and oral health to children. This tool which is in the form of tooth brush with sensor and microcontroller inside that is able to detect tooth brushing motion. The toothbrush is connected to TOMON game which display a group of tooth brushing steps that should be followed by the player. This media is intended to attract the interest of the school children to practice dental hygiene especially tooth brushing. Because children follow what they see and record it. Thus, the media to teach tooth brushing is created as interesting as possible. Besides, the media is also intended to assess the children ability of tooth brushing in which it is expected their tooth brushing attitude is getting better (Cristina and Bezerra, 2002). This program is in line with the problem suffered by children that they have low efficiency in adopting the tooth-brushing recommendation in prevention program and therefore, effort is needed to improve their tooth brushing ability (Deinzer *et al.*, 2019). The program of dental health education is also intended to reduce dental plaque index in children. In (Setiawati *et al.*, 2020), the effort to reduce dental plaque of the children is not separated from parents. Once the knowledge of dental health ofparentst is good, the dental plaque index of the children is decreased. This shows a line that the attitude of preserving dental and oral health of the children is started by the knowledge of the parent and the role of the parent themselves. Our research has also created an application for the parent to involve in the dental and oral health program, i.e. giving parents an access to application to report to the dental therapist regarding their children's behavior of tooth brushing.

Acknowledgments

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Kefir as a Prevention of Arsenic-mediated Toxicity in Uterine Female Rats

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Abstract
Background: kefir is a fermented milk product that demonstrates numerous health benefits including antioxidant and immunomodulatory. Aim: to study the protective effect kefir on the expression of estrogen receptor alpha (ERα) in endometrial stromal cells and endometrial thickness on female rats that were exposed to arsenic. Methods: twenty-five female Wistar rats (*Rattus norvegicus*) were divided into five groups (CRL, As, T1, T2, T3). Control group (given a normal diet), As group (given the normal diet and exposed to arsenic trioxide 2 mg/kgBW/day). The T1; T2; T3 were exposed to arsenic trioxide 2 mg/kgBW/day and treated with different doses of kefir (1.25; 2.5; and 5 mL/kgBW/day, respectively) for 35 days. The rats of group As treated with arsenic trioxide only and group CRL served as control with normal feed in water. Cytological samples were taken after 35 days of treatment and examined every day to see the rat oestrus phase, and the proestrus phase of the oestrous cycle was chosen for termination. Uterine tissue fixed in 10% neutral buffered formalin for tissue preparation. ERα expression in endometrial stromal cells was analized using immunohistochemistry method, endometrial thickness was observed using histopathological methods. Results: significant reduction of ERα expression in endometrial stromal cells and endometrial thickness in female rats exposed to arsenic were observed in groups on treated rats (p ≤ 0.000; 0.009, respectively). Conclusion: the administration of kefir in female Wistar rats exposed to arsenic had shown significantly differences on ERα expressions and endometrial thickness. The smallest dose of kefir (1.25 mL/kgBW/day) could increase ERα expression and endometrial thickness in female Wistar rats with arsenic exposure. Therefore kefir has protective effect related to female reproductive system.

Keywords: Arsenic, ROS, Kefir, Antioxidant, Endometrium, Estrogen Receptor Alpha

1. Introduction

Inorganic arsenic with high toxicity increasingly spread in the surrounding environment, such as air, water, industrial waste, cigarette smoke, and even food in the last decade (WHO, 2018). The widespread distribution of arsenic makes it difficult for humans to avoid its exposure (Sun et al., 2016). The World Health Organization

(2018) states that arsenic contamination is the biggest threat to global public health. The Agency for Toxic Substances and Disease Registry (ATSDR) mentions that exposure to high doses of arsenic can cause death, while exposure in a small dosage and for a long time can cause toxic, carcinogenic, and mutagenic effects (ATSDR, 2007; Tchounwou, Centeno, & Patlolla, 2004).

Exposure to arsenic, an Endocrine Disrupting Chemical (EDC), can disrupt the function and structure of the human reproductive system via the hypothalamus-pituitary-ovarian axis (HPO) pathway (Deyhoul, Mohamaddoost, & Hosseini, 2017; Rattan et al., 2017). Several studies reported the toxic effects of heavy metal arsenic (As) associated with decreased fertility and female reproductive health problems. In previous cross-sectional research by Lei et al. (2015) the concentration of arsenic in the blood of infertile women was significantly higher than that of pregnant women.

Decreased fertility and impaired female reproductive health associated with arsenic toxicity are primarily the results of oestrogen receptor damage and oestrogen signalling pathways disruption followed by morphological change and proliferation disruption of the endometrium (Chatterjee & Chatterji, 2010; Ronchetti, Bianchi, Duvilanski, & Cabilla, 2016; Sun et al., 2016). Oestrogen receptor alpha (ERα), the dominant mediator of oestrogenic action on endometrial tissue, is downregulated at the mRNA and protein levels by arsenic exposure. In addition, histologically, there is a degeneration of luminal epithelial cells and endometrial glands together with a reduction in the thickness of the uterine longitudinal muscle leading to a reduction in uterine thickness (Akram et al., 2010; Chatterjee & Chatterji, 2010). There was a significant decrease in endometrial thickness found in rats after the exposure of arsenic for 28 days in the study by Akram et al. (2010). Reproductive organs, especially the uterus, are one fertility determinant in which endometrium is receptive to embryo implantation (Strowitzki, Germeyer, Popovici, & von Wolff, 2006).

Arsenic bioaccumulates in essential organs, Sun et al. (2016) and Ronchetti et al. (2016) explained that arsenic accumulated in the anterior pituitary gland and gonads might block the development and function of reproductive organs. Several studies have stated that the dominant mediator of arsenic cytotoxicity occurred by the formation of oxidative stress responses and Reactive Oxygen Species (ROS) caused by the bioaccumulation of arsenic (Flora, 2011; Rao et al., 2017; Ronchetti et al., 2016; Sun et al., 2016). It causes an imbalance of endogenous antioxidants in the body. Ronchetti et al. (2016) and Rao et al. (2017) reported that the administration of external antioxidants could improve and prevent the adverse effects of arsenic toxicity.

Kefir is a probiotic product derived from the milk fermentation of goats and cows, using kefir grains with a complex microbiological composition. Kefiran, a type of potential exopolysaccharide in kefir grains, has active antioxidant activities. A potent antioxidant, kefir also functions as an antimutagenic, and antitumor, an anti-inflammatory, a radical scavenging system, and an oxidative stress-reducing agent (Chen et al., 2015; Farnworth & Mainville, 2008; Prado et al., 2015). Kefir is a probiotic, used in the appropriate dose, is expected to prevent damage to the endometrium due to arsenic toxicity through free-radical scavenging pathways. In addition, there is still a lack of research on the effect of kefir in preventing the toxicity of heavy metals, especially arsenic, to the female reproductive organs. Based on the explanation above, in this study, we aimed to investigate the effects of kefir on the female reproductive system, especially on the endometrium and ovaries of female Wistar rats (*Rattus norvegicus*).

2. Method

2.1 Chemical

Arsenic Trioxide (As2O3) powder is the product of Loba Chemie Pvt. Ltd., Mumbai, India. The powder dosage was 2 mg/kgBW/day (Mershiba et al., 2013). As much as 210 mg of Arsenic Trioxide (As2O3) powder was then dissolved in 700 mL of 0.9% NaCl using a magnetic stirrer at a temperature of 50º C for 3-4 hours until the arsenic powder dissolved completely.

2.2 Kefir

Kefir used in this study is made of fermented milk of goat, which was purchased from the Natural Probiotic Laboratory, Faculty of Animal Husbandry, Brawijaya University, Malang. Upon the receiving kefir was aliquot and frozen in -80º C until use.

2.3 Animals and experimental protocols

A female Wistar rat (*Rattus norvegicus*) aged 8-10 weeks weighing 100—150 g was purchased from Rattus Breeding Centre in Malang. Rats were kept and adapted in the laboratory for seven days at constant room temperature (20-25ºC) with regular light and dark cycles. The cycles include the 12-hour light cycle and the 12-hour dark cycle. For the housing of the animals, four rats were kept in a plastic box, covered with wire and given a husk mat. Every three days, the researchers change the husk mat to prevent infection. The dietary requirement for adult rats was 45 g/day/head. The regular diet consists of 67% Comfeed PAR-S (PT JAPFA *COMFEED* INDONESIA, Jakarta, Indonesia), 33% flour, and water as well as *ad libitum*. The experimental protocol has been reviewed and approved by the Ethical Committee of the Faculty of Medicine, Brawijaya University (Certificate No. 95/EC/KEPK-S2/04/2020).

Twenty-five female rats (*Rattus norvegicus*). (n=25) were divided into five groups (5 rats per group) : Control group, given a standard diet and 1 mL Normal Saline per day/rat ; As group, exposed to As_2O_3 2 mg/kgBW/day, and, T1, T2, and T3 groups, exposed to As_2O_3 and kefir at doses of 1.25, 2.5, and 5 mL/kgBW/day, respectively, for 35 days (Fahmy & Ismail, 2015). Arsenic and kefir were administered orally for 35 days.

The proestrus phase of the oestrous cycle was chosen for termination. Thus, after day 35 cytological samples were taken and examined every day to see the rat oestrus phase. The process included staining the samples using blue methylene, observing the morphology of epithelial cells under a microscope and choosing the proestrus phase of the oestrous cycle for termination (Khatun, Maity, Perveen, Dash, & Chattopadhyay, 2018). On the proestrus phase, rats were sacrificed through cervical dislocation and uterine tissue was collected.

2.4 Tissue Preparation

Uterine tissues are fixed in 10% neutral buffered formalin for at least 24 hours to prevent autolysis and tissue decomposition. After fixation, the tissue was sliced into 2—3 mm using a scalpel and inserted the tissue into the cassette and labeled it. Then, the tissue was processed into microscopic parts through the dehydration, clearing and embedding stages. Dehydration processed the tissue by immersing it in several concentrations of alcohol to remove water and formaldehyde. Then, the clearing process proceeded with the cleansing of the remaining alcohol. The final step was embedded, which was inserted the tissue into a paraffin block to produce a thin piece of tissue. A microtome (4-5 micrometres) formed a paraffin block to construct a thin layer of tissue and put it in a warm water bath (Llewellyn, 2013).

2.4.1 The Histopathological Preparations

The histopathological preparations use the paraffin block method. The method involved rinsing the fused uterine tissue for at least 1.5 hours. The tissue was added with 70% alcohol for 1 hour, 80% alcohol for 1 hour, 99% alcohol for 1 hour and absolute alcohol for 2x1 hours. Then the tissue was immersed in a mixture of xylol; absolute alcohol = 1: 1 for 0.5 hours, and xylol PA for 2x30 minutes. The tissue was cut as thin as possible and put in melted paraffin; xylene = 1: 1 for 1 hour, paraffin (54-58) for 2x1 hour. The liquefied paraffin was placed into a cube-shaped mould, placing the paraffin in the desired position. After watering it again with sufficient paraffin, the chilled paraffin block was outed from the mould. Then, the back of the paraffin block was on the microtome. The indicator position should show the thickness of the cut in 4-5 micrometres. The cut paraffin, in ribbons form, was then transferred into a warm water bath (45ºC), stretching the paraffin parts. A preparate or glass object was on the underside of the selected tissue and then removed from the warm water bath, after which it was allowed to dry for 24 hours, preferably in a thermostatic laboratory oven at 37° C (Slaoui & Fiette, 2011)

2.5 Immunohistochemistry (IHC)

During uterine tissue preparations, retrieval antigen was given using citrate buffer, rinsed using PBS for 3x5 minutes. After that, the endogenous enzyme block used 3% of H2O2, producing primary antibody (*oestrogen receptor alpha antibody* (C-311): sc-787 Santa Cruz), then dissolved in PBS 5% with a ratio of 1: 100 and incubated in a staining chamber at 40C overnight. PBS was essential for washing. Then the preparate uterine transversal section was diluted with biotinylated anti-rabbit immunoglobulin G and diluted in PBS with a ratio of 1: 200, containing 1% bovine serum albumin, for 2 hours. Horseradish peroxidase streptavidin (SA-HRP) was applied in a dilution of 1:200 in PBS-BSA for 2 hours. Immune precipitates were visible with diaminobenzidine (DAB). After staining the immune precipitate for 5 minutes, the preparate was rinsed in distilled water and applied a counterstain with Meyer's haematoxylen and mounted in Entellan.

The following process was observing ERα expressions quantitatively. The immunohistochemical stain was observed and photographed using an Olympus BX51 microscope with a magnification of 400 times and proceeded using the software image J using the Cell Counter plugin. ERα expressions were expressed in the number of endometrial stromal cells, brown in the nucleus of the cells, in ten visual fields.

2.6 Endometrial Thickness Measurement

The examination endometrial thickness was done by staining Haematoxylin Eosin (H&E) uterine samples were fixed in 10% formalin buffer. A thin tissue, cut by a microtome of 2-3 mm thickness, was inserted into a cassette. The result is a thin tape, dipped in Haematoxylin, seen under the microscope Dot slide Olympus XC 10 and then measured with Dot Slide Software.

2.7 Statistics

The researchers analysed the data using SPSS 23 software for windows. Oestrogen receptor alpha (ERα) expression and endometrial thickness were parametric numbers and presented by measuring mean and standard deviation (SD). The researchers used ANOVA to compare the mean of variables in the control group with the mean of the treated group. The result showed a significant difference with a p-value <0.05. The data was then analysed using post hoc analysis with the least significant difference (LSD).

3. Results

3.1 ERα Expression in Endometrial Stromal Cells

The study described the effects of kefir on ERα expression by calculating the cells mean in each treatment group. There were statistically significant differences in ERα expression (p<0.000) (Table 1).

Table 1: Effect of kefir on ERα expression in endometrial stromal cells of female Wistar rats (*Rattus norvegicus*) exposed to arsenic

Variable	Group	Mean ± SD	*p- value*
Expression of ERα	CRL	81.29 ± 3.15^a	
	As	70.12 ± 5.50^b	
	T1	83.86 ± 4.85^a	$0,000^*$
	T2	83.33 ± 2.19^a	
	T3	82.72 ± 1.42^a	

Note. Expression of ERα (%); CRL=control group; As=Arsenic group (As$_2$O$_3$ 2 mg/kgBW/day); T1=arsenic+kefir 1.25mL/kgBW/day; T2=arsenic+kefir 2.5 mL/kgBW/day; T3=arsenic+kefir 5 mL/kgBW/day. * = significantly different

IHC results demonstrated a significantly lowered expression of ERα in As group compared to the control group (Figure 1A and B). Rats in T1-T3 group showed an increase in number of stromal cells expressing ERα, which was significantly different from the As group (Figure 2). However, there was no significant difference among the three doses of kefir. Therefore, the interpretation of the data shows that the three doses of kefir have the same ability to increase ERα expression.
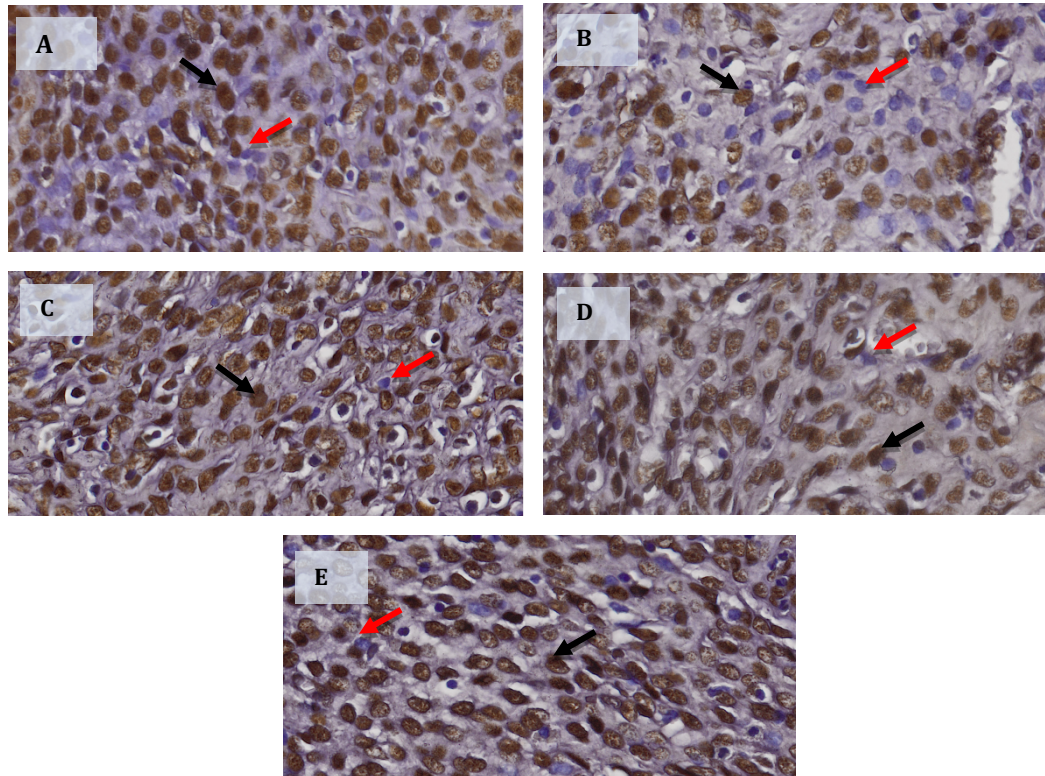

Figure 1: Immunohistochemical localization of ERα expression in the rat endometrial stromal cells.

Note. Black arrow showed positive ERα cell staining with brown color and red arrow showed negative ERα cell staining with blue color; A. CRL: control group, B. As: arsenic 2 mg/kgBW, C. T1: arsenic 2 mg/kgBW + different doses of kefir kefir; 1.25 mL, D. T2: 2.5 mL, D. T3: 5 mL (magnification 400x).
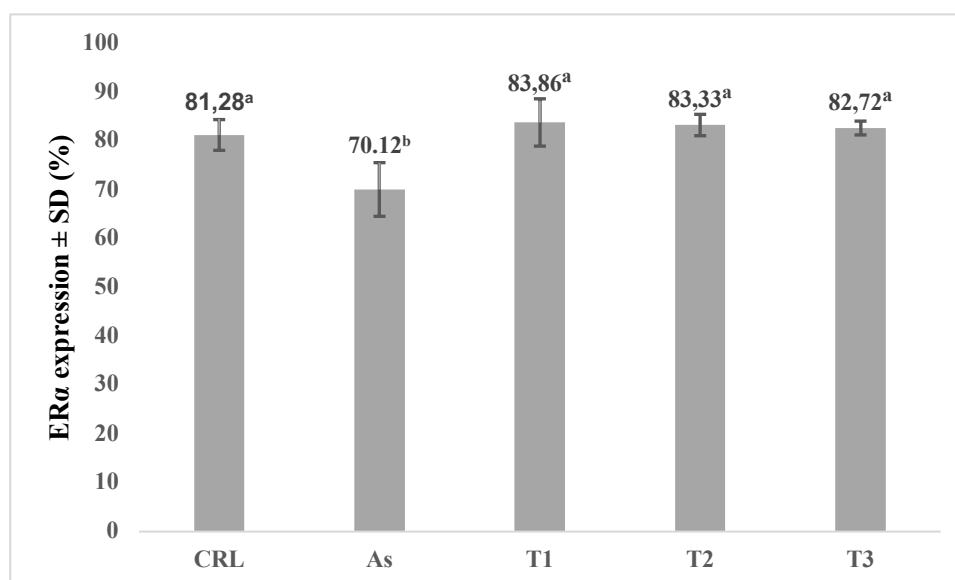

Figure 2: Histogram of ERα expression in the rat endometrial stromal cells.

Note. LSD Test. If it contains different letters, it means that there is a significant difference (p≤0.05)

3.2 Endometrial Thickness

Histological examinations showed significant differences in each treatment group (p<0.009) (Table 2). The controls exhibited normal endometrial tissue. In contrast, the arsenic-intoxicated rats demonstrated significant thinning of the uterine endometrial. The T1-T3 group exhibited no degenerative changes in the uterine endometrial layers (Figure 3). Compared to the As group, the endometrial thickness in T-T3 group was significantly higher and had a similar value compared to the control group (Figure 4).

Table 2: Effect of kefir on endometrial thickness in female Wistar rats (*Rattus norvegicus*) exposed to arsenic

Variable	Group	Mean ± SD	*p- value*
Endometrial thickness	CRL	504.13 ± 54.40[a]	
	As	332.57 ± 100.38[b]	
	T1	512.81 ± 69.79[a]	0,009[*]
	T2	521.84 ± 74.82[a]	
	T3	526.42 ± 57.45[a]	

Note. Endometrial thickness (μm); CRL=control group; As=Arsenic group (As$_2$O$_3$ 2 mg/kgBW/day); T1=arsenic+kefir 1.25mL/kgBW/day; T2=arsenic+kefir 2.5 mL/kgBW/day; T3=arsenic+kefir 5 mL/kgBW/day. * = significantly different
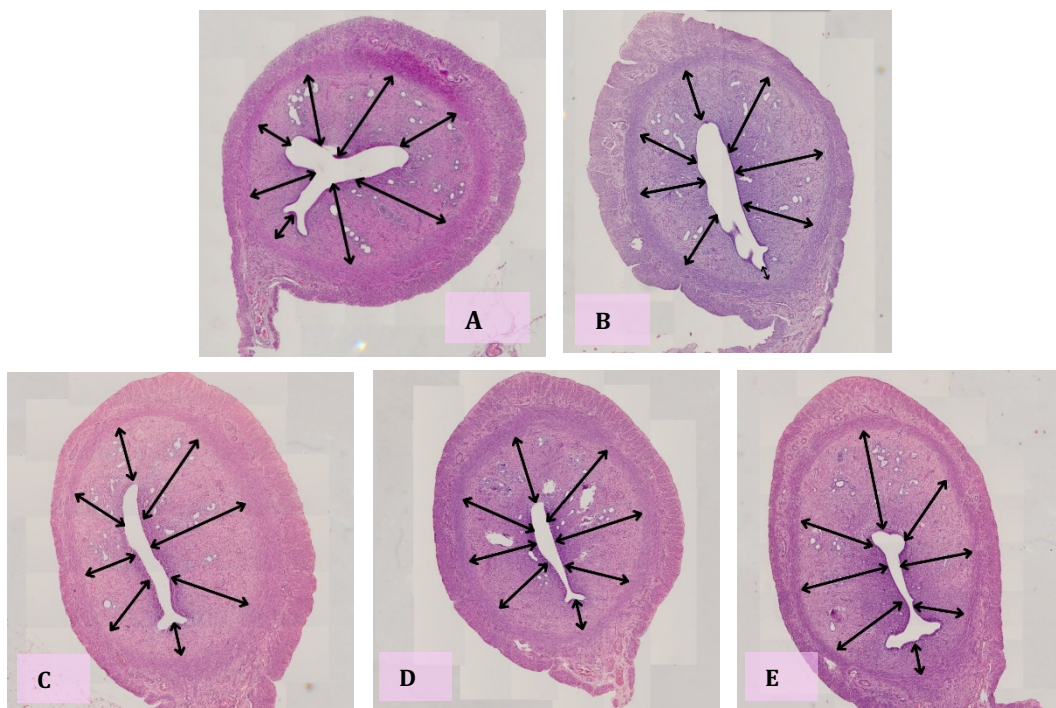

Figure 3: Endometrial thickness measurement of female rats by H&E staining
Note. A. CRL: control group, B. As: arsenic 2 mg/kgBW, C. T1: arsenic 2 mg/kgBW + different doses of kefir kefir; 1.25 mL, D. T2: 2.5 mL, D. T3: 5 mL (magnification 200x).
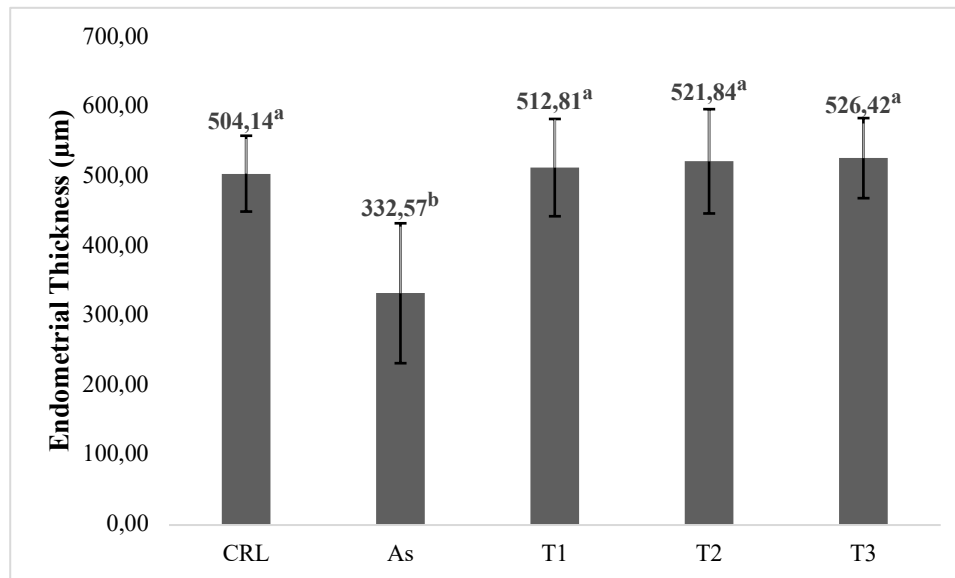
Figure 4: Histogram of Endometrial Thickness.

Note. LSD Test. If it contains different letters, it means that there is a significant difference (p≤0.05)

4. Discussion

Inorganic arsenic exposure causes arsenic bioaccumulation in intracellular and body tissues, especially in the anterior pituitary gland and gonads. Consequently, these organs can not perform their function as regulators of reproductive physiology accurately due to the production of Reactive Oxygen Species (ROS) and oxidative stress (Flora, 2011; Lushchak, 2014; Ronchetti et al., 2016). Huff et al. (2016) demonstrate that when exposed to arsenic, high ROS was produced in the body and inhibited the expression of oestrogen receptor genes through the MAPK/ERK pathway disruption. Mitogen-activated protein kinases (MAPKs) are protein kinases families that play the leading role in the transduction of extracellular signals from cell surface membranes to the nucleus via phosphorylation cascades (Bae-Jump, Chunxiao Zhou, Boggess, & Gehrig, 2008; Son et al., 2011). The disruption of the MAPK/ERK pathway, according to Bae-Jump et al. (2008), leads to the rapid phosphorylation of MAPK, inducing hyperactivation of the MAPK pathway that results in an ERα expression decrease. Therefore, arsenic exposure inhibits ERα mRNA transcription and decreases ERα protein expression in the endometrium via potentiation of the MAPK pathway. Our result indicated that exposure of rats to arsenic leads to the decrease of ERα expression in endometrial stromal cells.

Little is known whether there is association of the immune system in the regulation of arsenic-mediated toxicity. Considering that production of ROS is the most distinct mechanism of arsenic toxicity, it was assumed that compounds having antioxidant properties might be effective against arsenic toxicity. Several studies have demonstrated that kefir exerts extensive pharmacological actions in various diseases, including immune suppression in mice.

In this study, administration kefir into arsenic exposed rats, showed a significant increase in ERα expression leading to preventive action against the toxic effects of arsenic on the rat endometrium. The three doses of kefir, 1.25; 2.5; and 5 mL/kgBW/day, were significantly able to increase ERα expression in female rats exposed to arsenic. Moreover giving kefir with the smallest dose of 1.25 mL/kgBW/day to the rats had been able to increase both ERα expression and endometrial thickness. The repair effect of kefir is probably due to the antioxidant activity of kefir.

The content of kefiran, exopolysaccharides (EPS) formed by kefir, shows high antioxidant activity in protecting protein from oxidative and neutralizing superoxide radicals, as a Fe^{2+} chelating agent (Chen et al., 2015; Radhouani, Gonçalves, Maia, Oliveira, & Reis, 2018a, 2018b). The bioactive components of goat kefir are closely related to the properties of goat milk. Recent studies have also focused on the element and antioxidant activities of milk and dairy products, such as amino acids (mainly tyrosine and cysteine), vitamins (A, C and E), carotenoids,

and endogenous enzymatic systems, mainly by superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GSH-Px). Fermented milk products have antioxidant capacity and can act as radical scavengers for free radicals or ROS (Deeseenthum, Luang-In, John, Chottanom, & Chunchom, 2018; Farnworth & Mainville, 2008; Liu, Lin, Chen, Chen, & Lin, 2005; Yilmaz-Ersan, Ozcan, Akpinar-Bayizit, & Sahin, 2016). Some *Lactococcus* and *Staphylococcus thermophilus* bacteria in kefir, expressed the antioxidant activities of SOD. *Lactobacillus rhamnoses* bacteria are also known to inhibit the oxidation of linoleic acid then inhibit in vitro lipid peroxidation due to the chelation effect of the iron ions and the scavenging ability in superoxide anions (Kesenkas, Dinkcİ, Seckin, Kinika, & Gonc, 2011; Liu, Chen, & Lin, 2005).

The prevention of ROS accumulation by antioxidants is also proven to inhibit MAPK activation. It indicates the involvement of ROS in MAPK pathway activation (Bae-Jump et al., 2008). In line with the previous research conducted by Choi et al. (2015), ROS inhibition with antioxidants can downregulate the MAPK/ERK pathway. In turn, it can stabilize the function and expression of ERα. Based on the above explanation, kefir with potent antioxidant activity is proven to increase the expression of ERα in the endometrium of female rats exposed to arsenic.

In addition, the inhibition of lipid peroxidation is essential to prevent human diseases involving free radicals. According to Liu et al. (2005), when compared to milk, kefir showed significant inhibitory effects on linoleic acid peroxidation. The level of kefir inhibition of goat milk on linoleic acid peroxidation was 76.0%, indicating that by inhibiting lipid peroxidation, kefir has high antioxidant activities (Liu, Chen, et al., 2005; Liu, Lin, et al., 2005). Therefore, giving kefir can increase the thickness of the endometrium. Our result indicated demonstrated that administration of kefir independent from the dose could increase the endometrium thickness.

Morphologically, the endometrium is the most dynamic tissue in women and is very responsive to changes in reproductive hormones. Endometrial integrity is a reflection of the endometrial proliferation level in a healthy uterus. Thus, it displays the most compelled prognostic indicator for endometrial receptivity examination to implantation outcomes (Bromer, Aldad, & Taylor, 2009; Cunningham et al., 2013; Kovacs, Matyas, Boda, & Kaali, 2003). The thinning endometrium tends to fail to respond to cyclical hormonal changes resulting in implantation failure. In different words, after implantation, a miscarriage could happen due to the lack of blood supply that transports nutrients (Akram et al., 2010; Baradwan, Shafi, Baradwan, Bashir, & Al-Jaroudi, 2018).

Kefir, given in the appropriate dose, has desirable effects on the body. Meanwhile, too much dosage of kefir can increase the risk of a reaction change of antioxidants to pro-oxidants that potentially may cause harmful impacts (Laily, 2020; Raras, Hidayati, & Wardhani, 2021). The balance between oxidant production and antioxidant protection is indispensably essential in maintaining the health of biological systems. Physiological doses of exogenous antioxidants are required to maintain or re-establish redox homeostasis (Bouayed & Bohn, 2010; Raras et al., 2021).

5. Conclusion

Sub-chronic exposure to arsenic was able to decrease ERα expression and endometrial thickness. Giving kefir, containing antioxidant activities, was able to protect the reproductive organ system of female rats by increasing ERα expression and endometrial thickness. Therefore, the appropriate dose of kefir would benefit the body.

Acknowledgments

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The Wellness Program for Physical Fitness and Decreasing Metabolic Syndrome Risk Factors

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Abstract
Indonesia is currently facing a double burden of disease. The high rate of communicable diseases has been followed by high rates of non-communicable diseases (NCD) such as hypertension, heart disease, cancer and diabetes mellitus. This study aims to produce a holistic approach model in the form of a Wellness Program in an effort to improve physical fitness and decrease of metabolic syndrome for civil servants. This study was designed with an experimental design. Subjects were members of civil servants in Klungkung Regency, Indonesia who have one or more of syndrome metabolic risk. Subjects were divided into two groups, namely the treatment group and the control group. The treatment group is a group that is given a wellness program model in the form of physical exercise according to the rules of frequency, intensity and duration, balanced nutrition education and smoking behavior control. The results show a significant increase in nutritional knowledge (p<0.05), the implementation of physical activity rules with a frequency of 3-5 x/week in 78%, duration 20-60 minutes in 76% of light-moderate exercise, decreased smoking habit significantly p=0.042 (p<0.05), increased physical fitness with VO2max value 29.28 + 7.68 (treatment group) vs 24.28 + 5.91 (control group) with p<0, 05, decreasing of blood sugar was 118.08 + 35.81 mg/dl (treatment group) vs. 124 + 42.22 mg/dl with p value = 0.001 (p <0.05) with t- independent test. Meanwhile, the risk factor variables for the metabolic syndrome (obesity, cholesterol and blood pressure) showed a decrease but were not significantly different.

Keywords: Wellness Program, Nutrition, Physical Activity, Risk Factor

1. Introduction

Lifestyle is one of the important causes of non-communicable diseases (NCD). Smoking habits, excess nutrition, sedentary lifestyle and stress are problems closely related to NCD such as metabolic syndrome. The results to Riskesdas, (2007), smoking behavior increased from 32.0% to 33.4% and increased to 36.3% in 2013 (Kemenkes RI, 2013). While the prevalence of metabolic syndrome in adult population is around 21.8%. The prevalence of metabolic syndrome is directly proportional with the increasing age by about 10% in the population aged 20 years and reaches 40% at the age of 60 years. According to (Dwipayana *et al.*, 2011) stated that the prevalence of Metabolic Syndrome in Bali Province is increasing, as much as 18.2% (men 16.6% and women 20.0%). The condition of this metabolic syndrome occurs in many productive ages, and it may influence the productivity.

The prevalence of metabolic syndrome is 11. 28% for men and 20. 38% for women. Metabolic syndrome is one of the risk factors for changes in consumption patterns towards high-fat consumption patterns. Food consumption excess of nutritional needs has an impact on overweight and obesity (Wiardani and Arsana, 2011; Toti et al., 2019). The obesity rate in Indonesia reaches 14.8%. The sedentary lifestyle in the metabolic syndrome is caused by a lack of physical activity. As much as 26.1% of the Indonesian population lacks physical activity. There are 22 provinces in Indonesia with population of less doing of physical activity classified as less active which is above the Indonesian average, specifically DKI Jakarta (44.2%), Papua (38.9%), West Papua (37.8%), Southeast Sulawesi and Aceh (37.2% each). The high prevalence of metabolic syndrome will affect a person's level of physical fitness (Lee, Ko and Lee, 2020). It is necessary to design a holistic program to help prevent or improve metabolic syndrome, especially in civil servants. One of the lifestyle modification efforts is Wellness Program which includes nutrition management, physical exercise and smoking cessation for civil servants. This study aims to improve physical fitness and decrease of metabolic syndrome for civil servants in Klungkung Regency.

2. Method

This study is a true experimental study with a randomized pre-test-post-test control group design. The study population was civil servants in Klungkung Regency with inclusion criteria including male or female, 25-60 years old, there were of 1 or more metabolic syndrome, domiciled in Klungkung regency and willing to be respondents. The sample was divided into two treatment groups, who were given the Wellness Program approach (regulating physical activity, balanced nutrition education with nutritional counseling and smoking control approaches), while the control group was without Wellness Program. Wellness Programs were conducted for 8 weeks or 2 months. The sample size using the Pocock formula (Pocock, 2008), with $\alpha = 0.05$ and $\beta = 0.2$, F = 7.9, $\mu1- \mu2 = 2.1$ kg. m^2. Based on the calculation, the results obtained 42 people and 20%, so the sample per group is at least 48 people, rounded off by 50 people, so the total sample in both groups is 100 people. Sampling technique is done by simple random sampling and selected from 2 civil servants (SKPD) then carried out a screening process in accordance with the inclusion criteria to obtain the expected number of samples. The sample selected in each SKPD was determined by the control and treatment groups by simple random sampling.

The types of data collection in this study include characteristic, food consumption patterns, physical activity, smoking behavior, physical fitness, body mass index, metabolic syndrome status (obesity, blood pressure, blood sugar levels and blood cholesterol/triglyceride levels). Identity data samples were collected by interview using a sample identity form, data on food consumption were collected using the 2x24 hour recall method. Meanwhile the BMI data was measured using a stepping scale, and height was measured using a microtoise. Metabolic syndrome data were collected by measuring blood pressure using a blood pressure meter, blood sugar and cholesterol/triglyceride levels with Multi Check Parameters. Physical fitness with the Rockport method test was done through the SIPGAR application by walking or running of 1.6 Km distance. Smoking control data is carried out by interviewing and assessing with two indicators including the category of good (stop smoking), and not good (still smoking). Data were compiled, processed and analyzed by statistical of univariate, bivariate and multivariate including *Kolmogorov-Smirnov* test, *Levene* test, paired t-test and independent t-test.

3. Results

3.1 Characteristics

The research subject were civil servants of Klungkung Regency, as many as 100 people where 50 people are the treatment group and 50 people are the control group. The proportion of male gender is 80% in treatment group and 54% in control group. The average of age in the treatment group was 43 years (± 10.2 years), with the highest age being 58 years and the lowest being 22 years. The average of age in control group is 43.26 years (± 9.3 years), the highest is 58 years and the lowest is 22 years.

Table 1: Sample Characteristic

Variable	Group				Total	
	Treatment		Control			
	n	%	n	%	n	%
Gender						
Male	40	80.0	27	0.54	67	0.67
Female	10	20.0	23	0.46	33	0.33
Total	50		50		100	100
Age						
20 – 30 years	8	16.0	5	10.0		
31 – 40 years	10	0.0	14	28.0	29	.5
41- 50 years	16	2.0	19	38.0	31	.9
51- 60 years	16	2.0	12	24.0	24	.6
Total	50	00.0	42	100.0	84	0.0

3.2 Wellness Program Implementation

There are 3 activities in the implementation of the Wellness Program such as first, nutrition education (balanced nutrition, diet counseling). The diet counseling was given are weight loss diet for obesity/overweight, DM diet (if blood sugar levels >140 mg/dl), low cholesterol diet (if cholesterol level >200 mg/dl, and hypertension diet (blood pressure > 140/90 mmHg. Second, arrangement of physical activity according to the FITT concept (frequency, intensity, time and type) of physical fitness. Third, controlling of smoking behavior that the subjects were expected to stop smoking in their life.

a. Nutritional knowledge

Knowledge of the subject is related to balance and dietary regulation in metabolic syndrome disorders and physical activity. Figure 1 shows the level of nutritional knowledge of the subject.
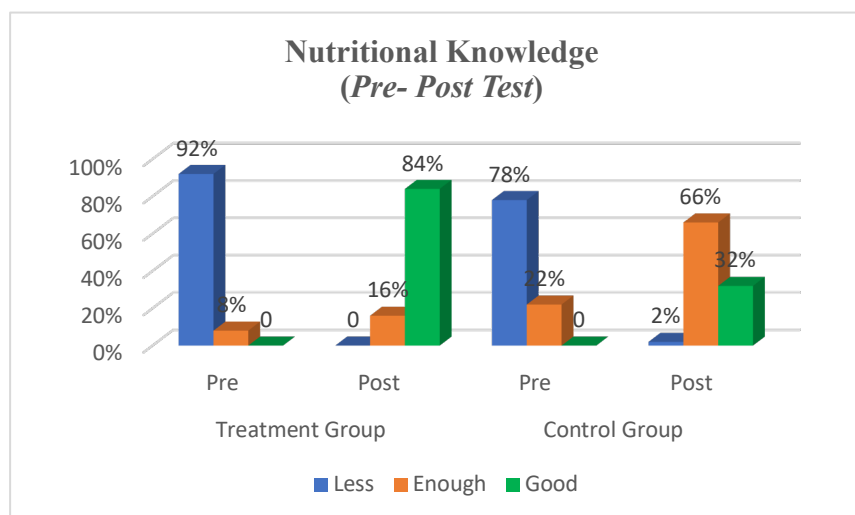

Figure 1: Nutritional knowledge

There is a sharp increase of nutritional knowledge in the treatment group from the less category (92%) to the good category (84%). Meanwhile in the control group there is a change from the less category (78%) to the good category (66%). Some of the questions that have been answered correctly include the function of nutrients for the body, the concept of balanced nutrition, the importance of reducing sugar and oil salt, and following the food pyramid concept. There were questions that had the lowest answered correctly such as serving's portions of various food and glycemic index food for blood sugar levels. The average score of nutritional knowledge in the treatment group is 85.10 + 3.71% and 77.10 + 7.89% in control group. Mann-Whitney analysis was applied to

assess the difference in the level of nutritional knowledge because the data is not homogeneous variance (p<0.05). Mann-Whitney test results obtain p value = 0.001 (p <0.05) which means that there is a significant difference in the level of nutritional knowledge in the treatment group (Wellness Program) compared to the control group.

b. Physical Activity or Exercise

Physical Fitness Training Program to achieve fitness success is largely determined by the quality of the exercise which includes: training objectives, selection of exercise models, use of training facilities and more importantly the dose or dose of exercise described in the FITT concept; Frequency), Intensity , Time and Type (Fitri et al., 2014).

1) Exercise Frequency

Figure 2 shows the exercise frequency distribution. According to exercise frequency in the treatment group, the subject who did exercise in <1 – 2 times/week is 7 people (16%), while the recommended frequency 3 – 5 times/week was accomplished by 39 subjects (78%). On the other hand in the control group, the exercise frequency in <1 – 2 times/week was done by 35 subjects (70%), and the recommended frequency of exercise in 3-5 times/week were performed by 10 subjects (28%)
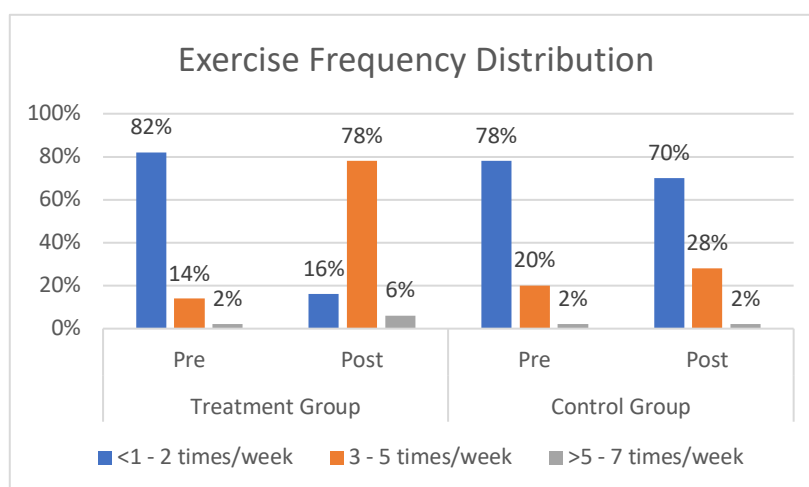
Figure 2: Exercise frequency distribution

2) Exercise Duration

Exercise duration is an essential factor in increasing physical fitness. According to figure 3, in the treatment group, the exercise duration <20 minutes was performed by 70% of the subject (pretest) decreased to 20% (posttest), while the recommended duration of 20-60 minutes increased from 26% (pretest) to 76% (posttest). Exercise duration in control group <20 minutes was done by 70% of the subject (pretest) decreased to 46% (posttest), while in the 20-60 minute duration, there is an increase from 28% subject to 32%. Based on this, the treatment group leads more to the recommended exercise duration of 20-60 minutes.

Figure 3: Exercise duration distribution

3.3 Type of Exercise

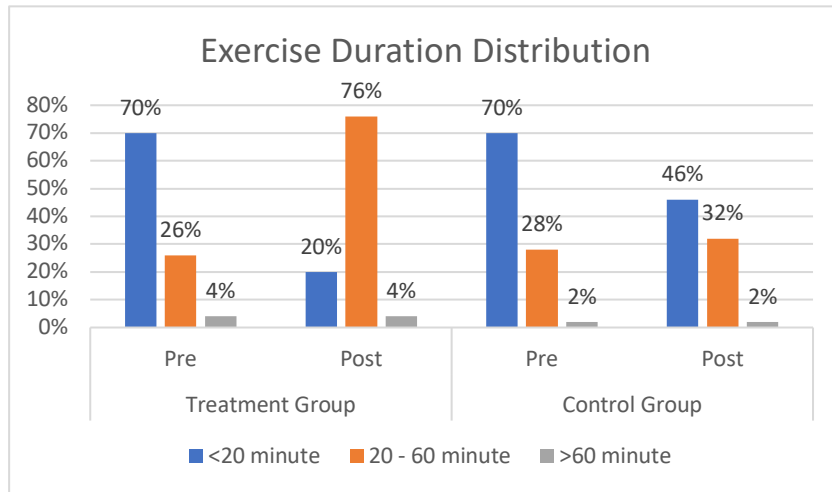In the treatment group, the type of exercise that was carried out the most was jogging with 29 subjects (58%) and running at least 2 subjects (4%), and in control group, the subjects chose the most at jogging with 21 subjects (42%) and the least chose to run as much as 4 subjects (8%). Other types of exercise carried out by the two groups included yoga, gymnastics and cycling.

a. Smoking Behavior Controlling

Figure 4 shows the smoking behavior distribution where the results show that 18% of the treatment group and 10% of the controls had a history of smoking. Wellness programs have decreased of smoking behavior in the treatment group from 9 subjects (18%) to 4 subjects (8%). In control group there is no change in the subject's smoking behavior that still in 5 (10%). The results of the Mann-Whitney test obtain p = 0.042 (p <0.05) which means that there is a significant difference in the decrease in smoking behavior in the two groups.
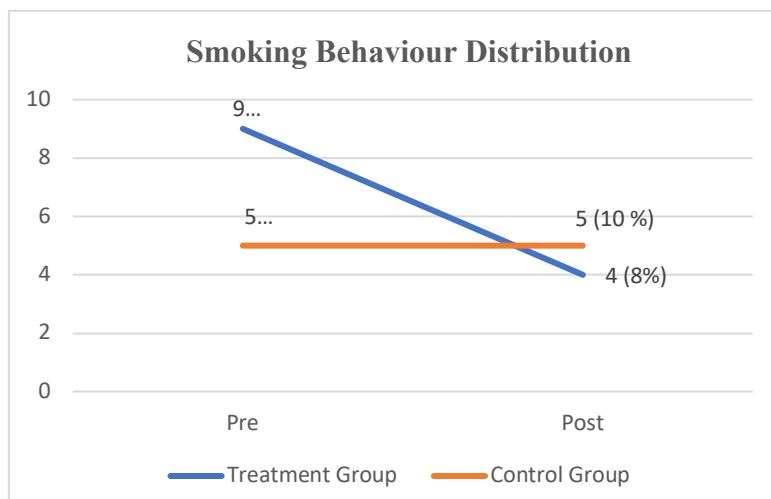

Figure 4: Smoking behaviour distribution

3.4 Physical Fitness

Physical fitness assessment was carried out through the Rockport method based on the SIPGAR application using of Android type mobile phone. The Rockport method was carried out by running or walking for 1.6 km distance. The SIPGAR application would be reported of speed time, VO2Max level and physical fitness category. The physical fitness of the treatment group from the less category (70%) in pretest decreased to 30% in posttest. In the good category starting from 0 (zero) increase to 42%. In the control group, the fitness less category (78%) in the pretest, there was relatively no decrease, which is 76% in the pretest. The average VO2 max in the treatment group is 29.28 + 7.68 (ml/kg/minute) and in the control group is 24.28 + 5.91 (ml/kg/minute). The results of the t-independent test obtain t value = 4.156 and p value = 0.001 (p <0.05). The results show that there is a significant difference in the mean VO2Max in the treatment group and the control group. This means that the wellness program is effective in improving the physical fitness of the civil servants.
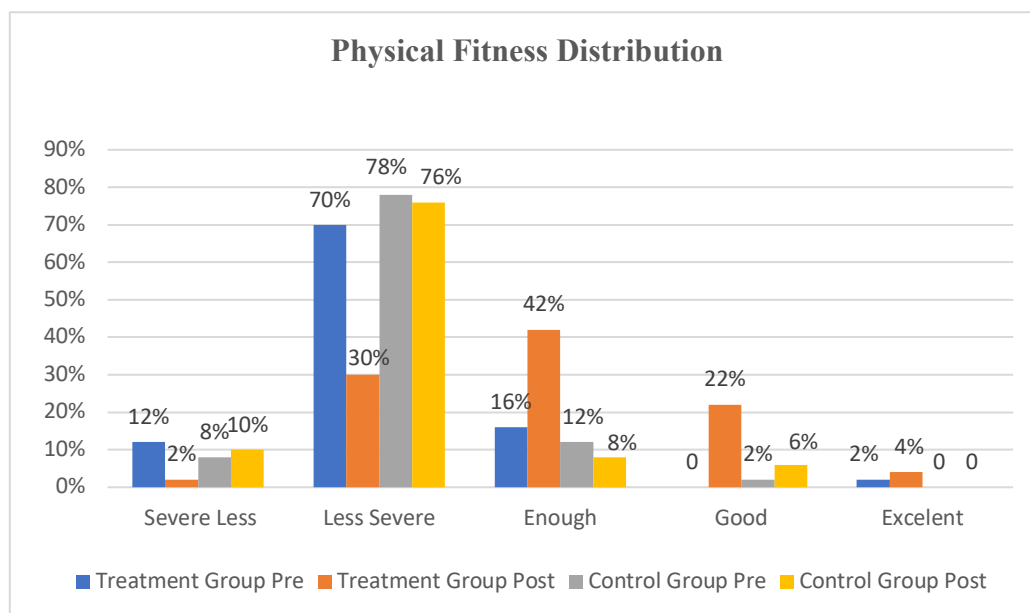
Figure 4: Distribution of subjects by category of physical fitness

3.5 Metabolic Syndrome Risk Factors

a. Obesity

Figure 5 shows the body mass index status. The obesity number decreased in the treatment group from 20% to 14%. But in the control group there is an increase from 14% to 18%. The average body mass index in the treatment group is 26.77 + 4.57 kg/m^2 and in the control group is 26.05 + 4.46 kg/m^2. The results of the t-independent test obtain p = 0.428 (p>0.05). There is no significantly different in BMI between two groups
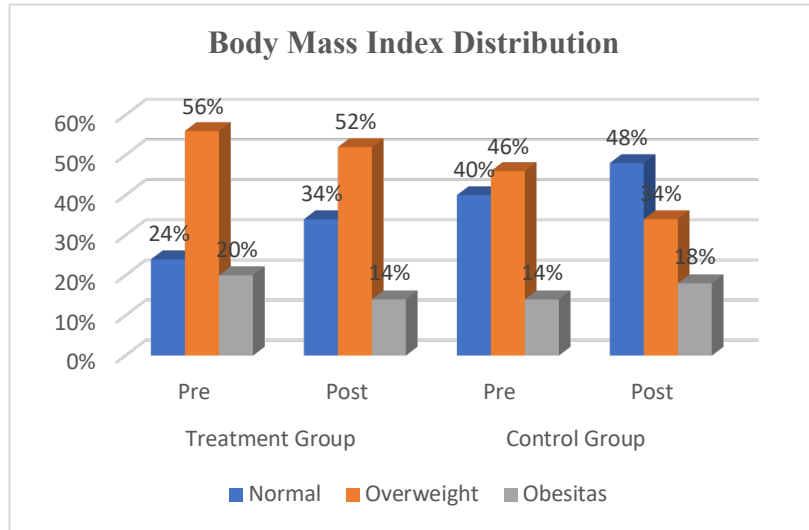
Figure 5: Body Mass Index distribution

b. Blood Pressure

According to figure 6, the average of blood pressure in the treatment group is 119.2/78.54 + 14.85 mmHg (pretest) and 115.2/77.2 + 8.02 mmHg (posttest). On the order hand, in control group is 115.9/77.8 + 9.8 mmHg to 116/80 + 9.84 mmHg. The results of the t-independent test show that p = 0.911 (p>0.05). Hence, there is no significant difference of blood pressure in two groups.
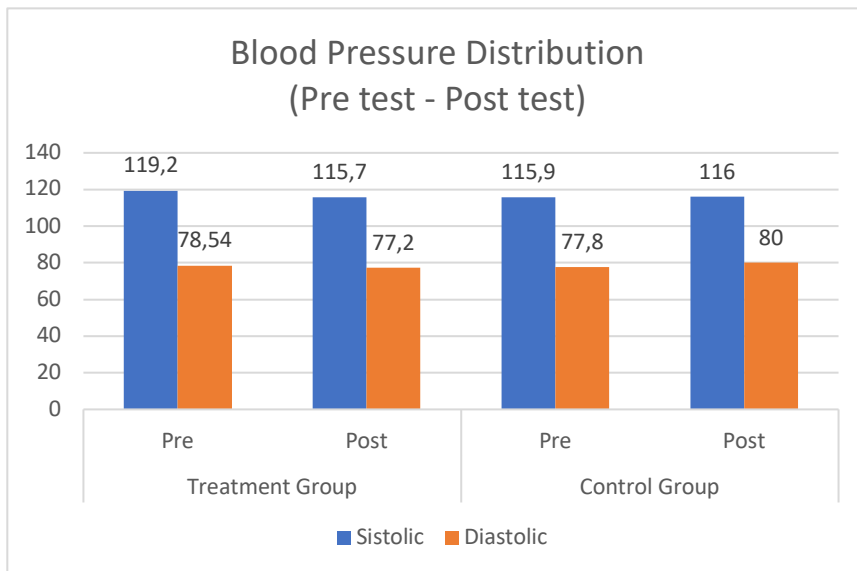
Figure 6: Blood pressure distribution

c. Blood Glucose

Figure 7 indicates that blood sugar levels in the treatment group decrease sharply from 135.78 + 62.57 mg/dl to 118.08 + 35.81 mg/dl. Meanwhile, in control group is 126.24 + 38.41 mg/dl (pretest) to 124 + 42.22 mg/dl. The results of the t-independent test obtain p = 0.001 (p <0.05),so, there is a significant difference in blood sugar levels between the treatment and control groups.
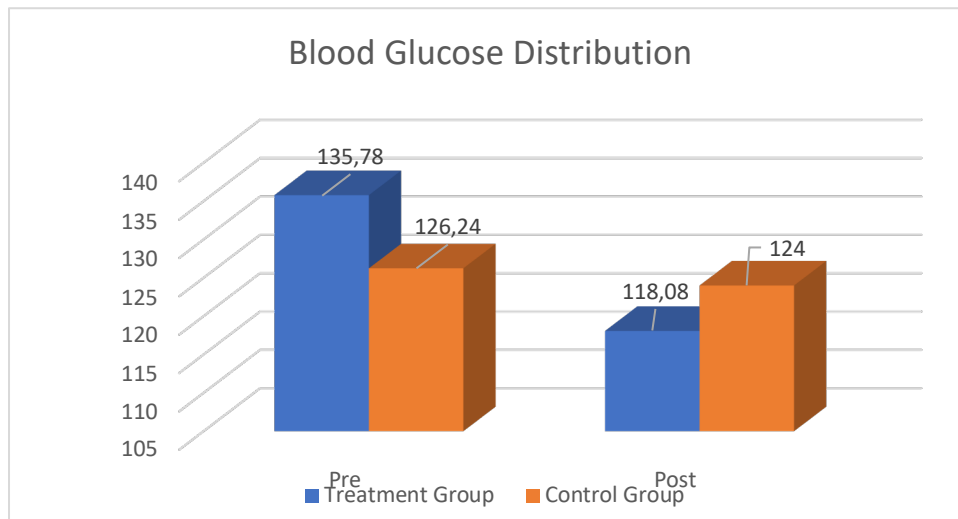
Figure 7: Blood glucose distribution

d. Cholesterol

The average of cholesterol levels in the treatment group is 196.38 + 39.09 (pretest), decreasing to 193.80 + 50.76 (posttest) after given wellness program intervention. Meanwhile in the control group is 185.18 + 38.53 (pretest) increased to 196.82 + 40.41 mg/dl. The results of t-independent test show that p value = 0.743 (p>0.05), so, there is no significant difference of cholesterol levels between two groups.
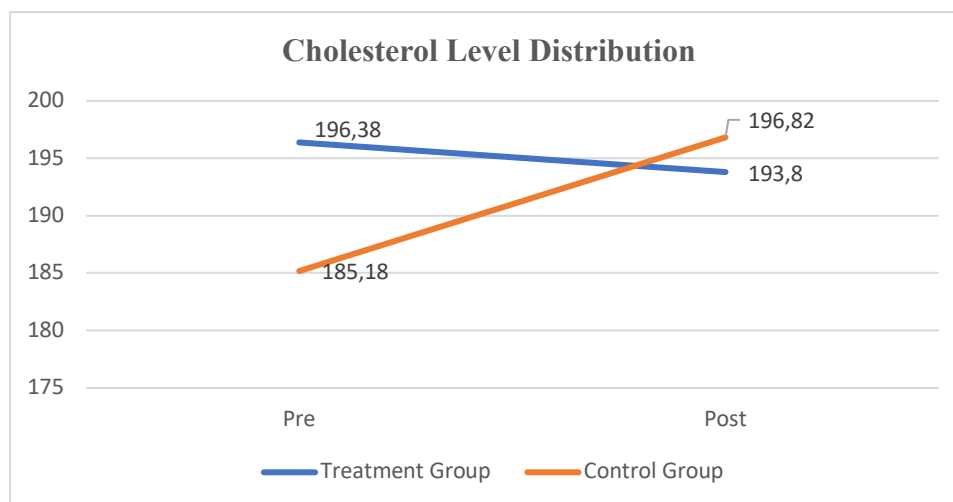
Figure 8: Cholesterol level distribution

4. Discussion

The results show that the Wellness Program approach gave significant results on the health condition of civil servants which is seen from several variables including nutritional knowledge, regulating of physical activities based on FITT, decreasing of smoking behavior and decreasing of blood glucose as one of the risk factors for the occurrence of metabolic syndrome. The difference in nutritional knowledge in the treatment group compared to the control group is due to information being repeatedly conveyed through counseling or WhatsApp Group which was made with the permission of the head of civil servants. The higher nutritional knowledge level, the better one's management in quality and quantity of food that must be consumed (Hamulka *et al.*, 2018; Eze *et al.*, 2017). Increasing the nutritional knowledge will have an impact on the regulation of eating and minimize of metabolic syndrome risk. Increasing nutritional knowledge in the intervention of Wellness Program has given an impact of

reducing blood glucose levels significantly. The results of this study are similar to the research by (Friedrich and Goluch-Koniuszy, 2017), that providing nutrition education to 56 pre-menopausal women in Poland regularly every week has an impact on increasing nutritional knowledge, regulating diet, and controlling blood sugar. Meanwhile the results of (Wiardani and Kusumajaya, 2018) on obese women show that education followed by training or mentoring can increase knowledge, skills and the application of balanced nutrition.

The Wellness Program intervention is able to reduce the percentage of blood pressure categories from pre-hypertension to the normal category but does not show a significant difference. This is probably due to the fact that 2 (two) months of the wellness program is not enough time. The results of this study are similar to (Blackford et al., 2016) research result that application of healthy lifestyle modifications such as changes in diet and physical activity can reduce blood pressure by 30 mmHg for 6 months.

The administration of Wellness Program intervention for 8 weeks along with the guidelines for civil servants in carrying out of physical activities with a frequency of 3-5 times/week, intensity 60-75% maximum pulse rate, duration of 20-60 minutes with aerobic type of exercise is able to improve physical fitness through increasing physical fitness indicator such as VO_2 max. This is in accordance with the research from (Pescatello, 2014) which states that the time required for each exercise is 20-60 minutes / exercise with aerobic type of exercise. The results of the exercise will increase cardiopulmonary endurance after exercising for 6-12 weeks and stable after 20 weeks. The increasing physical fitness is marked by a significant increase in VO_2Max in the Wellness Program. It is because of applications like SIPGAR that make people more easily to do of exercise, besides, it can also provide information on the importance of a healthy lifestyle, can be used as monitoring when running an exercise program, provide evaluation of cardiovascular endurance test results, provide body mass index output values from user profile data, provide education to users regarding information about fitness (Putro et al., 2018).

According to (Ford et al., 2005) states that regular physical activity can prevent the occurrence of metabolic syndrome. Employees was encouraged to be an active at all times doing physical activities such as stretching, not always being in front of the computer, or in front of the television, as it will tend to reduce the risk of metabolic syndrome. The wellness program intervention can decrease of smoking behavior, increase physical fitness (VO2max) and reduce blood glucose levels significantly. Such improvement is due to a togetherness approach in the government environment, such as support from leader to always give motivation to the employees in implementing of Wellness Program and that become sustainability program including of eating arrangements, certain diets and physical activities through social media by forming WhatsApp groups. This is in accordance with the results of research by (Lemstra and Rogers, 2015; Budreviciute et al., 2020) which states that the support of social groups, family, close friends, superiors in a workplace can have positive implications in preventing and minimizing the risk of Non-Communicable Disease (NCD) including metabolic syndrome and improve quality of life.

Acknowledgments

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Basic Approach to Prevalence of Iron-Deficiency Anemia among Pregnant Women and Children in South Florida before 2003

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Abstract

Obviously iron deficiency is determined as the most prevalent nutritional problem in the world today. It is provoked by a lack of iron in the diet. In South Florida, since pregnant women tend to neglect prenatal care, the prevalence of anemia primarily occurs during the first and second trimesters of their pregnancy. Accordingly, medical studies show that premature deliveries, low birth weight, birth defects, infant mortality, etc. result from iron deficiency anemia. In this, birth defects are, however, considered as quite associated with folic acid deficiency anemia. That explains why, this paper also deals with the study published by the March of Dimes on folic acid and pregnancy. In addition, the paper approaches qualitatively the socioeconomic and sociocultural aspects of the disease according to eight (8) interviews conducted in Broward and Miami Date counties to highlight the existing preventive programs for vulnerable population such as women, infants and children in South Florida, USA.

Keywords: Iron Deficiency Anemia, Folic Acid Deficiency Anemia, Prenatal Care, Low Birth Weight, Cognitive Delay

1. Introduction

Among the diseases, anemia rates are used as indicators to understand the poverty level and malnutrition in a population. Then, anemia that is seen as a malnutrition disease associated with poverty or "a lack of availability of food materials" (Dettwyler, 1992) is an important public health problem. It is the most frequent disease after types I and II diabetes. Its effects (like maternal mortality, low birth weight, birth defects and infant deaths due to birth defects) affect every year vulnerable population, such as pregnant women, teen mothers, children, etc. in South Florida. The whole country, seeking either to stabilize the population or to avoid a demographic scandal, "increased knowledge about screening for iron status, raised questions about the necessity and effectiveness of existing …programs to prevent and control iron deficiency" (CDC, 1998).

According to Centers for Disease Control and Prevention (CDC, 1998), these programs brought a decline of the prevalence of iron deficiency anemia among children. However, "the rate of anemia among low-income women during pregnancy is high, and no improvement has been noted since the 1970s" (CDC, 1998). In Florida, where the rate of anemia resulted from more than 1.6 million of people living below the poverty level, and determined with the incidence of maternal mortality, low birth weight, birth defects and infant deaths due to birth defects, factors as international migration and majority of the nonwhite population are largely associated with this rate.

For example, Broward County counted 1,623,068 residents and Miami Dade 2,253,362 that gave a total of 3,876,380 for South Florida in 2000; whereas in 1990, the population was estimated at 3,192,755 people. In this, the international migration by itself enhanced a growth of 427,358 people within this decade (US Census Bureau, 2000). Forty-one and two (41 and 42) percent of Whites, 33.8% of Hispanics, 19.2% of Blacks, 1.9% of Asians/Pacifics and 3.9% of others obviously made up the population. Numerous blacks here are African-American. They also compose with a large Haitian population that accounts for more than 100,000" (Broward Regional Health Data Sourcebook, 1997; South Florida Health Data Sourcebook, 1996).

As a function of this, it is to note that: "Florida [the Southernmost United States in the Caribbean region] has on several occasions experienced an influx of refugees who are fleeing their native countries in search of political asylum and the start a new life" (Haitian Nutritional Initiative, 1998). Thus, they either bring with them on the US, their poverty and malnutrition diseases, or leave behind their economic problems and lack of food access.

Here, however, "the adjustment to new customs including new foods is a crucial one. Frequently, the mainstream of their diet is not readily available and appropriate substitutions must be made" (Haitian Nutritional Initiative, 1998). In the meantime, it is understandable that it takes time for the refugees to bring change in their culture of diet. Since this transition probably lasts a bit, refugees could still remain vulnerable. A doctor at Family Health Center in Broward notices that Cubans, Haitians, South Americans, Indians, Pakistanis, just to name a few, come to the clinic with some of the worse anemic cases.

In light of the above explanation, two characteristic questions are formulated to explore the disease in South Florida. The first one refers to a global question like: "How can be explained factors associated with high rate of anemia among pregnant women and their children in South Florida? The other ones are specific or researchable. They are formulated as follows: Does the lack of prenatal care provoke iron and vitamin deficiency anemia in pregnant women? Do the pregnant women's culture of diet contribute to the prevalence of iron deficiency anemia in South Florida? Can socio-cultural environment be considered as a factor to the incidence of anemia among children?

This study will focus on anemia among pregnant women and children in the southern (Broward and Dade particularly) portion of Florida. This population is very different from other groups of individuals since it is considered at risk or vulnerable. When there are a lack of food access and inadequate prenatal care, due basically to socioeconomic status and sociocultural behavior, women and children remain the first to be touched by this penury and anemia.

According to Florida Health Data Sourcebook (1997), more than 1.6 million *Floridians* including about 525,446 children live below the poverty level. However, behind districts 2 and 3, district 11 designated for South Florida, has the great percentage of children living in poverty. It is probable to consider that the highest rates of anemia are identified with this community. This community could face the highest rates of premature deliveries, low birth weight babies, infant mortality and migration which can primarily create a 'decrease in its numbers.'

In the other words, this study will attempt to understand the prevalence of anemia among pregnant women and children in South Florida by analyzing the related causes and consequences of the disease. Also, it will attempt to show the consequences of sociocultural behaviors on the other factors that can provoke anemia. This idea can create an adequate iron deficiency anemia awareness among the population and point out the health programs that were or are underway in order to control the disease.

2. Etiology of Iron Deficiency Anemia

As stated earlier, anemia has multiple etiologies. "The etiology of acquired anemia [iron-deficiency anemia] is difficult, if not impossible, to determine in the absence of *serum ferritin* values or bone marrow aspirations" (Molher in Kent & Dunn, 1996: p. 455). Through this, we point out that *serum ferrentin* concentration is considered as an early indicator of the status of iron stores (CDC, 1998). And when the *serum ferrentin* is low, that probably indicates low iron stores, a perceived cause of anemia. Many other factors explain the causes of anemia. Such causes are subnormal levels of hemoglobin hematocrit, serum iron, and/or transferrin saturation (Hoffbrand & Pettit, 1993; Kent & Dunn, 1996).

In addition, we highlight as causes of anemia, blood loss, menstruation, gastrointestinal tract, food sensitivity, hookworms, blood donation, growth, and pregnancy or repeat pregnancy. However, we reveal that the causes of anemia vary in function of regional conditions and population group (CDC, 1984; DeLoughery, 2014). According to CDC (1984):

> Thalassemia and iron deficiency anemia may have similar blood film appearances. But in a region where thalassemia does not occur, a hypochromic blood film is much more likely to be due to iron deficiency anemia. Similarly, a high incidence of a hemoglobinopathy, red cell enzyme deficiency, or malaria in a region may suggest a likely cause for anemia in that region (p.2).

Further, adds CDC (1984):

> In the occasional region where the diet has a high folate content, for example, bananas, megaloblastic anemia [or folic acid deficiency anemia] would more likely be due to B12 deficiency rather than to folate deficiency. Frequently, several causes of anemia may coexist in the same person and therefore diagnosis may be difficult (p.2).

Since in the previous tips, iron and folic acid are considered as two key words, let us see them below.

2.1 Role of Iron in Human Body

In short, we highlight that "iron plays an important role in many metabolic processes, including oxygen transport, oxidative metabolism, and cellular growth" (Ryan, 1997: p.25). The total body iron averages approximately 2.3g in women and 3.8g in men, which is equivalent to 42mg/kg body weight for a 55-kg woman and 50mg/kg body weight for a 75-kg man, respectively (CDC, 1984). Someone diagnosed with iron deficiency or who has anemia can be currently treated with the oral iron therapy (Janus & Moerschel, 2010).

2..2 Folic Acid Intake

According to the March of Dimes (1999), "folic acid plays an important role in production of normal red blood cells, and that individuals who were deficient in folic acid sometimes developed a form of anemia called megaloblastic anemia" (p.2). Additionally, we point out that people having high levels of a substance called homocysteine in their blood are exposed to heart disease and stroke. Through this, the study also tends to show 'the role of high homocysteine levels in causing birth defects.' In this case, "when these people take folic acid, the level of homocysteine in their blood drops, possibly decreasing their risk of cardiovascular disease" (March of Dimes,1999: p.2).

The ending section displays the background of the iron deficiency anemia. In order to see how the disease is perceived on the global form, the following section as a brief literature review will give you an insight.

3. Literature Review

The following review of literature highlights the relationships between iron deficiency and anemia and the related causes (like poverty or a lack of availability of food materials, SES, inadequate access to prenatal care,

sociocultural behaviors) and consequences (such as premature deliveries, low birth weight babies, and infant development and mortality).

Current research into iron deficiency anemia indicates that 58% of pregnant women in developing countries are anemic (Galloway et al., 2002). The common cause for that is due to inadequate iron intake resulting from inadequate counseling and distribution of iron tablets, difficult access and poor utilization of prenatal health care services, beliefs against consuming medications during pregnancy, and in most developed countries, fears that taking too much iron may cause too much blood or a big baby, making delivery more difficult (Galloway et al, 2002).

In Costa Rica, women having this cultural perception from taking iron supplements during their pregnancy can also nourish the fears that iron prescribed to their children provokes some side-effects and do not administrate it to their children. In this area, (liquid) "iron is said to permanently stain the teeth and some women state their conviction that iron eats away the teeth until they fall apart, and only black nubs are left" (Jefferds, 2002).

Studies for the Russian and Massachusetts (USA) communities show in fact that dietary iron intakes were deficient in the most vulnerable groups like young children and women of reproductive age (Kohlmeier, Mendez & Shalnova,1998; Sargent & Johnson, 1996). The same studies show that iron deficiency was strongly associated with poverty status or low SES. The studies conclude that women and children in Russian and Massachusetts communities are at higher risk of iron deficiency due to risk factors associated to SES. Further studies in Maryland (USA) and Uzbekistan about anemia in young children precise that anemia is associated with financial difficulty in acquiring food (Giebel, Suleymanova & Evans, 1998; Klesges, Pahor & Shorr, 2001).

The study of Giebel et al. (1998), for example, 'examined prevalence […] of anemia in the Muynak District of Uzbekistan, an area of rapidly changing social and economic conditions following the collapse of the Soviet Union.' Questionnaire data and blood samples were collected on a random sample of 433 children aged 1 through 4 years. The results showed that the prevalence of anemia ranged from 89% in 1-year-olds to 48% in 4-year-olds. Probably, those children could face physical growth and cognitive development problems (Ryan, 1997).

Regarding iron-deficiency anemia and infant development, Ryan (1997) indicates that both iron status at birth and requirements during infancy, and iron-deficiency anemia and growth are relatively important toward understanding the prevalence of iron and vitamin deficiency anemia among pregnant women and children. The study showed that when the mother is iron deficient, probably the fetus will be affected and even the neonatal health. That gives birth to premature deliveries and low birth weight babies, and rise to infant mortality (Galloway et al., 2002).

This literature review tries to ascertain the prevalence of iron-deficiency anemia in pregnant women and children by focusing on related causes (like poverty, inadequate access to prenatal care, sociocultural behaviors) and consequences (such as premature deliveries, low birth weight babies, and infant development problems and mortality). And the report will try to provide evidence to support the idea that the prevalence of iron deficiency anemia might be perceived through the understanding of causes and consequences of anemia indicated above among pregnant women and children in South Florida.

4. Methodology

Anemia has multiple etiologies. Several causes and consequences are examined in order to ascertain the prevalence of anemia among pregnant women and children in South Florida. Since anemia is not considered as a major public health problem in Florida, data are not labeled under anemia disease directly, but under prenatal care, maternal nutrition, child health, etc. Therefore, data were collected under the terms prenatal care, maternal nutrition, child health, WIC (Women, Infants and Children), infant and women mortality rates for the target population. The qualitative method was used to examine those factors and show the prevalence of anemia. However, some numerical data were gathered but remain qualitative because they are collected verbally or within published documents, articles and books.

Between the last quarter of 2002 and the first quarter of 2003, data were collected from HRS including the WIC Office and Broward County Health Department, and within the Health publications (Florida Health Data SourceBook, 1997; Florida Health Data Sourcebook, 1998; March of Dimes StatBook,1993; Florida vital statistics and health annual reports; Maternal and Infant Health Status Indicators For Florida: 1991-1995; Adolescent Pregnancy Report, Florida's Family Preservation and Support Services Plan, 1995-1999; Florida State Plan of Program Operations and Administration for FFY 1995; Florida Kids Count; CDC's Public Health Surveillance for Women, Infants, and Children; MMWR 1998: Recommendations to Prevent and Control Iron Deficiency in the United States; Haitian Nutrition Initiative, 1998) and internet sites (http://doh.statefl.us/, www.cdc.gov and www.modimes.org).

About the interviews, eight (8) short interviews were conducted. Informants in Dade County were contacted from Miami Children's Hospital, U of M Hospital and Clinic, and United Cerebral Palcy. In Broward County, informants were contacted from Family Health Center, Healthy Start Coalition or State Road 84 Health Center, and Trinity Health Center, etc. These informants include friends who work in the medical field or the mentioned health facilities. Four Haitian parents and pregnant women in Broward were currently questioned in order to understand their nutritional attitude and their prenatal care access.

This paper is dealing with the prevalence of iron anemia and its detrimental effects among populations considered at risks, such as pregnant women, infants and children. Since the fieldwork was done in a few days or where access was very limited or restrictive, only integral findings are expected. However, they can provide an insight about the anemic situation in South Florida before the year 2003.

The quantitative information displays numerical data according to each group like women, babies, toddlers, etc., living under detrimental effects of nutritional anemia and nutritional deficiencies. Based on any percentage of people who are identified with this disease, the principal causes, the socioeconomic and sociocultural factors are determined. Original data collected and secondary source data are coded and reassembled into themes, concepts, ideas or arguments to display the findings (Rubin & Rubin, 1995). In addition, this approach indicates the proportion of racial or ethnic groups affected by this disease.

This study is considered as a preliminary step toward an eventual research based on anemia among pregnant women in 2003 and after.

5. Findings: Prevalence of Anemia among Pregnant Women and Children

In the State of Florida, particularly South Florida, there is no special emphasis on the prevalence of anemia. This trend is because the researchers understand that iron deficiency anemia is *acquired anemia*, which means that it is different from the congenital one, and therefore, it might be controlled through healthy and adequate nutritional assistance to vulnerable population that consists of pregnant women, infants, and children. That trend can also explain why health-care providers or agencies are not interested in classifying data for eventual studies on anemia. Even when data are not collected which keep people informed, everyone knows that the risk 'for or prevalence of iron deficiency' exists.

Uthman (1998) argues that "each year thousands are told they suffer from anemia, but most have only a vague understanding of the condition … 'Anemia' a generic term that includes many specific diseases, each of which has its own history regarding cause, manifestations and treatment." In fact, on the national level, some medical studies have been directed between 1970 and 1998 in which data are collected by sex and age (years), iron deficiency, iron deficiency anemia, etc.

In South Florida when we take into account literature on anemia, public documents and original data associated with the absence of prenatal care, premature deliveries, low birth weight babies, etc., and compare them to the "manifestations of iron deficiency" (CDC, 1984: p. 5) given for the whole country, we consider there is a prevalence of anemia in South Florida. Accordingly, the prevalence of anemia will be shown through the themes displayed below.

5.1 Iron deficiency Anemia and Pregnant Women

Data are not available about the percentage of pregnant women suffering from anemia in South Florida. So, we can take into account the argument of a WIC nutritionist supervisor in Broward. She states: "It is not necessary to seek the percentage of pregnant women suffering from this disease when you know the percentage of pregnant women who don't receive prenatal care," or the percentage of premature deliveries, low birth weight babies, fetal death, etc. In this respect, it is to note that CDC (1984: p.6) points out "among pregnant women, iron-deficiency anemia during the first two trimesters of pregnancy is associated with a twofold increased risk for preterm delivery and a threefold increased risk for delivering a low-birth weight baby. Then, through these complications, "anemia can be 'passed' from the mother to the baby causing the baby to be born too thin, weak, deformed, premature, or sick" (Galloway et al., 1992: *p.* 539).

In addition, we reveal that 'women who were deficient in folic acid were more likely to have [not only] a baby who was premature and of low birth weight (less than 5-1/2 pounds),' but also to have one with "birth defects of the brain and spinal called neutral tube defects (NTDs)" (March of Dimes, 1999: p.2). On this level, available data on these cases can give us an idea about the prevalence of anemia in South Florida.

As a matter of fact, 1996 statistical data for Dade County reported that 7.8% of mothers delivered low birth weight babies and 9.7% of mothers delivered preterm births, and 1995 data for Broward indicated that 16.5% of mothers were recorded as delivering low birth weight babies. However, in Broward, data did not mention premature birth because "low birth weight [is] primarily [considered as] the result of premature birth" (Broward Regional Health Sourcebook, 1997).

Furthermore, since we have no data available about fetal death and birth defect for all South Florida, we just highlight some cases according to two reports, one from Jackson Memorial Hospital, JMH (South Florida Perinatal Network, 1988) and the other from the United Cerebral Palsy-Preschool (UCP-PS). JMH emphasized 36% of fetal death among teen mothers for 1986.

Original data shows that UCP-PS, Miami, recorded between 1997 and 2000, 102 cases of Cerebral Palsy (CP) Children. Besides UCP-PS, there are at least 14 institutions specializing in infant services, developmental delay (or disability) and early intervention. Unfortunately, due to unavailable time, we didn't contact these institutions.

To indicate the prevalence of anemia, we reveal that UCP urges for the prevention of Cerebral Palsy, by the control of diabetes, anemia and nutritional deficiencies. Obviously, all of these unfortunate conditions are primarily due to iron-deficiency and folic acid anemias in pregnant women who receive late prenatal care or no prenatal care.

In fact, women with late or no prenatal care were evaluated to 16.7% in South Florida including about 7.0% in Broward within 1996-1997 (Broward District Health Plan, 1998; Florida Department of Health, 1996). Of this, a Medical Center practitioner, according to original data, indicated that 80.0% of pregnant women were found anemic during their first prenatal blood test. Probably, among these women, "expansion of blood volume by approximately 35% and growth of the fetus, placenta, and other maternal tissues increase the demand for iron threefold in the second and third trimesters to approximately 5.0mg iron/day" (CDC, 1984: p. 9). In this case, if a pregnant woman "[doesn't] take iron supplement to meet increased iron requirements during pregnancy, she cannot maintain adequate iron stores" (CDC, 1984: p. 9) during both given trimesters.

Thus, "these normal physiologic demands are reflected in the CDC trimester specific reference criteria for anemia during pregnancy" (Wilcox & Marks, 1995: p. 28). In addition, these normal physiologic demands in association with a lack of vitamin and mineral supplementation can enhance "the prevalence of underweight" (Wilcox & Marks, 1995: p.23) among pregnant women. In a 1998 study about a Haitian project in Broward, for two treatment Groups, 31% and 41% of 239 and 397 pregnant women did not gain 'enough weight.' Normally, during pregnancy 25 to 35 pounds are additionally required for most healthy and normal weight women, 15 to 25 pounds for overweight women and 28 to 40 pounds for underweight women (Haitian Nutrition Initiative, 1998: p.2).

"Weight gain during pregnancy has a tremendous effect on the outcome of the pregnancy. Adequate weight gain is necessary for normal growth and development of the fetus, and also for the health of the mother" (Haitian Nutrition Initiative, 1998: p.2). In a conversation, a 4 children mother reveals that a pregnant woman must not take too much weight during her pregnancy. This can 'lead to diabetes mellitus and 'pregnancy induced hypertension' (PIH). On the contrary, "if a woman does not gain enough weight, she is far more likely to deliver a low birth weight baby and/or have other complications with delivery and with her baby" (Haitian Nutrition Initiative, 1998: p.2).

Since premature delivery and low birth weight are associated with infancy, let us see them in the following section.

5.2 The Prevalence of Anemia among Children

As previously indicated, data are officially unavailable on anemia according to sex and age (years) in South Florida. Whereas, on national level, "data from the Pediatric Nutrition Surveillance System (PNSS), conducted by the Centers of Disease Control (CDC) in 1980-1991, indicated a 20-30% overall prevalence of anemia among children younger than 2 years of age" (Ryan, 1997: p.22-23). In addition, the CDC points out for all children under 2 years of age whose a hemoglobin is <11.0gdl or a hematocrit, 33.0%, are anemic.

Although other causes during pregnancy and infancy can lead to low birth weight, fetal death and to a subnormal hemoglobin among children concentration, the iron deficiency and 'B12 vitamin deficiency' anemias are commonly highlighted (Hoffbrand & Pettit, 1993). Therefore, the percentage of premature deliveries, low birth weight, infant mortality, etc. in South Florida indicates the prevalence of anemia.

5.2.1 Premature Deliveries

Between 1995-1996, South Florida counted 8.6% of premature deliveries compared to the Statewide being 8.4%, nationwide 11% in 1997 (Florida Department of Health, 1996; March of Dimes,1997; Lawton and Rhea Chiles Center, 1991). Although a premature delivery indicates the iron deficiency among the mothers, but it also does among the infants. "Preterm ... infants are born with the same ratio of total body iron to body weight, but because their body weight is low, the amount of stored iron is low too" (CDC, 1984: p. 5-6). Generally, when there is this kind of complication, study could show that the total amount of iron required for an average pregnancy is [less than] 840mg" (Ryan, 1997: p.18). So, most of the time, pregnant women with poor iron status are unable to transfer at least 350mg of iron to the fetus and placenta. In function of this, their body cannot support a full-term pregnancy. That implies further the premature delivery.

In the Haitian culture according to an interviewee, "we deliver a preterm baby, when we are in 'perdition,' [a kind of miscarriage]. In this culture, several factors are associated with 'perdition.' The most common one is blood loss during the first months of pregnancy due to bad luck or witchcraft. Rarely, Haitian women follow the biomedical perspectives to explain premature delivery. On April 24, 2003, during a multicultural festival that took place at Wilton Manors Elementary School in Fort Lauderdale, Broward County, a second grade teacher in her late 20s was asked if she has kids since she was seen with 3 ones. She replied, "No, Bondye poko vle mwen genyen (God doesn't want yet)." Further, "I had a miscarriage a couple of years ago," she added. In saying, "God doesn't want yet," she would like to imply that God doesn't conjure yet the bad luck and magic things preventing her a normal-term pregnancy.

5.2.2 Low Birthweight Babies

The conditions that provoke the preterm infants are quite similar to those that explain low birth weight infants. Thus, we recall that iron-deficiency anemia is associated with both conditions" (CDC, 1984: p.5). In this case, we highlight that low birth weight babies are under 2500 grams (very low birth weight are under 1500 grams). In fact, Broward and Dade recorded about 7.9% of low birth weight infants for the years 1995-1996 (Florida Department of Health, 1996; Lawton and Rhea Chiles Center, 1991) while the State of Florida counted 8.34%. At last, we add that these 'infants are born with lower iron stores and grow faster during infancy, consequently, their iron stores

are often depleted by age 2-3 months and at greater risk for iron deficiency than are full-term infants of normal or high birth weight.'

5.2.3 Infant Mortality

In 1997, CDC analyzes that "low birth weight infants were 21 times as likely and very low birth weight, infants were almost 90 times as likely to die before their first birthday as not low birth weight infants." Here, it is important to remind that birth defects are commonly associated to very low and low birth weight. All of them, in 1990 were responsible for about 33% of infant mortality on countrywide level and 6.4% on statewide level in 1995 (March of Dimes, 1993: p.30; Lawton and Rhea Chiles Center, 1991). Compared to the statewide data, we see that the infant mortality is high in South Florida with a rate of 8.26%.

5.3 Effects of Iron-Deficiency on Child Development

Iron-deficiency anemia is the most common anemia (DeLoughery, 2014). As one of the malnutrition diseases, it provokes mental deficiencies and reduces the intellectual quotient (IQ). "In humans, the brain growth spurt [or increase] is both a prenatal and postnatal event" (Ryan, 1997: p.43). Thus, the iron-deficiency anemia delays this process. Infants with iron-deficiency anemia stored significantly lower than the control and non-anemic iron-deficient groups on both the Mental Development Index (MDI) and Psychomotor Development Index (PDI) (Ryan (1997).

In Dade County, for example a study (Hurtado, Claussen & Scott, 1999) is based on all birth records for the years 1979-80 and all school records for the years 1990-91. Data concerning the children were provided by the WIC Program. "About 69% of the sample was Black, 23% was Hispanic, and 7% was White." The study shows that "children with very low birth weights and those with low birth weights were 4.58 and 2.50 times as likely, respectively, to be classified as mildly or moderately retarded as children with normal birth weights" (Hurtado, Claussen & Scott, 1999: p.117). In addition, the study reveals that "males were 2.17 times more likely to be classified as mildly or moderately retarded than female." At last, to conclude the study "supports [in part] the efforts to provide proper nutrition to mothers, infants, and young children" (Hurtado, Claussen & Scott, 1999: p.117).

5.4 Socioeconomic Implications

As indicated, the population said vulnerable like pregnant women, infants and childhood remains the most affected by iron deficiency and folic acid anemias. However, among individuals whose the socioeconomic status is relatively low, the prevalence of anemia presents the highest rate. In the last quarter of 2002, at the time we started gathering information for the current research, the US Pediatric Nutrition Surveillance System reported increase among low-income children was 13 percent, and that continued to increase up 15 percent until 2007 (Janus & Moerschel, 2010). Since in the United States the ethnic group difference is used as a predicting factor of analyzing the degree of income or the poverty level, statistical data show that the highest rate of no prenatal care or late prenatal care [...], premature deliveries, low birth weights, infant death, birth defects, are primarily recorded among Black and followed by Hispanic and White people. As we already know all of these complications as for leading causes the iron deficiency and vitamin deficiency anemia.

In fact, on countrywide level, CDC, in 1993, indicated that the prevalence of Anemia in low income pregnant women enrolled in public health programs was 9%, 14% and 37% in the first, second, and third trimesters, respectively (CDC, 1998). Despite the fact that data for all pregnant women were unknown, CDC added that "the high prevalence of iron deficiency and iron-deficiency anemias, and the increased demand for iron during pregnancy suggest that anemia during pregnancy may extend beyond low income women" (CDC, 1998: p. 9). Consequently, that explains in 1994 the prevalence of prematurity and low birth weight of 13.2%, 16.0% and 6.1% among infants born to Black, Hispanic and White mothers respectively (March of Dimes,1997).

In South Florida particularly Dade County, during the third quarter of 1996, counted 11.3% of low birth weight and 12.9% of premature deliveries among infants born to Black mothers. Compare to 6.7% and 8.5% of low birth

weight and premature babies born to Hispanic mothers, the Black mothers proportions are high. Here, among the Black mothers' proportions, those of Haitian mothers represent about 49% of either premature deliveries or low birth weight (Florida Department of Health, 1996). These particular data obviously picture the trend toward the high risk of prevalence of anemia among populations with the lowest income. Thus, we point out that the income of Haitian women is very low vis-à-vis that of African-American women.

Most Haitian pregnant women are refugees and do not speak English. For example in 1992, "22% of the Guantanamo Bay Haitians surveyed reported that they had no schooling and 23% of them reported completion of the 6th grade. Of the 4,414 Guantanamo Bay Haitians who were asked to self-report their knowledge of English, 99% reported 'None'" (Haitian Nutritional Initiative, 1998). The situation of Haitians is similar to that of Central and South Americans. As pointed out, these factors made educational efforts really very difficult, and lead these refugees unable to start a new life and develop a healthy lifestyle (Haitian Nutritional Initiative, 1998). In this case, Family Health Center, Broward, dealing with these refugees, currently receives at least 5.0% of anemic children under 5 years of age and consults pregnant women and breastfeeding mothers with some of the worse anemic cases.

These women or "particularly recent immigrants [coming in US without anything and being] in a very difficult situation both economically and emotionally, work hard during pregnancy, and do not get rest" (Haitian Nutritional Initiative, 1998). Therefore, they have no time or enough time to take care of themselves and their kids. In function of this, if we go back to 1990, we can particularly find among 39.6% of African-American children under six years of age [in Broward and Dade] who were living below the poverty level, the Haitian children might be represented a significant percentage (Florida Kids Count, 1993). Here, all of these factors enhance a sociocultural approach of the target population, such as pregnant women, infants, and children.

5.5 Sociocultural Environment and the Prevalence of Anemia

Here, sociocultural environment expresses any factors other than socioeconomic status which can contribute to the emergence of malnutrition disease. In this, we point out for example sociocultural malnutrition that is "due to factors other than the lack of availability of food materials" (Dettwyler, 1992: p.18). Since the United States is a developed country where individual poverty and food access are more associated with one's level of adaptation than underemployment and 'availability of food materials,' sociocultural factors obviously become an 'accurate predictor' of the prevalence of anemia. So, among many sociocultural factors, we emphasize three important ones such as under education, female headed-family and refugees' environment.

In fact, in a recent study conducted in Miami Dade, the results indicate that "children of mothers with low education and children of mothers with normal education were 11.94 and 8.32 times as likely, respectively, to be classified as mildly or moderately retarded as children of mother with high education" (Hurtado, Claussen & Scott, 1999: p. 117). In this, the results primarily showed a significant relationship between children with a low hemoglobin concentrations and mothers with low education and lack of experience; whereas an educated mother gets control over her pregnancy, focuses on gaining weight, and is aware of taking iron and folic acid supplements in order to avoid premature delivery, low birth weight baby, birth defects and further child cognitive and physical delays.

At last, we reveal two cases concerning either uneducated or ignorant mothers. First, in Broward, we know about a mother under 20 who already has three kids. Now she is pregnant although the doctor's advice claims, "Don't try a fourth pregnancy" or she will be anemic. Then, according to the nurse, "she said that she is pregnant in order to get a car offered by her boyfriend." Second, in Dade, in a conversation, a mother in her 20s who proudly tells us that during her 9 months of pregnancy, she did not go to the clinic. She went to the hospital directly when she got pain delivery. For both cases, maternal attitude is quite related to education rather than financial situation (Dettwyler, 1992).

In both cases, we notice that the cultural environment doesn't provide any necessary advice to these mothers. However, "in any society people are bound to depend on others…for most of what they know about [health and] illness" (Mascie-Taylor, 1993: p. 95). Here everything is left to the individual's self-control while all family

members, friends, and neighbors' supports and advice were supposed to be more influential than whatever the public preventive program or assistance is. That explains why, although migrants, for example, are WIC program and welfare participants, their lifestyle choices remain greatly limited since many have been separated from the extended families and communities they were raised. Housing, employment and supportive families or friends may be very limited to them in the US (Haitian Nutritional Initiative, 1998).

In view of the above, it is to reveal that a Haitian mother accounted that in July 1999 her son, 3, was anemic according to a WIC program evaluation test. This test is required every six months. She was stressed about her son's healthy condition and faced the "cultural bereavement" (Helman, 1998: p.309). She said, here, the babysitter did not feed her son properly since almost every time she noticed that the boy returned home with his lunch. A similar situation was found in Costa Rica. There, a woman "explained that her son developed anemia because she was not taking care of him during the day; he was with a babysitter" (Jefferds, 2002).

6. Discussion

If the prevalence of anemia taken alone is not considered as a major public health problem, on the contrary, that of premature deliveries, low birth weights and birth defects resulting from anemia or the absence of prenatal care does and remains the main emphasis of the whole country. That explains why since 1973, the WIC (Women, Infants and Children) program has continuously focuses on pregnant women, infants and children being the ideal groups to maintain the population growth.

Here we obviously point out that in the State of Florida, the HRS-WIC Program involves in prenatal health care, post prenatal health care, and child welfare in order to raise the level of living among the target population effectively consisting of "low and moderate income pregnant, breastfeeding, and postpartum women; infants and children up to age 5" (FFY, 1996). So, to be eligible for this program, pregnant women and infants must be classified below 185% of the poverty income guidelines established by the federal government. In addition, we indicate that the purposes of the program are to control malnutrition disease associated with iron deficiency anemia and vitamin B12 or folic acid anemia within its target population.

In this respect, the "program [including Medicaid] provides a combination, of supplemental nutritious foods, nutrition education, breastfeeding promotion and support, and referrals for health care" (FFY, 1996). For example, in 1995, 53.4% of total potential eligible population has been served. Particularly, "WIC has proven to be effective in preventing and improving nutrition-related health problems within its target population" (FFY, 1996). In terms of this, the WIC program generally joins the March of Dimes and CDC in their recommendations to prevent and control iron and folic acid deficiencies.

In fact, all of them "recommend universal iron supplementation to meet the iron requirements of pregnancy … [since] absorption of iron increases during pregnancy" (CDC, 1998: p.2-3). In addition, they recommend that childbearing women or women who could become pregnant consume 400 micrograms of folic acid daily of the synthetic form despite the fact that the body can absorb almost 100.0% of the synthetic form of folic acid (March of Dimes, 1999). But in repeat pregnancy, women should increase their intake of synthetic folic acid between 600 to 1000 micrograms according to their doctor's advice. Here, we mention that Natural Folic Acid 400mcg (Rugby Laboratories), Ferrous Fumerate, Ferrous Sulfate are currently prescribed in Broward.

Thus, at last the preventive program was called to reduce the incidence of low birth weight babies, birth defects and infant mortality. In fact, in Broward, the percentage of low birth weight, very low birth weight (<1500g) (Hurtado, Claussen & Scott, 1999) preterm deliveries and infant mortality decreased 20.8%, 24.4%, 8.4% and 36% respectively between 1991 and 1995 (Hurtado, Claussen & Scott, 1999; Lawton and Rhea Chiles Center, 1991).

In addition, HRS-WIC program in order to improve diets, decrease anemia and improve growth and development among infants and children, extends children's eligible age to at least 6 or to 7 or 12 (FFY, 1996). According to this, foods rich in protein, iron, calcium, and vitamins A and C are recommended. That explains why WIC checks are valid to buy milk, cheese, eggs, cereals high in iron, peanut butter or dried beans or peas, fruit vegetable juices,

iron-fortified infant formula, etc. Most of these foods are served for free in school breakfast and lunch for children over 6-year-old whose parents income is low.

7. Conclusion

In summary, iron deficiency is considered as one of the most widespread deficiencies today. "The most well-known effect of iron deficiency is anemia, a low concentration of blood hemoglobin" (Goodman, Dufour & Pelto, 2000: p.223). Currently, it is characterized by inadequate nutrition, inadequate iron supplements during pregnancy, and blood loss. In South Florida, this pattern of anemia is manifested among women, infants and children despite the fact that women are undereducated 'about the dietary needs for themselves and their families.' Consequently, that entails an unexpected percentage of premature deliveries, low birth weight, birth defects and infant mortality. Most of the cases are recorded among Caribbean, Central and South American refugees.

Besides Iron-deficiency, there is the prevalence of B12 vitamin and folic acid deficiency anemia. This new pattern is also responsible for 'affected pregnancies end in miscarriage or stillbirth and for birth defects such as spina bifida and Anencephaly (NTDs).' Spina bifida is a leading cause of childhood paralysis, whereas Anencephaly is associated with a severely underdeveloped brain and skull of the baby (March of Dimes, 1999). To prevent all of these incidences in South Florida, Health and Rehabilitation Services (HRS), WIC, Healthy Start Coalition, and so forth, elaborate important programs in order to provide necessary needs to the target population.

In this perspective, we previously pointed out that in 1995 local agencies (Broward and Dade) reached approximately 53.4% of potentially eligible population (FFY, 1996). Finally, we highlight according to Broward District Health Plan (1998) that Health-Care Providers or Agencies in Broward, for example, intended to improve the percentage of healthy people since the year 2000 by increasing live births up to 7 per 1,000 (it was 10.1 per 1,000 in 1997), prenatal care to 90% start in first trimester (it was 84.1% in 1996) and reducing to 5.0% the low birth weight, and 1.0% the very low birth weight compared to 8.2%, and 1.7% in 1997 respectively.

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Socio-cultural Conceptions and HIV-related TB among Haitian Immigrants in Broward County, Florida: A Brief Historical Insight, 1995-2002

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Abstract

This study deals with tuberculosis (TB), human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) in Broward County, South Florida. Theoretically, it demonstrates the existing co-infection between TB and HIV that provokes HIV-related TB or AIDS. Additionally, it indicates that AIDS is provoked by HIV co-infection with all opportunistic infections. Nine (9) qualitative interviews and one focus group conducted with 12 Haitian patients and TB control program workers at Fort Lauderdale Health Care Center allowed to understand the connection between TB and HIV, and the patients' socio-cultural conceptions about HIV-related TB. Then, the study reveals that the prevalence of TB and HIV-related TB has every year a dramatic increase among foreign-born individuals including Haitian residents. To determine this prevalence, the Broward County Health Department charts of 778 reported TB and HIV co-infection cases for the last 6 years were analyzed along with the qualitative interviews. Finally, the study shows that the indicated prevalence is due to both Haitian immigrants' socio-cultural conceptions and reactions vis-à-vis the TB screening, prevention measures, and treatment.

Keywords: TB, HIV-related TB, AIDS, Transmission, Socio-cultural Conceptions, DOT, MDR

1. Introduction

Today, it is almost impossible to diagnose a tuberculosis (TB) patient unless human immunodeficiency (HIV) infection is taken into account. In the United States, tuberculosis is considered as the most opportunistic infection to HIV. However, before the 1930's, tuberculosis taken alone was so rampant in the United States that it was the leading cause of death. At that time, very little was known about how the disease was spread and how best to treat it. People infected with TB were isolated from their families in Sanatoriums which represented the main thrust of the nation's fight against this disease (U.S. Department of Health, Education, and Welfare [DHEW], 1974).

Between 1940's and 1970's, DHEW (1974) reported that through many efforts of researchers, physicians, and public health officials, tuberculosis had been brought under control. Improvements in living conditions and the introduction of effective drug therapy have led to a dramatic and steady decline in tuberculosis deaths for this period. This improvement created the reason for closing the doors of many tuberculosis sanatoriums. And at the end of its report, DHEW had yet announced the swan song of tuberculosis in these terms: "Not so many years ago, tuberculosis was considered a fatal disease. Today *[by 1974]*, there is hope for a long and productive life for the individual patient." Then, continued DHEW: "As a result of rapid research advances, there is also hope that tuberculosis can be one day virtually eradicated in the United States, and eventually, in the world."

During the 1980's, however, there was a recurrence of TB in the United States, with the apparition of the HIV/AIDS infection. Thus, in 1986, after 3 decades of steadily-decreasing tuberculosis morbidity, annual tuberculosis morbidity in the US increased. The increase occurred mainly in geographic areas and demographic groups with large numbers of AIDS cases, which suggested that the HIV epidemic had begun to influence tuberculosis morbidity (CDC, 1991).

Human Immunodeficiency Virus (HIV), that provokes acquired immunodeficiency syndrome (AIDS), infects more than 40,000 people of all ages in United States every year. From 1981 through 2000, more than 688,000 Americans were diagnosed with AIDS. According to the Center for Disease Control (CDC, 1994a), between 1985 and 1993, the number of new TB cases which increased by 14% – from 22,000 to 25,313 – first resulted from HIV infection. The states of New York, California, Florida, and Texas which perceived the highest rate of HIV/AIDS, counted more people infected with TB within the country. In fact, data (US Census Bureau, 2000) show that in 1998, while 8,714 AIDS cases were reported for New York, 5,654 for California, 5,448 for Florida, and 3,967 for Texas, respectively 2,000, 3,852, 1,302 and 1,820 tuberculosis cases were diagnosed in those states. In California alone, between 1988 and 1994, TB cases have increased about 51%.

This research, on a restrictive view, focuses on foreign-born individuals including Haitians particularly in Broward County, South Florida. Most of them are refugees or asylum seekers who have less than five years in the county. They span the Florida's borders without undergoing a health assessment overseas. They are not considered as those who were born or came legally to the United States since they have no medical records either here or in the American Embassy in Port-au-Prince, Haiti. Just here in Florida they eventually recognize they have the disease when their health condition worsens or they get tested for the infectious diseases to complete their file with immigration (INS) for permanent residence. Their names are counted every year among new reported TB cases or HIV-related TB cases for the county. Statistical data show that a high HIV-related TB prevalence rate in this population. Data for 1999, for example, reported that 56% of TB cases were among foreign-born individuals including 73% of Haitians.

Accordingly, we were asking a couple of questions like Why is the prevalence of HIV-related TB high among foreign-born Haitians in Broward County, South Florida? What is the role played by the Haitian socio-cultural conceptions in the spread of tuberculosis in Broward County, South Florida?

This research attempted to show the role play the Haitian socio-cultural conceptions in the TB transmission or spread and in the treatment regimens among Haitian immigrants in Broward County. Prior to focusing on a review of literature and our research findings, a background of TB, HIV, and AIDS, and how TB and HIV/AIDS are related to each other, is provided below.

2. Background of the diseases

From 1981 to 2001, after 20 years of HIV/AIDS appearance (CDC, 2001; Keiser Family Foundation, 2001), it seems that lots of people were unable to make a difference between HIV and AIDS. Then, in 2002 four students in a PC Computer Lab at one of the universities of South Florida asked us to differentiate HIV and AIDS while we were working on the present research. That is the reason why prior to presenting a relative review of literature,

a background of those diseases including TB is first given and also provides a part of the theoretical framework to this study.

Theoretically, this section explains TB, HIV, and AIDS. The background of each one is presented separately. At the end of the section, the connection between TB and HIV will be shown since the research thoroughly relies on HIV-related TB.

2.1 Tuberculosis (TB)

As Helman (1998) points out, tuberculosis (TB) is the most serious of the more chronic respiratory diseases. "Every year, an estimated 8 million cases of TB occur world-wide, as well as about 3 million deaths from the disease" (Helman, 1998: 367). Tuberculosis is caused by a germ called *Mycobacterium tuberculosis*. As the etiologic agent, reveals the CDC (1991: 41), *Mycobacterium tuberculosis* is carried through the air in infectious droplet nuclei (small airborne particles less than 5 microns in size) which are produced when persons with tuberculosis of the lung or larynx sneeze, cough, speak, or sing.

Tuberculosis has two different manifestations. In a TB guide for adults and adolescents with HIV, CDC (1991) indicates that "TB most often affects the lungs, but TB germs can infect any part of the body. TB may be latent or active TB." Since latent means in medical terminology, a disease that does not present visible symptoms, therefore, latent TB germs are seen as remaining in the person's body but are not causing illness. In other words, a person with latent TB has no symptoms and cannot transmit TB to others.

Generally, TB is spread from one person to another through the air. When persons repeatedly breathe air contaminated by an infectious patient, they may become infected with the tubercle bacillus or with tiny, moist drops that contain TB germs that are sent through the air. Normally, persons at highest risk of acquiring infection with tubercle bacilli are close contacts – those living in the same household with the infected person, or close friends and co-workers who daily breathe the potentially infectious air from a person with undiagnosed or untreated pulmonary tuberculosis (CDC, 1991).

The tubercle bacillus, the organism that causes TB disease, can be traced as far as 5000 BC, when archeologists found evidence in human bones of the existence of TB. Evidence was found in ancient Egyptian mummies which show deformities consistent with TB disease. Paleontologists have concluded that the disease must have been prevalent in that part of the civilized World (CDC, 2000). Between 4000 and 350 BC, other evidence showed that TB existed in China, India, and Greece. Later, during the medieval years, the TB epidemic was called the « Great White Plague » in Europe.

In 1882, the same year, TB was killing one in seven people in Europe and America Robert Koch, a German biologist, discovered the organism that caused TB. "The organism was called tubercle bacillus because rounded bodies (tubercles) occurred in the diseased tissue and were characteristic of the disease" (CDC, 2000: 82). Dr. Koch tried but failed to find a treatment to TB. Calmette, a French bacteriologist with the help of Guerin, used specific culture media to lower the virulence of the bovine TB bacterium, thus creating the basis for the BCG vaccine in widespread use today.

In the United States, with the use of the BCG vaccine and the anti-TB antibiotic, *streptomycin*, and with the opening of at least 700 sanatoriums by 1938, an intense TB control program took place, resulting in a decrease in the TB death rate from 188 per 100,000 in 1904 to 9.3 per 100,000 in 1984. However, as stated earlier, beginning 1985, because of the connection between TB and HIV, 'the number of TB cases began increasing and continued to rise through 1992.' But, in the developing countries, where 'malnutrition exacerbates the course of the disease,' the increase of TB cases was steeper. Today, there are some efficient drugs such as rifampin, ethambutol, isoniazid, capreomycin, ofloxacin, and pyrazinamide that can help fighting the disease. According to the treatment regimens, these drugs should be administrated as directly observed therapy (DOT).

2.2 Human Immunodeficiency Virus (HIV)

Called *le mal du siècle* which is interpreted as "the sickness of the century" in Farmer's book (1992:101): *AIDS and Accusation*, HIV remains an enigma thus far. Accordingly, Fleming et al. (2000) pointed out that despite steady advances in prevention science and medical treatment to improve survival among infected persons, HIV remains a major public health threat in United States. Since 1981, more than 800,000 Americans have had HIV and more than 40,000 new cases are reported every year ((Keiser Family Foundation, 2001). A special report published in South Florida Sun-Sentinel (2001), with up-to-date data indicated that 850,000 people in United States (Population: 276,090,000), including 47,305 in Florida (Population: 15,982,378), are currently infected with HIV.

Human Immunodeficiency Virus (HIV), once entered one's body through blood, semen or vaginal secretions, 'weakens and depletes the immune system,' the white blood cells that fight germs. One reference shows that the virus 'attaches itself to and destroys white blood cells (CD4 lymphocytes, also known as helper T-cells), an essential component of the immune system.'

Meanwhile, another reference adds that after the virus attaches to the CD4 cell, it 'injects its genetic material (RNA). The RNA then instructs the CD4 cell to produce more of the virus. These viruses (virions) are then released into the bloodstream and the CD4 is destroyed. Over time, the virus may destroy CD4 (cells) faster than your body can replace them, leading to a gradual decline in the number of CD4 cells.' At this point, a positive result in an HIV test can currently reveal that your CD4 count is below 200 cells per cubic millimeter (mm^3), or your immune system is damaged. And 'your body becomes increasingly susceptible to an array of other infections' termed as 'opportunistic infections.'

2.3 Acquired Immunodeficiency Syndrome (AIDS)

A constant effort is being made in order to distinguish HIV the virus, AIDS the disease, and statistical data related to each one. The HIV virus itself is not a disease and cannot kill a person. Its limit has been previously described. However, when your defenses are down or your immune system is destroyed by HIV, opportunistic infections can assail your body and create the condition AIDS. In other words, AIDS is a co-infection of HIV, and makes victims susceptible to any opportunistic infection like *pneumoncystis carinii* pneumonia (PCP) or *Toxoplasma* encephalitis, Kaposi's sarcoma, Herpes simplex ulcers, Tuberculosis, etc.

AIDS is the final process to HIV. Human Immunodeficiency Virus (HIV) can take less than 5 years or as long as 15 years before it progresses to AIDS. At that time, AIDS was considered as incurable and has killed more than 400,000 of the 688,000 Americans who have been affected since 1981 (CDC, 2001). "There is good news, however, in the form of protease inhibitors, a new class of drugs [like AZT, zidovudine (100mg), lamivudine (150mg), and indinavir (400mg) that make up the "cocktail," the complex regimen of anti-retroviral drugs] that helps keep HIV in check. Protease inhibitors helped cut the number of US AIDS deaths by almost half from 1996 to 1997. As a result, AIDS dropped from the eighth leading cause of death in the United States to 14th. Beforehand, one could only avoid the HIV/AIDS virus, by protecting oneself during sex by using a latex condom during intercourse, and not sharing with others needles for tattoos, piercing, or injecting (heroin, cocaine, etc.) steroids or vitamins.

2.4 The Connection Between TB and HIV

After presenting TB and HIV separately, it is plausible to understand how TB and HIV are related to each other. First, consider HIV as the virus that destroys the immune system and the CD4 cells. Then, when the normal CD4 count, which is 400-1200/mm^3 falls between 200 and 400/mm^3, one can develop tuberculosis (Infectious Disease Consultants of South Broward, 2000). In a fact sheet, the Broward County Health Department (Infectious Disease Consultants of South Broward, 2000) indicates that HIV infection increases one's risk for tuberculosis by as much as 800 percent.

According to the CDC (1991), all patients with HIV infection and undiagnosed pulmonary disease should be suspected of having tuberculosis, and appropriate precautions to prevent airborne transmission should be taken until tuberculosis is diagnosed and treated or ruled out. HIV-infected patients present extra-pulmonary tuberculosis cases. As a result, an HIV-infected patient having tuberculosis has AIDS.

Currently, about 35% of TB cases are provoked by HIV/AIDS. Treating these HIV-related TB cases are among the most complicated. As a function of this, to stop the increased risk for TB among persons with HIV infection, the CDC, in 1990, issued *Guidelines for Preventing the Transmissions of Tuberculosis in Health-Care Settings with Special Focus on HIV-related TB issues* (CDC, 1994b). Generally, HIV-infected patients are taking medications to prevent the risk of developing TB.

3. Literature Review

The following review of literature highlights 1. the relationship between TB and HIV or HIV-infected patients with tuberculosis; 2. these include the patients' socio-cultural conceptions vis-à-vis these diseases and; 3. geographical and international prevalence of tuberculosis due to the HIV epidemic and migration.

Studies for some African countries demonstrated that since 1985, tuberculosis rates increased 10% to 15% per year with most of the increase being associated with HIV infection. In Abidjan, Côte d'Ivoire, for instance, 40% of all tuberculosis cases were associated with HIV (De Cock, 1996). Another study conducted for Ghana revealed, through a physical examination of 20 patients (n=20), 11 of them female, that HIV-infected patients were likely to develop tuberculosis. Further, it showed that patients with both smear-positive pulmonary tuberculosis and HIV had a *prolonged duration of cough* (Lawn et al., 1999) compared with patients who have TB only.

By the same token, Lawn et al.'s study showed that anti-tuberculosis treatment with thalidomide and pentoxifylline, which are both inhibitors of tumor necrosis factor-α (TNT-α) which plays an important role in the upregulation of HIV replication by *M. tuberculosis*, have not shown an appreciable impact on HIV load in African patients with tuberculosis.

A larger study of 22,620 cases based only on the workforce in Kinshasa, Zaire (now Democratic Republic of Congo), confirms that tuberculosis was five to seven times higher in HIV-1-infected patients compared with uninfected patients. In this study, Ryder et al. (2000) attempted to examine the connection between TB, fertility and HIV-1 infection. They hypothesized that the effect of HIV-1 infection on tuberculosis and fertility has a serious negative impact on a large workforce in Kinshasa. To test their assumptions, they conducted a 2-year prospective longitudinal cohort study, two large Kinshasa businesses, a textile factory and a commercial bank considered as Business A and Business B respectively.

The research concluded that the baseline HIV-1 seroprevalence varies according to the three job category levels such as manual, semi-skilled, and management. Among male employees, the low HIV seroprevalence rate tends to be associated with manual workers, middle rate to semi-skilled workers, and the high rate with managers, whereas among female employees, the high seroprevalence rate is associated with manual woman workers, middle rate to semi-skilled woman workers and the low rate with manager women. This implies a variation in the gender. The research also concluded partially that 15,277 seropositive cases of 'HIV-1 infection were more likely to develop *Mycobacterium tuberculosis* infection when compared with persistently HIV-1 seronegative individuals.'

Human Immunodeficiency Virus (HIV) infection and its impact on TB were also studied by Farmer (1992). In his study, Farmer attempted to describe HIV-infected TB patient, social and socio-cultural aspects in Haiti. With respect to this issue, three HIV-related TB patients from Do Kay, a village in Central Plateau, Haiti, were randomly selected to participate in the study.

The first case is a patient named Manno Surpris. According to the Haitian national laboratory, Manno did indeed have antibodies to HIV. Further, a TB test or an X-ray revealed he had tuberculosis too. Since he had tuberculosis, he responded very well to an antituberculous regimen (Farmer, 1992: 66). HIV/AIDS and TB are atrocious

diseases when existing together. Manno, however, was most afraid of tuberculosis. He said before he knew the characteristics of his illness: "Most of all, I hope it's not tuberculosis. But I'm afraid that's what it is. I'm coughing, I've lost weight…I'm afraid I have tuberculosis, and that I'll never get better, never be able to work again…. People don't want to be near you if you have tuberculosis."

In this case, Farmer looked at HIV-related TB provoked by witchcraft. The study indicated that the patient "believes that he is the victim of someone's ill-will" because he was a teacher and a pigsty manager, and one day beat one of his schoolboys for some transgression in the pigsty. In revenge, he thought that the schoolboy's relatives sent a TB death on him and he got TB or an AIDS death and he got AIDS.

At the same time that Manno had fallen ill with tuberculosis, a very hushed rumor was circulating around Do Kay, Farmer (1992) recounted. 'Manno was the victim of some sort of evil. His illness was the intentional result of some anger of a jealous rival. I heard this from an eighteen-year-old former student of Manno's. He would not say who had passed this gossip on to him, and attempted to dismiss it. 'I don't believe it myself,' said the student, 'but that's what some people say'. He also stated that he did not know who would wish to harm the teacher. When asked how he thought such an illness could have been inflicted on Manno, the youth was rather vague: "I don't know…some people can do it by themselves, some go to a *bokor*," (Farmer, 1992: 64) a sorcerer. In this situation, Manno, who in fact believed that someone sent him the illness, tried to be treated by a *houngan* (traditional healer) in a neighboring village to Do Kay.

Similar conclusions were derived in the two other cases presented in Farmer's book. For example, Anita Joseph was also an HIV-related TB patient. She "was promptly diagnosed as having tuberculosis, and she responded rapidly to antituberculous therapy." The cause given for her tuberculosis is because she was exposed to a lot of heat and a lot of cold while she was working as a maid. Whereas, the cause of her AIDS referred to sexual contact she had with a person having the syndrome. Anita contracted *SIDA* (French acronym equivalent to AIDS) because 'she lost her mother, run away at fourteen, and been forced into a sexual union by poverty.' Contrarily to this version, people in Do Kay believed that Anita did not have *SIDA*: she was "too innocent." Farmer (1992: 87) tried to explain the term "too innocent" as follows:

> The logic behind the statement [too innocent] was radically different from that underpinning similar statements made in North America. "Innocence" had nothing to do with such things as sexual practices (some villagers believe that Anita had led a "free life"), but rather underlined the fact that, very often, a string of bad luck signifies that one is the victim of *maji* [magical things]. But sorcery is never random; it is sent by enemies (p. 87).

To give a complete detail about this issue, continued Farmer (1992) in these terms:

> Most people make enemies by inspiring jealousy or their own malevolent magic. Destitute and dogged by bad luck, Anita had never inspired the envy of anyone. Two persons who had previously explained to me the nature of the Manno's illness queried rhetorically, "Who would send a SIDA death on this poor, unfortunate child?" It was this sense that Anita was qualified "innocent" (p. 87).

In this case, the study showed that a person who has a *sent disease* or supernatural one tends to see a *houngan* or a traditional healer to find treatment to. Anita stopped using her TB medications for a couple of weeks and her relatives brought her to a *houngan* for traditional treatment as they did for Vincent, Anita's lover who died from TB and HIV/AIDS five years before. Here, it is to consider that medical pluralism and cultural factors influence patients' medical choices, curing strategies, and their decisions to adhere to treatment regimens (Menegoni:1996) which refer to Western medical treatment.

Further, in the last of the three chapters concerning HIV/AIDS, tuberculosis and sorcery in the book, Farmer (1992: 95-109) came with the case of Dieudonné Gracia. Dieudonné was a victim with the same condition as those of Manno and Anita. The examination of Dieudonné's sputum revealed the bacillus that causes tuberculosis. People thought that "a person who had died of *SIDA*, they raised a *mò SIDA* (AIDS death) from the cemetery, and sent it on Dieudonné," and Dieudonné got *SIDA* or AIDS. Since he had *SIDA*, according to popular beliefs, he could

have TB because a sent *SIDA* "leaves you weak and susceptible to TB." *SIDA* is TB's older brother (Farmer, 1992: 107).

In one abstract reviewed, Glynn (1998) was interested in the resurgence of tuberculosis in many countries. The study concluded that "in some areas [or countries] the major influences on tuberculosis trends are the traditional ones: poverty, failures in the treatment system, and immigration system." In South Florida, United States, for example, this is at the root of those three traditional ones that 49% of 629 TB cases were diagnosed for 1995 in the three counties, Broward (34%), Dade (58%) and Palm Beach (40%). All of those cases were among refugees or people born outside the United States. Data showed that 26 percent of those people had HIV-related TB (Granich et al., 1998).

In other areas or countries, "increasingly, the HIV epidemic has a huge impact. HIV infection increases the risk of tuberculosis approximately 7-fold, though this may vary with the stage of the HIV epidemic, the prevalence of tuberculosis, and the groups considered" (Glynn, 1998). Therefore, "dually-infected individuals develop tuberculous disease at a rate of 5-10% per year. HIV also increases the risk of disease following infection, which makes a major contribution to the burden in some settings" (Glynn, 1998).

The literature's review of the present report tries to provide empirical support for the connection between TB and HIV in Broward County. In turn, the report will try to provide evidence to support the idea that an HIV-infected patient is more likely to develop TB or to provide evidence about patients living with HIV/ AIDS and tuberculosis. Also, it will try to provide empirical support to the increase of HIV-related TB rate due to immigrants' socio-cultural conceptions in Broward County.

4. Methodological data

As stated previously, the main research objective is to study the connection between TB and HIV, and its socio-cultural aspects in Broward County in Broward County, South Florida. In order to collect qualitative data that were appropriate to the research, we have paid a lot attention to the participant selection, which consisted of HIV-related TB patients who were observed and interviewed according to their illness perceptions. Since this research focuses on foreign-born Haitians in Broward County, we have selected our participants of HIV-related TB patients among this population, to attempt to explain the Haitian socio-cultural conceptions and TB transmission or spread and treatment regimens among the Haitian immigrants in Broward County. The primary focus of the current research is not to make inferences about some larger population like foreign-born Haitians from a few research participants encompassing HIV-related TB patients (see Berg, 2000 about sampling strategies), but to in fact explore at least with them "the ethno-medical knowledge and practices related to TB conceptualization and management" (Vecchiato,1997).

After looking at the TB prevalence in the foreign-born Haitian community in order to reveal the extent of TB infection in the population, we attempted to constitute our participant list from TB patients and HIV-related TB patients who frequented and were observed in the TB Clinic at Fort Lauderdale Health Center on State Road 84. In doing the selection job, we resorted to the triangulation process since this job has been done with the help of the social worker and/or supervisors because it was quite difficult for us alone either to pick some participants for this research or have their consent.

Most of patients contacted for interviews did not want to firmly participate because they did not intent to expose themselves or according to the stigma that TB carries in both Haiti and USA. For privacy purpose and subtlety, we revealed that we are a young professional (student) and doing independent study. Also, we reveal we will keep their name anonymous and all data confidential according to the informed consent form. The supervisor limited the number of participants to seven TB patients including three HIV-related TB patients without taking into account the criteria of gender, age, and religious beliefs.

 The sample in this context, refers to a *convenience sample* since it "relies on available subjects [or patients] – those who are close at hand or easily accessible" (Berg, 2000: 32). The *convenience sample* is one of four types

of nonprobability sampling which tends to be the norm in qualitative research including ethnography for example. But, in constituting the sample, we attempted to make confirm whether the converse testing advice was followed— all patients who had TB were tested for HIV, and if they had HIV, on the other hand, they were tested for TB too. It is a very important idea, since the research also focuses on the HIV-related TB patients.

4.1 Research Setting

This research takes place in Broward County Public Health Unit (2421 SW 6th AVE, Ft. Lauderdale, FL. 33315). Fieldwork or observation, some interviews and research contacts were maintained there. Broward County Public Health Unit is the main public health clinic for the Broward County. Geographically, it is located in the Middle of Fort Lauderdale, compared with the Pompano Beach Clinic in North Broward and Hollywood Clinic in South Broward. About 1200 TB and HIV-related TB patients visit, every month, all of these medical places.

Broward County Public Health Unit is called currently *Eighty-Four Health Center* because its North Side of the Building the State Road 84, an important traffic way. Although it is called *Eighty-Four Health Center*, the entrances to the parking lot and the front (main entrance) of the Health Center building are not on State Road 84, and the address of the Center either. Both the entrances to the parking and the Health Center address are on a small street like SW 6th Ave, at the East Side. This street is perpendicular to State Road 84 (an east-west traffic road).

Haitian People tell you *they are going to Eighty-Four* (rarely they add the word *Clinic* to *Eighty-Four)*. The East Side of the Building is longer because it is the front of the building. The East Side of the building is longer than the North Side, but the North Side that faces a main or busy road like *State Road 84* (and a cemetery across the road) tends to be the main side and seems to be more attractive.

For this research, the North side is emphasized because the TB Clinic is located in the west wing of that side. Generally, there are two wings, the east one and the west one to be differentiated from East Side and West Side of the building. Both wings are a kind of architectural shape that stands out. Inside the east wing, there is a staircase that links all of the three floors of the building, whereas inside the west wing, there is the TB Clinic.

There are different clinics in the same building. Among all of those clinics, only the TB clinic that has a side door where TB patients can enter into the TB Clinic without penetrating the rest of the building or without having contact with other types of patients. Because TB is a contagious disease, the TB Clinic is designed in order to keep the TB patients away from other patients or people who come to the Health Center for Adult Health Services, Women Health Services, WIC (Women, Infants and Children) Services, drug store, laboratory tests, immunizations, and to request birth or death certificates.

Behind the TB Clinic entrance door, there is a blue and white sign which is hung in the room with a metallic chain attached to the ceiling. The sign indicates: "Please cover your mouth when coughing." An additional poster indicates: "Do not speak of your medical condition in an effort to ensure your privacy unless asked by a Health Department representative."

Everyone has to wait in the waiting that is the largest one. The waiting room faces all additional rooms which are located in the TB Clinic. TB workers as well as patients cannot switch from one room to another without crossing the waiting room. The waiting room is decorated and equipped with pots of flower, art paintings, posters, a TV, one garbage can, a fire alarm, two flyer carriers or shelves, a little table, fourteen chairs, two vision test accessories, etc. On the walls, two big posters are exposed. The first poster pictures a young light skin woman who has HIV. This poster is about starting a combination of HIV medicines. *Combivir* is the name of the tablets issued from this combination (lamivudine 150mg/zidovudine 300mg tablets). The second poster displays only the word HIV written in black ink on a green paper. The letter "I" in the middle of the word HIV takes the form of an African traditional drum. The additional message, *An Nou Frennen SIDA* ("Help to Stop the Spread of HIV") on that poster is in both Créole and English.

Free flyers and brochures are laying down on the small table for review. They are about Refugees Services; Florida Kid Care; What you should know about living with HIV, TB and HIV: Know the risks; Tuberculosis facts: TB can be cured; and Rights and obligations as a consumer of Broward County Health Services. There is a three leg flyer carrier; it is attached to the wall next to the glass of the glass window shaping the Information Office. Twelve different flyers are placed on this carrier. They are about prevention, screening programs, and other medical programs posted by different health care providers. One flyer indicates the TB Clinic Schedule. The Clinic is opened Monday (12PM-7PM), Tuesday and Friday [(8AM-4PM) and except third Friday at 1PM-4PM], and Wednesday (8AM-3PM).

After the waiting room, come the first room which is the Information Office. Three of the four sides of the Information Office room have glass windows. Two windows face the waiting room and the last one faces the North side and dominates the parking lot and the *State Road 84*. Next doors to the Information Office located are the doors of the interview rooms. There are five rooms including the doctor interview room, two nurse interview rooms or clinical service rooms, and a medical records or storage room.

On the door of the doctor's interview room, two posters indicate two things: 1. *No one should have to suffer from Tuberculosis* and; 2. *Refugee Health Assessments are free.* Inside the room, there is a sink area where a TB medicine guide, a mug, and a latex glove box are available. Other medical instruments or stuffs are placed there. Books and flyers are placed on a small shelf. A patient examination bed, a weight scale, and a wheelchair are located by a glass window, which faces the North parking lot and State Road 84. On the walls which constitute the west and south sides of the room, an otoscope, an X-ray reading machine, two medical demonstration posters about shots, the *Mantoux tuberculin skin test*, medications used in HIV management, AIDS, and TB are hung. Finally, on the doctor's desk, a sphygmomanometer, tong depressor, a biohazard infections waste can, a stethoscope, and a blood pressure meter are left.

Next to the doctor's interview room, there are the other interview rooms or clinical service rooms which are less equipped in medical materials than the doctor's interview room. However, they have some materials such as cabinet files, oxygen cylinder, a poster about how TB medicines work, a fifteen-minute-air-vacuum, and refrigerators that are not included in the doctor's room. Only nurses operate in those rooms, and take care of either positive or negative TB patients. The nurses have also access to the medical records and storage room which has a large record file, a refrigerator, a sink area, biohazard infections waste cans, and stocks of water, juice, and packs of boost or nutritional energy drink.

In the south corner of the TB waiting room, there is a back door. This door is always close and limits access from the TB Clinic to the rest of the building or the other clinics located in the building. A warning sign is written on the door: "Please keep the door closed and locked at all times."

TB Workers: One doctor, three or four nurses, and one clerk work in the TB clinic. The TB Clinic is led by a charge nurse (an African-American woman in her late 30's or early 40's). As a team leader, she makes sure that patients are seen. She is also interested in following-up with patients. She is assisted by three other nurses. Two of these nurses work full time. And the third one, a Spanish/English Speaker, is on and off. The doctor is in the Clinic every Tuesday. The other days, she is seeing patients in other Broward County clinics. She is the only TB doctor for all Broward Public Health units.

There is the TB program or TB Control Program whose the Office is located on the second floor of the Building. Employees in this office deal with the bureaucratic tasks and the application of the TB program for all Broward County. Among them, there are the TB area surveillance manager, a nurse case manager, social workers, field supervisors, statisticians or area TB surveillance coordinators, and other TB specialists. The General Administrative Office for Public Health in Broward County is in charge of them all and is located in a separate Building.

Patients: The TB Clinic receives about 500 TB patients including new and old patients every month. This number represents 50 percent of the total TB patients who seek treatment in the three of Broward County public health units including Pompano and Hollywood. Since the Eighty-Four Health Center (or Fort Lauderdale Health Center)

depends on the city of Fort Lauderdale and the surrounding cities such as Wilton Manors, Oakland Park, Lauderhill, Plantation, and Davie where the Haitian community is more concentrated, it is frequented by a lot of Haitian TB and HIV-related TB patients. It is considered as the main setting of this research, and our fieldwork was conducted and completed there.

4.2 Data Collection

Interview is a major way of collecting qualitative data (Berg, 2001), and interviewing important people and HIV-related TB patients would be of interest in order to explore the Haitian ethnomedical conceptions of TB and TB transmission in Broward County. During the fieldwork from July to October 2001), conducted were nine (9) interviews whose two only in English and the rest in Haitian Creole. The first two interviews were done in Haitian Creole with an employee and a TB worker in the TB control program. The first interview was conducted with the Area TB Surveillance program coordinator who has a broad idea about the TB program, its management, and most of the TB cases. He is a respiratory therapist and worked for 20 years in the STD program, HIV/AIDS program, and the TB program as a field supervisor prior to being assigned to the statistics position. He provided the required statistical data for the research and granted an unstructured interview in his office. A tape recorder was used during this interview, since a tape-recorded interview is the most accurate way to record what people say (Spradley and McCurdy, 1988).

This interview was transcribed by using a professional transcribing machine. From the transcription, an interview guide was prepared, which allowed to hold three semi-structured taped interview with the social worker, the charge nurse and the Area TB Surveillance Manager. Then, the social worker was interviewed in Créole in the conference room located on the second floor, and the charge nurse in English in the charge nurse office of the TB clinic located on the first floor, Fort Lauderdale Health Center or Clinic 84. In both interviews, questions were asked about the TB program running, patients' perceptions of their disease, patients' attitudes to the received treatment, and recounting one or two HIV-related TB patients' illness history or ideas of disease causation.

Finally, all data from previous semi-structured interviews allowed us to eventually prepare 'structured and semi-structured interviews' (see Bernard, 1995) and conversation with the five (5) informants or patients, including two women. The informants have different religious beliefs. The characteristic of the sample was at least appropriate. It allowed us to collect diversified data about medical knowledge of the patients, since Haitian people have different religious conceptions of their illness. Sometimes, patients during the interviews were embarrassed to come up with information that tended to associate their illness causation with witchcraft.

Then, to bring patients to come up with particular information about the magico-religious perceptions of their illness, was used Menegoni's style, which presents questions on sensitive matters as witchcraft in an indirect manner: "In other communities, people believe that tuberculosis is caused by witchcraft. What do you think? (Menegoni, 1996). However, questions for the interview/focus group were a bit modified and asked in this way, "Do you know someone whose illness causation is associated with *move zè*?"[1] All the informants, for more convenience, were interviewed in Créole, to allow them to better express their ethno-medical and biomedical knowledge. A tape recorder is also used for all interviews and some conversations.

In addition, information from observations and interviews were used to formulate the focus group topics. The focus group was conducted with four TB patients or participants, including two males and two females. Three of the participants were dually infected with HIV and TB. Among all four participants (the 5th one was met in the hospital room in Broward General Hospital), only one participant was previously interviewed when patients were being interviewed individually. Then, the others were completely new in the research process, and they were met during the focus group hour. The focus group was conducted in such a fashion since it was not easy to put TB patients or former interviewees together, and it relied on available participants chosen by the social worker with *the go-ahead* from Area TB Surveillance manager. The latter one provided an empty house that belongs to him, in which the focus group discussion took place on 1513 NE 15th Ave, Fort Lauderdale. Subsequently, the

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[1] . Move = bad, and Zè = air. *Move zè* or bad air is a kind of bad luck ("airbone magical agent").

"telephone interview" (Berg, 2001) or conversation, interviews and the focus group were transcribed and partially translated in English.

To ascertain the prevalence of HIV-related TB among foreign-born individuals including Haitians, data provided by Area TB Surveillance of Broward County Health Department were used. The charts of 778 reported TB cases by HIV co-infection during the period 1995-2000 were reviewed. This methodology description points to the fact that that the Health Department or TB control programs used the 'tuberculin skin test and the extent of chemoprophylaxis' to determine the incidence of tuberculosis among individuals (Florida Health Department; Gourevitch et al., 1999). While testing people for HIV, an HIV blood test is required to detect HIV in the patients' blood. Converse testing is advised—all patients who have HIV should be tested for TB, and if they have TB, on the other hand, they should be tested for HIV.

4.3 Data Analysis

As we know it, along our fieldwork, the lack of time and other occupations did not allow us to transcribe all the interviews to translate them into English, and to decipher the data interviews on a regular basis. The transcribing job was done in three steps and the translating one was completely performed just before the final coding or analysis. Thus, the two first interviews conducted with the statistician and the social worker on July 27, 2001 were transcribed three days after. These interviews were coded and 'analyzed for content themes, recurrent ideas, and key points.' As Rubin and Rubin (1995) suggest, "you examine the data you have heard, pull out the concepts and themes that describe the world of the interviewees, and decide which areas should be examined in more detail (p. 226)." As stated earlier, with the help of this preliminary analysis, an interview guide was prepared in order to interview the TB patients and the charge nurse of the TB clinic.

After all patients were interviewed, interviews were transcribed and also analyzed in order to figure out additional themes and concepts. The second step of the analysis was completed and the focus group topics were formulated. The focus group discussion relied on 7 topics, but 4 of these topics were relatively discussed. Thereafter, the focus group discussion was transcribed. One hundred twenty-five pages of data were collected including 5 'fieldnotes that were transformed into observation data' (see also Emerson, 2001: 131-134), 6 interviews and one focus group that were completely interpreted in English. All of them were merged in order to perform a final coding or a final analysis to conclude the report.

Our "fieldnotes [that] have a […] *descriptive* thrust, providing accounts of people [or TB patients], scenes [or different days of observation in the TB clinic), and dialogue" (Emerson, 2001, 133) contribute to the writing of some methodological components such as description of the setting, description of our relationship to the setting, etc. Additionally, they allow us to confirm or validate some informants' viewpoints or some interview statements. Compared with the fieldnotes, *information* from the coded interviews and discussion *was reassembled into themes, concepts, ideas or arguments* (Rubin and Rubin, 1995) to display the findings. Below, four major themes will characterize our findings. Selective direct quotes were extracted from observation data or fielnotes, interviews and discussion to support these themes.

5. Findings about Haitian TB Patients and HIV-related TB Patients' Ethnomedical Knowledge

This study is about Haitian socio-cultural conceptions of TB and HIV-related TB. It attempts to see the role play these conceptions in the early diagnosis, TB transmission or spread and the treatment regimens. Then, Haitian TB and HIV-related TB patients' socio-cultural conceptions are considered as an important factor in the TB spread, treatment regimen or TB management in Broward County. Interviews and a focus group with some TB control program workers and TB patients and HIV-related TB patients allow us to understand the extent of the influence of those conceptions among the Haitian foreign-born immigrants. Prior to displaying the findings at the socio-

cultural level related to the themes identified throughout the data analysis, let's see how HIV infection contributes to influencing the TB infection.

5.1 Prevalence of HIV-related TB in Broward County

The retrospective Broward County Health Department charts of 954 reported TB cases show that TB cases and TB cases by HIV co-infection rates varied gradually year to year between 1985 and 1991. First, we see an increase in reported cases of TB between 1985, when only 106 cases were reported, and 1991, after the intensive progression of HIV in Broward County, when 164 cases of TB were reported. This suggests that HIV infection started influencing the TB infection or HIV-related TB rate.

Second, between 1995 and 2000, charts of 718 reported TB cases show that the rates of TB cases by HIV co-infection varied slightly due to new and available TB treatment regimens, as compared to those of 1985 through 1991. In this, we see that the HIV-related TB rate was 34% of 136 reported TB cases in 1995, 35% of 142 in 1996, 38% of 123 in 1997, 32% of 135 in 1998, 37% of 140 in 1999, and 35% of 102 in 2000. That gave an average of 35% of HIV-related TB cases or TB cases provoked by HIV co-infection for the last 6 years. Compared to both 3,402 HIV cases and 102 reported TB cases in 2000 for example for Broward, the HIV-related TB rate was low. Broward County health care providers came to detect HIV-related TB among infected persons by testing everyone for both HIV and TB when suspected the patient had either TB or HIV. Among the 500 to 600 people who were tested for TB or both TB and HIV every year, only an average of 130 people were found to be infected and co-infected every year.

> Q. *When you see someone has TB, do you automatically test him for HIV?*
>
> A. It is a good question. Usually, in the hospital, they have already tested the patients for HIV. Let's say that between 75 and 85% were already tested in the hospital. The thing we noticed 5 to 6 years ago, was that patient assessment testing was biased due to the fact that TB patients who were over 60, 65 year old were not tested for HIV. Particularly, the hospitals did not test them. Perhaps they think that people from this age category are HIV-free. This implies that they have no sexual life. It was wrong. My responsibility now is to assign a new doctor to the patient—after the patient leaves the hospital, our own doctor is assigned to this patient. If we have no HIV/AIDS test results from the hospital, our job is to put this patient on counseling. Automatically, this person starts with his/her treatment here, we ask him/her to be tested for HIV/AIDS. But that person is entitled to reject our request. However, according to the policy, our responsibility obliges us to test for HIV everyone who has TB, and we are supposed to put him/her on counseling.

Currently, the population of Broward County is 1,535,261 people (US Census 2000). For this large population, the TB morbidity rate or HIV-related TB morbidity rate in the county was not high. However, when the problem was considered from an epidemiological point of view, it became worrying. In 1999, for example, 56% of reported TB cases were among foreign-born individuals including Haitians. Since, in this case, official data are not available about the exact percentage of Haitians infected with tuberculosis and HIV-related TB among foreign-born individuals, our interview data are taken into account. They suggest that 53% of reported foreign-born TB cases were Haitians. Seventy-five percent of them were HIV seropositive. This proportion was relatively high compared to that of people of Hispanic origin (17%).

> Q. *And about the Hispanic community?*
>
> A. We do not record a lot of cases. In some cases, we record in the Hispanic community, only a few are HIV-positive. Let's say for the year 1999, we recorded 23 Spanish TB patients. However, only 4 of them were HIV-positive. But, if we take 4, we divide it by 23, that gives 17%. When we compare 17% to the statewide rate that is 30 to 35%, we conclude the coinfection rate among the Hispanic community is very low. Now, let's compute for the black population, that we call African-Americans, which includes Haitians. We recorded 83 cases in 1999. In those 83 TB cases, 42 of them, that gave 49.75%, were dually infected. If we take these 42, you can believe me, 75% of them were Haitians.

Since the prevalence of TB and HIV co-infection is high among foreign-born people or refugees, particularly among Haitians, then, the following sections will attempt to approach transmission and treatment and socio-cultural aspects of the diseases among the immigrant community or foreign-born Haitians.

5.2 Patients' socio-cultural conceptions, Transmission and HIV-related TB

Most cases described below refer to transmission of TB and HIV-related TB among the foreign-born patients. Foreign-born patients make up more than 50 percent of Haitians visiting the State Road 84 Clinic. Informants were highly motivated to provide information about Haitians and the high prevalence of TB cases and HIV-related TB among Haitian patients.

That explains why at this point, the research tends to focus on Haitian cases. Several reasons may explain this prevalence among that community or the large TB spread in Haitian immigrant population. The most common factor associated to this is due to the fact that Haitian people are among the most nostalgic ethnic groups in South Florida. They frequently visit parents and family in Haiti. Because tuberculosis is prevalent or remains an endemic disease in Haiti, people with HIV infection can be infected with TB during even a short visit in Haiti. When they return to Broward, they can contaminate friends or other relatives, since they live in social/sexual promiscuity. Up to four people may share a single bedroom, or up to 7, 8, 9, or even 10 people may share a two-bedroom dwelling. In this situation, they use the same eating utensils and breath the same air infected through coughing and sneezing. Tuberculosis is significantly transmitted according to permanent contact with the infected air; therefore, roommates or residents who live in the same house or area with the infected person are at a greater risk to catch the disease.

> We must be realistic; we always want to go back home. We have "alma mater" (homeland) nostalgia, we must go back home to see our family. We know that TB comes from there. TB is prevalent in Haiti. We cannot lie to ourselves. Therefore, if, for example, in good health, let's say rather if I have HIV/AIDS, and I go back to Haiti. There, I will expose myself to TB wherever I go. It is a normal fact that I can come back with the disease, I can catch it. So, I come here, I have TB and share a house with 8, 10 people, I have chance to transmit TB with those people […] Let's say I am not in Haiti and I have my brother who travels back and forth in Haiti, my brother is in contact with TB. He becomes sick, he transmits the disease to me. Then, all those details can explain high TB rates in the Haitian community.

However, contact investigation worksheets and interviews with patients reveal that Haitian patients never knew where they contracted the disease, or never knew if people who lived with them, worked with them, and were in the same class with them had the disease. Their perceptions about the disease indicated that their disease came from nowhere, and fell on them.

> Q. *How do you think you catch your disease?*
> A: Well! I don't know. Because I am not in [sexual relation], I don't know.

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> Q. *How do think you catch this disease?*
> A. I don't know.
>
> Q. *Haven't you any idea?*
> A. No-no!
>
> Q. *Do you know someone who lives close to you and has the disease?*
> A. No!

A third patient who did not know where he caught TB tried to explain how he caught it in such a fashion:

> Good! He-e-e-e-ey, then while I come here (United States), while I come, and it was almost, it was almost this kind of food I eat here rather than eating the Haitian food to which I was accustomed, I eat other food too. In this context, I did not eat as much food as I was supposed to. When I was in Haiti, as I was well cared for, I am not cared for like that here (or in Haiti, I ate better than here).

Somewhere, our focus group discussion, after showing that participants do not know where they catch TB or HIV-related TB, revealed that someone can catch TB if he/she switches from a hot area, while his/her body is still hot, to a cold area suddenly or if he/she is exposed his/her body to both heat first and cold immediately after. "Heat and cold can give it to you (Cho ak fret la kapab ba ou li),"said a participant. Farmer (1992: 86) reached the same conclusion in a case study through his book. He pointed out this from a dialogue with one of his patients: "If I had tuberculosis … truly, I might, because I was cooking, I was in and out of the refrigerator."

In light of the above details, the social worker being a supervisor of the TB control program argues that they cannot contract tuberculosis miraculously because it is a contagious and acquired disease. They intend to hide the fact that a member of their family, or a friend of theirs, had the disease, because of the fact that, since the time they were in Haiti, they had a negative view regarding TB, a disease that, in Haiti, carries a heavy stigma. In Benin, West Africa, country where came most Haitian ancestors, TB carries the same stigma. "When you are in Haiti, once you have this kind of disease, all your stuffs are set aside (Se le-ou Haiti, depi ou gen bagay sa yo tout bagay ou se apa ke li-ye)," a patient revealed. Haitian people are prejudiced against individuals infected with TB.

> Q. Why do they hide that they know people who have TB?
> A. But merely we think that most of our patients…may be…it is one of…you know the stigma that carries TB disease, stigma that carries AIDS disease.

> ***

> When we know before all TB, TB, we know that we came from the Third World country, we are familiarized with it, and we know the kind of stigma it carries. Most of the time, they say that people who have TB are poor people, people who are truly poor, people who are undernourished, it is a kind of malnutrition that causes this disease.

Once a person catches TB or further, HIV-related TB, and people know that he/she has it, they humiliate him/her. They tend to give up any relationship with the infected person. The Broward patients or participants during the interviews and the focus group discussion always mention the humiliation problems that they have in their environment.

> Well! They consider me as anything, because the way we used to stick together is not the same now. They are supposed to be like… I don't know how they think. I don't know if after the disease, they changed their mind. I don't know (sad voice).

> ***

> But, there are so many people once they know that you have the disease, they do not eat with you, they do not talk to you, and then they *chi-chi-chi* (whisper) about you. Anyway, I am not disappointed. I do not talk my business to nobody. Only the doctor knows my business, and maybe I have (a close) friend who knows my business.

Currently, in Haiti, when a person dies of TB, all of his/her belongings or clothes are often burned down or dropped off in the bush.

Taking into account all those criteria, most of Haitian TB patients in Broward rejected Western medical etiology or the scientific causes attributed to their illness, and believed that their disease was caused by witchcraft. In relying on such perceptions, they tend to minimize the social impact of the disease around them. They do not feel deeply ashamed in this case when people envisage that their illness causation is due to supernatural or magic agents. In

this respect, a twenty-six-year-old patient, for example, when asked if he is victim of someone's ill-will, he gives this account.

> But, I know evil exists, while, when I sleep I have some revelations, I do not want to say I believe in revelations, but through those revelations, perhaps if I think to them, I focus on them all the time, I would believe that someone is doing something to me (is sending bad luck on me).

There was another case, a 45-year-old HIV-related TB patient who already knew he had tuberculosis because he had all of the common symptoms, such as weight loss, cough and fever, but refused to see a doctor to undergo a clinical diagnostic since he thought that his disease is a sent disease or *sent TB* (see Farmer, 1992). Once this patient went to the doctor, clinical diagnostic revealed that he had both TB and HIV/AIDS or HIV-related TB. Then, he tried to explain the origin of his disease by linking it to a friend who borrowed more than a thousand dollars from him.

> Q. *You told me, you know some people [that they sent magic things on them].*
> A: Yeah!
>
> Q. *I think that it was another person?*
> A: Yeah!
>
> Q. *For some money?*
> A: It was me.
>
> Q. *It was you?*
> A: Yeah!
>
> Q. *How much was the money?*
> A: 1500 dollars.

Later, when he claimed his money back, they refused to give it. In this context, he maintained that they sent magic things, witchcraft, or *SIDA death* on him in order to kill him or stop him getting his money back. In his mind, he believed that this *magical expedition* made him sick or infected with either TB or AIDS.

> A: Yeah! They never give me the money back. They preferred to send me underground [kill me] in order I stopped asking it to them.

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> Q. *Since that time, you never ask them it?*
> Patient IV: I don't want that this thing repeats anymore.
>
> Q. *Did they go to Haiti or here in order to manipulate this magic thing?*
> A: They went to buy the magic powder in Gonaives [Artibonite Department, Haiti].
>
> Q. *Gonaives. Oh-ho, they came back (with the powder), they sent it on you. That means all those diseases you have, they just…?*
> A: It can provoke all those diseases.

From 1996 or 1997 to at least 2002, this patient was hospitalized several times in Broward General Hospital. Despite his morbid state, he got married and informed his wife that his disease was a supernatural one. He fathered

one child in this marital union. Since he thought that his disease was supernatural, he maintained that he was unable to transmit it to his wife and child.

In the same perspective, a 42-year-old woman had TB and AIDS/HIV from her first husband. After the death of her husband, she was remarried with a pastor. She never said to the pastor that her first husband died from TB and HIV/AIDS. She only let him know that her illness was sent by the members of her first husband. She had two children with the pastor. Both children were born with HIV infection. Later, when she was really sick and hospitalized in Broward General Hospital, people in her medical staff asked her if her husband was informed about her illness. She said that she never explained it to him. The medical staff constrained her from warning her husband about her disease.

In light of this conception, HIV-related TB transmission rates are increasing in Broward among the Haitian community. Haitian people often do not rely on prevention methods. Some participants in the interviews and focus group discussion affirmed that they never heard about a TB prevention program.

> Did you never hear about prevention; the way you must behave to avoid catching the disease?

> No! I don't know how I can behave to avoid catching these diseases. Once
> they told me to see the doctors regularly, I do it, that's all.

They do not protect themselves and others. They continue to engage in unprotected sex and live in sexual promiscuity. During two interviews, TB workers revealed such behaviors.

> We must look at our behavior; a factor we don't like to approach. Let's look at the behavior of the Haitian men, let's look at their perception toward HIV/AIDS, whether the person has HIV/AIDS or not, once that lady is in good shape (fat), she looks beautiful down the street, they think she cannot have HIV/AIDS. In their view, it is thin people who can have HIV/AIDS. This is all of these things we must take into account, not only the problem of TB we must only focus on, but also on the problem of HIV/AIDS. Once we come to eradicate the HIV/AIDS epidemic, by educating Haitian people about HIV/AIDS influencing the TB rates, we believe that we can resolve the TB problem itself.

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> If someone believes that they send a supernatural disease on him, then, he became ill, he can do everything because he has any chance…he cannot transmit the disease to other people, because he catches the disease supernaturally. If I look at supernatural disease well, if someone sends a supernatural disease on someone else, the disease has to fall on the targeted person, and produces the appropriate effect. This disease cannot come from one person and goes to another one. Well!. In this way the patient sees it, and he gets married with the idea he cannot transmit the disease to his wife. So far, I don't know if his wife catches the disease because I have no contact with her. But probably her wife can catch the disease too. He has the disease, he doesn't protect himself, he doesn't protect his wife, and he fathered a child in the same condition, that which contributes to enlarge the problem.

When patients come to the Health Center and are informed that their HIV and TB tests are positive, they argue that it is a *move ze* (magical air) or bad air that was on them. Here, bad air has the same connotation with a *sent SIDA* or *a sent TB* (see Farmer, 1992*)*. In this respect, a 35-year-old patient was recently noticed at the clinic for maintaining that a *move ze* had been sent on him by jealousy. He said that he was hated by people around him because he was taking care of his mother who lives in Haiti.

Generally, patients who perceive their illness in this way, as a sent disease, plan a trip to Haiti in order to see a *houngan* or *bokor* and look for the traditional or herbal medicine. Consequently, data interviews reveal that the clinic loses many patients. When those patients go back to Haiti for spiritual work or traditional treatment, most of them do not return here to Broward, but die in Haiti.

This kind of stuffs causes a lot of disease in my body, man (…) Now it provokes in my body a pneumonia that makes me tired. I will go back to Haiti for the pneumonia, man.

***

Q. *Why you go to Haiti (...) ?*
A: In order to be healed more quickly.

Q. *How, in order to be healed more quickly?*
A: In order to be healed more quickly.

Q. *What happens, there are good doctors here, and you go to Haiti*?
A: Pills to pills.

Q. Um-hum!
A: Pills.

Q. Mhou houm!
A: Pills I am taking.

Q. It's hard?
A: Pills I am taking.

Q. Pills you are taking, and in Haiti, what you will do in Haiti?
A: Herbal Medicine!

***

He spent one month in Haiti. Since he was in Haiti, he started following traditional counseling there that brought him to change his mind, and he started taking herbal medicine. He stopped taking the medicine prescribed by the doctor. He spent one month there, all the month spent in Haiti, he did not take this medicine.

However, those who have the chance to return here are in critical condition and need to be hospitalized before long. Because, when they were in Haiti, they followed the *tradipracticians'*[2] therapy and stopped using the prescriptions they were given in Broward.

5.3 HIV-related TB Patients' attitudes vis-à-vis treatment regimens

From the interviews, we noted that the majority of patients who believed that their disease is a sent disease or witchcraft-caused tuberculosis, did not respond to a TB treatment properly at the clinic. On the contrary, those who believed in either Protestantism or Catholicism and attributed the causes of their illness to malnutrition effects and tubercle bacillus that were spread through the air, tended to adhere more to the modern medicine. As my interviews indicated, two protestant patients completed their therapy normally, and favor a positive relationship with the TB field supervisors.

One of those two patients was a church member in Fort Lauderdale. He had all the TB symptoms such as fever, weight loss, and cough. He was so sick that he was unable to work. With the help of the church, he paid his rent and other utilities. When the social worker at the clinic knew that through his cousin being a pastor assistant at the same church, he contacted the chief pastor directly and presented to him the condition to fill in order to be admitted to the hospital without health insurance. The patient went to the hospital and was immediately hospitalized for 6 weeks because an emergency TB test revealed that he had TB.

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[2] . Tradipractician (*tradipracticien*) is a French West African word used for one who practices traditional medicine or ethno-medicine.

He was enrolled in a therapy program which consisted of a rifampicin-based, six-month regimen with streptomycin infections in the initial phase (see also Menegoni, 1996). A few months later, he was again tested for TB and HIV in order to complete his file with Immigration and Nationalization Service (INS) for legal permanent residence. His new test revealed that he had HIV/AIDS. He returned to the hospital and the doctor prescribed him "*Combivir*, a drug combined with AZT and *epivir.*" [3] Often doctors who specialize in HIV-related TB can also prescribe *isoniazid* (INH) which reduces the tuberculosis risk in HIV anergic persons (Gourevitch et al., 1999).

Because the patient needed more help than that offered by the church, the clinic sent a nurse to his home for six hours every day to supervise his treatment regimen, as well as to cook and clean. He wanted to be completely cured, therefore, he was receptive to the nurse's additional recommendations concerning the necessity to continue therapy.

> Effectively, he (the patient) arrived to the hospital, they hospitalized him for one month to one month and half. They came to test him. They saw that he had TB. This person above all learned that he had TB when he arrived at the hospital. But he was diagnose with AIDS/HIV before, when he was completing his file with INS for permanent residence. He at this time went to the doctor. After testing him, the doctor let him know that he had the virus. And then, he spent a lot of time in the hospital. After he went back home, and I visited him personally there. I provided him some services because I am an employee from…entered to his home, and people in his church helped him too. But help provided by people of his church was not enough, I dispatched an aid nurse to his home every day for 6 hours to help him and assist him in cleaning his house, cooking, washing his clothes, and a series of domestic jobs. He was recovered. He is now very fine because he is regularly taking his medication, and following medical recommendations.

Thereafter, our data revealed that he gained weight and went back to work. Farmer (1992) described such a health improvement through the Manno Surpris case. Manno, before his health declined to death, was able to go back to teach and retake care of the pigsty after he followed the initial phase of the therapy.

In fact, the attitudes indicated above were concerned with patients with Western beliefs and their attitudes to complete the full course of therapy. So, the following sections will be filled with details about the patients motivated by traditional beliefs. As stated earlier, those patients who believed in witchcraft tended to discontinue therapy and did not come to the clinic regularly for medical checkups or refill their prescriptions. During observation in the TB clinic, we noticed that nurses and supervisors arguing with those patients either while they had contact with them physically in the clinic or while they were talking to them over the phone about missing appointments and failing to refill their prescriptions on time.

Our interview data showed a 39-year-old man who lived in Coral Springs, Florida, and had contracted TB and HIV/AIDS since the time he was in Haiti. He attributed the cause of his illness to supernatural agents such as magical powder, a *sent SIDA* or *a sent TB*. He favored the idea that he was victim of a sorcery act perpetrated by some people in his family. Although he reached Florida's borders, he continued to assume that he was still persecuted by magic. Recently, according to a social worker who went to his home twice a day for 4 months to make sure that he took his medications daily during the initial phase of therapy, the patient stopped taking his medications because he was informed by people in Haiti that he has a supernatural disease. The *bokor*, traditional voodoo sorcerer, who was consulted in this matter, wanted the patient to change his medications.

> He always thinks that his family members in Haiti, living in the region he is from, sent bad luck on him, they hated him, they did magic things (…)

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[3] . It was mentioned by an interviewer. Further research indicates that COMBIVIR tablets are lamiduvine 150mg/zidovudine 300 mg tablets.

> He was sick before he came here. Since he was in Haiti, he used to be sick. And, then, he came here, they still think (…) other close family members who did some routes for him [or went to a magico-religious healer], came to inform him that what kind of problem he has, and he must take his medication in such a way. "Do some routes" means go to or consult a Houngan [a Voodoo priest, a magico-religious healer, a tradipractician, or a traditional healer], it is also called; make a round (means go somewhere or consult a Houngan in order to know what is going on magically). This kind of thing lets him know, act like (…) that explains why he refuses to take the medicine.

This change of medication by the patient was a worrying observation for the TB control staff. They realized how deep the patient, an asylum seeker, trusted the traditional medicine when they discovered that the patient dropped their Western recommendations at the expense of the traditional ones. He did this expecting an immediate recovery, in order to face his appointment with INS for green card purposes—which he saw as an important issue— without the disease. While the social worker had long recommended him to take the medications such as ethambutol, streptomycin, and Isoniazid (INH), and rifampin (RIF) and come regularly to the clinic in order to be qualified for filling with INS a waiver available for applicants living with HIV/AIDS, the patient never did.

> This patient had an appointment with immigration. But to be fully qualified, if the applicant has the HIV virus, he must file a waiver stating on his infection for immigration grants him/her the green card. I encouraged him a bit to follow doctor's recommendations. That allowed him, when the time came to file the waiver, to file it with no problem and sends to immigration. He never did.

Additionally, our interview revealed two cases. The first case referred to a young Haitian soccer player in Fort Lauderdale. He waited until the last moment to come to the clinic when all TB symptoms appeared. Further TB testing and radiography confirmed that he had TB and was in critical condition. He failed to come to the clinic to undergo an early diagnosis; since his illness was attributed to supernatural causes, he stayed home to follow traditional treatment. But he did not know that medication that was not specifically related to TB treatment can produce a considerable side effect in treating TB.

The second case focused on a patient who believed that he was overtook by magic, but adhered normally to the initial phase of the modern therapy because he was educated by the social worker about tuberculosis *bacilli*, the treatment of tuberculosis and the importance of taking medications, despite his cultural beliefs. However, when the medications occasionally developed side effects[4] or allergic reactions in him, he found a pretext to travel to Haiti in search of traditional treatment. He spent one month there.

Although he traveled with enough medications for one month, he did not use them at the expense of the herbal medicine recommended in Haiti. When the herbal medicine did not work in his case either, he came back to Broward sicker than before and with a recrudescence (regrowth) of the TB symptoms. He went to the clinic and the doctor required new DNA tests. Thus, the DNA test indicated that the patient became resistant to either INH or rifampin or both due to his imprudence in Haiti. In this case, the doctor changed the regimen. The literature review suggests that the doctor may also supplement the regimen with ethambutol or streptomycin.

> I allowed people in the clinic to refill his drug prescription before he went back to Haiti [...] He spent one month in Haiti. Since he was in Haiti, he started following traditional counseling there that brought him to change his mind, and he started taking herbal medicine. He stopped taking the medicine prescribed by the doctor. He spent one month there, all month spent in Haiti, he did not take this medicine. Unaware, he (the patient) came back from Haiti after one month, he went to see the doctor. The doctor required him some tests. The doctor has some special tests for that. He has a DNA test that can show that the patient's disease dev*/elops resistance to a

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[4] . The most common reasons for discontinuation were patients reports of side effects and documented hepatotoxicity (Gourevitch et al., 1999).

medicine. They saw that the medication cannot help him anymore because of one month he spent there without taking it. The doctor changed it, and prescribed him some different ones.

It is important for a patient to follow the drug regimen one hundred percent, as interviews revealed. Non-compliance is one of the most significant contributors to treatment failure and acquired drug resistance (Spiegler and LLowite,1999).

5.4 Multiple Drug Resistant (MDR) to Directly Observed Therapy (DOT)

Tuberculosis is a chronic infectious disease that requires extended therapy (6-12 months). Completion of treatment is a major issue in tuberculosis therapy. Irregular or incomplete treatment can compromise the cure, cause drug resistance and give rise to relapses (Toman in Menegoni, 1996). Accordingly, *State Road 84 Health Center* developed particular norms to bring the patients to take their medications regularly. Thus, it established monthly prescription refills and medical appointments as principal norms to bring the patients to consume the medications before they came to their next visits. Despite this process, the clinic recorded several cases in which patients came to refill prescriptions after one month and a half or two months, whereas the normal time period for refills was one month. That indicated that the patients skipped several days or weeks without taking the medications.

> Sure, patients they come in, they say "Yes, they are going to take it" they get home and they don't take it. They come back the next month, and get more medicine. You go by their house, and there is a whole shelf-full of medicine up there.

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> It is very important for the patients take his medication with 100%. If they tell you to take it twice a day, you must be accustomed to take it twice a day, to avoid skipping dose. In this case, it is unacceptable to take it one week and then skip a week. We face a lot of cases. (Normally), they prescribed the medicine to the patient for one month. The patient went back to the clinic to refill his drug prescription after one month and half, after two months.

In fact, those patients, in addition to others described previously, who did not complete the full course of therapy according to their health beliefs or socio-cultural perceptions, became resistant to one drug or multiple drugs (Spiegler and Llowite, 1999). Consequently, treating those patients who are resistant to one or multiple drugs took 9 to 18-month regimen of *isoniazid* (INH). In this case, the clinic applied the *directly observed therapy* (DOT) program in which social workers, field supervisors, or volunteers went to the patients' house and assisted or witnessed the patients while they were taking their medications.

> If they require you a prescription for one month, and you take more than one month to refill, it means you skip several days without swallowing your pills. Then, it is probable that this person is at a greater risk to develop drug resistance.

<div align="center">***</div>

> MDR, multiple drug resistance. The same case can happen in TB, but in TB, this case [MDR] is not too frequent because we develop what we call DOT. We make sure we went every day to the patient's house and witness that he swallows his medicine.

Interviews and focus group discussion reveal that most patients did not know what is DOT. To questions asked about the DOT practice, they gave an inappropriate answer or answered that they don't know.

> Good! In fact, I have no problem with, but most of the time, when you think to yourself, you think to your destination, you feel that I do not progress.

<div align="center">***</div>

> No! (…) D-O-T, I don't know (…) Well! As I don't know, I cannot inform you about it. I don't know if they talk to the person who gives me the medicine, but I never meet nobody who talk to me.

Interview data show that several patients have no idea about DOT, so DOT was in this case defined for them. Patients were asked further questions about. There is one patient (Patient III) who was hospitalized in Broward Hospital with whom we were speaking about DOT in order to know after she gets discharged, if she will be able to receive an aid nurse or a TB supervisor for administrating DOT at home. She did not completely share this idea. That can be explained by the fact that either she would neglect the western medicine at the expense of traditional medicine once she gets back home or she would feel that with an aid nurse for home health assistance, neighbors would find out what is her disease. Since she was not willing to adequately answer my questions, both the social worker and a nurse who was present in the room and was removing the IV (intraveneous) bag to talk to her and make sure she does not want to answer the question.

> In the hospital, every medication you are taking here is handed to you by a nurse. When you leave the hospital, you go back home, TB workers will visit you at home to give you the medication, will you have problem with those people.

<div align="center">***</div>

> Q. Will you have problem with this kind of things?
> A. Hum-hum! Just write down the name of the medication for me, I will (…).

> Nurse: No, no, no, they do not ask you for that. When you leave the hospital, you go back home, they will continue to give the prescription to take them at home, but they will not give to you directly, but a TB worker they will send to your house to give them to you every morning, do you have problem with people who come to your house to give you the medication, to witness you in taking them?

> A: I used to take them by myself.

Further, interview data reveal that there are some patients that either the clinic or Broward General Hospital placed them on DOT right after the first diagnosis because their health state was very worrying or they were very weak physically. That happened in major cases in which the patients believe that their illness is a *sent illness* or caused by witchcraft, and as a matter of facts they did not urge for early diagnosis, and stay home in order to use herbal medicine or magico-religious healing. In fact, a 46-year-old man was hospitalized for one month during his first medical visit diagnosed with HIV-related TB in Broward General Hospital.

> Well! What happened, but there is one of the two cases I was trying to tell you about the two asylum seekers, which I administrated DOT for. I missed…because he doesn't want to take the HIV/AIDS medication…he doesn't want to follow the doctor. This is the same patient about which I told you beforehand that they send the disease on him, he said.

Before the patient left the hospital, the doctor contacted the clinic in order to meet him and continue with the DOT assistance. In such cases, the clinic dispatched the social worker and the nurse case manager to meet the patients. The case manager looked at the patient's medical status and the social worker looked at the patient's socio-economic status.

They met, in fact, the patient in question at the hospital. The case manager reviewed his medical status and educated him about the disease, food to eat, and the vitamin or dietary supplement like *boost*, a shake to take three times a day. In part, the case manager was also interested in the patient's nutritional regimen. Whereas the social worker in his investigation realized further that the patient necessitated financial support. Thus, the TB support program took his rent in charge for two months, and granted him fast food coupons and a gift certificate, which is also a kind of coupon to buy shakes and food.

> She (the case manager) is a nurse. Me as a (…), I went to the hospital with her. She, the case manager, was taking care of the medical things that have nothing to do with the social things, economic things, which are related to my responsibility. Lots of people believe that when a person is sick, if he/she has no insurance, how he/she will do to be treated. It is my responsibility to temporarily find shelter for him/her [for example].

The TB control program is also supported by Broward General Hospital and both North and South Broward District hospitals. It also backed up by some private agencies such as the American Lung Association of South Florida, the Catholic Charity Center, and Jewish Services. Most of those sponsors referred patients to the DOT program administrated by the clinic. Thus, by participating in the TB control program, hospitals and patients, for example, reduced their expenses. In short, hospitals, which transfer patients to *Clinic 84*, tended to invest less money in their treatment, because holding them in the hospital for several weeks cost the hospital administration more money in payments to the medical staff for labor and services. Meanwhile, patients who were transferred from a hospital to *Clinic 84* for DOT assistance avoided increasing their hospital bill concerning room and medical services.

Most patients that hospitals or private agencies referred to *Clinic 84* were smear positive. They were contagious or could contaminate people living close to them. They could cough blood, were dehydrated, and physically weak. Therefore, if they could not stay in the hospital, they had to be isolated somewhere else. In function of this, the TB control program provided many patients motel rooms and board and placed them on DOT for several weeks or months until they became smear negative. Meanwhile, let's mention a patient who had impression that she was atrociously submitted to her DOT regimen.

There is no exception. All patients were expected to adhere to DOT regardless their <<*illness-identity*>> (Lindenbaum and Lock, 1993: 260) or health beliefs, and complete the full course of their treatment regimen since TB treatment is legally recommended. If they did not, for non-compliance, the clinic could request an order from the Court House in order to isolate them in the AG Holley State Hospital in Lantana, Palm Beach County.

AG Holley State Hospital is the only remaining sanatorium within the country. It is compared to a "little jail" in the view of Haitian TB patients. A lot of patients refused to face this medical place, because once in Lantana, they could probably lose the contact with their cultural environment, and the possibility to resort to the magico-religious agents. There, they were constrained to "develop norms of conduct consistent with treatment regimen" (Menegoni, 1996) or take their medications regularly until they completed their treatment regimen.

> Lantana is a hospital. It is considered as a hospital and a little jail as well. Patient over there, they cannot move from this place. They put them in a small room. In any case, whether they like it or not, they must take their medication.

As interviews indicated, the mission of the health care providers, which administrated regimens as DOT, was to really cure TB patients or the TB part in patients with HIV-co infection and help them get back to their families or re-assume their responsibilities in the community.

6. Discussion

Our discussion focuses on immigration, Haitian socio-cultural conceptions of TB, TB control programs and prevention. Currently, in United States, the list of communicable diseases of public health significance considered "inadmissible," are infectious TB, syphilis, lepromatous, Hansen's disease, HIV infection, and sexually-transmitted diseases (CDC, 2000). Therefore, significant decisions are implemented to stop their spread. In the case of TB or HIV-related TB, the most important measures to stop TB spread are associated with immigration policy.

United States immigration laws mandate an overseas health assessment for immigrants and refugees, with the intent of denying admission to persons with certain diseases of public health significance, physical or mental disorders, drug abuse or addiction, or a "likelihood of becoming a ward of the State" (CDC, 2000). However,

transgressions of their laws are widespread in Florida. Illegal immigrants continue to span Southern Florida's borders. A large number of these people are from areas of the world such as Haiti with high prevalence rates of TB, according to the World Health Organization (Granich et al., 1998). That explained why most of cases of tuberculosis reported in Broward County for the last three years beginning to 1998 were among foreign-born individuals.

In 2000, for example, the percentage of foreign-born TB patients reached 62% in Broward. Statistical data for the same year indicated that the highest percentage of reported TB cases was located at the Zip Code area 33311, one of more than 30 zip codes in Broward County. This points to the fact that TB is prevalent in the Haitian community, since Haitian people are more likely to concentrate in this Zip Code area, 33311, which counts 15% of TB cases, whereas the neighboring zip code areas in which the ethnic groups are more diversified counted 6% of TB cases maximum.

Fighting against illegal immigrant entries in the USA is the most efficient way to prevent the propagation of TB through the country. However, it was not an easy task for US immigration to control the entry of those people in United States since most of them came into US with non-immigrant visas and as boat people, while health assessment for infectious disease is required for people seeking immigrant visas only. They "entered as asylum seekers and were not examined until their hearing dates" (Granich et al., 1998). Original findings, in fact, showed two patients who recognized that they had TB and HIV/AIDS just during the time they were tested for immigration purposes in the U.S.

However, in an exceptional case, a Haitian refugee was denied entry into the U.S. due to HIV infection. He knew that he was infected just before his hearing date, due to take place in Haiti in 1993. A former asylum seeker during the period of the *coup d'état* (military putsch) in Haiti, he currently lives in Carrefour, a shanty town located at the South entry to the capital or at the South West Port-au-Prince, the capital (South Florida *Sun Sentinel,* 2001).

Most of those refugee cases reveal the *incomplete notification of suspect TB cases to the TB County programs* or TB country programs. Although the TB county programs in America, for example, cannot be blamed for the illegal entry of the refugees, they can be criticized at least for lacking credible or integrated prevention and screening activities.

As the original findings also show, the Haitian socio-cultural conceptions of TB play a significant role in the TB transmission, in the non-compliance of TB and HIV-related TB patients to TB treatment regimen. In other terms, this non-compliance is due to the fact that many Haitian people, because of their socio-cultural and magico-religious conceptions of the disease, do not rely thoroughly on the modern TB health care (Western medicine) to be treated, and the kind of prevention teaching on how to avoid catching the diseases or transmitting it. They think that their disease is a *sent disease* or someone sends the disease on them by magical means.

As Farmer (1992) indicates in his anthropological research on Do Kay, Central Plateau, Haiti, every patient "believes that he is the victim of someone's ill-will." Then, in the view of most of them, once a disease caught in this way, the disease does not attain their body deeply or their immune system, therefore they think that they cannot transmit it to their family members, close contacts or partners and they don't need to be treated by the modern medicine either. To really treat the disease, they recourse, in this case, to traditional medicine or magico-religious healing.

When we take into account this whole reality, we notice that in Broward County, the TB control programs do not focus on Haitian health and illness conceptions meshed with voodoo culture to make up the prevention and therapy programs. Because they ignore Haitian health beliefs or an ethnomedical approach to TB and HIV/AIDS in their program, they do not come to increase awareness among Haitian people of possible signs and symptoms of tuberculosis or HIV-related TB, and move toward early diagnosis. In other words, without such an ethnomedical approach, it was very difficult to elaborate a workable prevention program or tracking system to both TB and HIV/AIDS for Broward County or South Florida.

As we know, there is not a pre-existing medical knowledge of AIDS, and AIDS treatment in Haiti; prior to the arrival of AIDS from abroad and linking AIDS with traditional religious and cultural practices in Haiti is even more absurd (Farmer, 1992: 2-3). However, it is not impossible in the long run for North American researchers to draw in the vast Haitian traditional medical knowledge in a logical strategy [an integrated TB control program] which can help to prevent or to track these infectious and parasitic diseases among Haitians.

In Cuba, which has the lowest HIV infection rates in the world, there are small groups of AIDS activists who hope to use ancient *Yoruba* traditions and legends to stop the spread of this modern-day disease (Sun-Sentinel, July 2001). Cuban activists probably study *La Santeria*, a kind of West-African Voodoo. Indeed, they also know the influence of the voodoo legends or the West-African mysticism on some Brazilian people because they practice *El Condomble.* Indeed, they also know the influence of those religious components on most Caribbean people like Haitians, Cubans, Jamaicans, and other islanders because they praise Voodoo too. Therefore, they envisage through the linkage of voodoo recommendations with Western treatment means and prevention they will come to adequately motivate their fellow citizens about the diseases in question.

It might be important to envisage a counterpart program in Broward County and other parts of South Florida similar to the Cuban HIV/AIDS control program. Otherwise, the prevalence of HIV infection and HIV-related TB will continue to increase among foreign-born individuals. Although, in Broward, the total TB cases dropped about 25% between 1995 and 2000, the foreign-born TB case proportion increased about 24 %. The TB control workers were happy about the total decline, but ignored the dramatic increase of the proportion of those new cases among foreign-born individuals.

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