**TITLE PAGE**

**INVESTIGATION OF THE PANCREATIC EFFECT OF BUCCHOLZIA CORICACEA FORMULATED DIET IN SUCROSE FED PREGNANT RATS AND THEIR OFFSPRING**

**BY**

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**CERTIFICATION PAGE**

This is to certify that this work titled investigation the metabolic effects of sucrose fed rats in their offsprings is the original work of Obingene, Odinakachukwu Chinonso with registration number U14/NAS/BCH/024.

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**DEDICATION**

I dedicate this work to Almighty God, for his steadfast divine guidance, provision and inspiration throughout the period of this work.

To my uncle Obingene Emmanuel Maduabia for all his love throughout my stay in school. And to my late sister and brother

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**ABSTRACT**

Several plants have been used in the treatment of various disorders without scientific basis. The present study examine the pancreatic effect of *Buchholzia coriacea* formulated diet in sucrose-fed pregnant rats and their offspring. *Buchholzia coriacea* seeds were obtained from Ogbete main market, Enugu state, identified, dried and grounded using a miller machine. 10% of the seed powder was used to formulate their diet. Thirty (240) adult female and six (6) adult male albino rats (180-250 g) were used in this study. High sucrose (20%) were given via drinking water to animals before, during and after pregnancy. Group A; Control normal was administered distilled water, group B received sucrose + 10% *Buchholzia Coriacea* formulated diet (BCFD), Group C; untreated rats were administered sucrose and distilled water while Group D received 10% *Buchhoiza Coriacea* formulated diet (BCFD) only. All animals were sacrificed following overnight fast by anaesthetic does of diethylether and cervical dislocation. Blood samples were obtained through cardiac puncture error of mean. SUC (20%) (untreated) significantly elevated blood glucose levels (P<0.05); Leptin (P<0.05) and LPO of the pancreas (P<0.05); (when compared with normal control group. However, following treatment with BCFD, the blood glucose level in treated rats were significantly reduced when compared with the untreated group. Interestingly, all offspring showed reduced blood glucose level, leptin level and low MDA level in the pancreas except for the negative control whose offspring showed significant increase (P<0.05) in the paramenters when compared with the normal group. In conclusion, this research suggests that *Buchholzia Coriacea* seeds has protective effect on the damage induced by high sucrose diet on the pancreas of pregnant rats as well as their offsprings.

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**CHAPTER ONE**

* 1. **INTRODUCTION**
  2. **BACKGROUND OF THE STUDY**

Herbal medicine is the oldest form of health care known to mankind. The use of medicinal plant in the treatment of diseases has been in practice since ancient time in different parts of the world especially in Africa. Plants have always been the most vital source of drugs mainly because most plants are autotrophs, and are able to synthesize a large variety of basic biochemical and organic substances such as carbohydrates, protein, terpenes, steroids, alkaloid and glycosides (N’guessan*etal.,*2009)

The plant kingdom provides a tremendous reservoir of various chemical substances with potential therapeutic properties. Generally, plants which produce constituents having medical values are designated as medicinal plants (Lawrence *et al.,* 2008). In addition, all plants that taste bitter are used as medicine (Barrett, 2009).

Diabetes mellitus is characterize by insufficient blood levels of the hormone insulin. If the blood concentration of insulin is too low, muscle and liver cells do not absorb glucose from the blood which in turn leads to increase levels of blood glucose (hyperglycemia), impaired metabolism of fats and proteins, ketosis and possible diabetic coma. (willam, *et.al*  2009)During the past 12 years, the world health organization has been collecting information on the prevalence of diabetes mellitus in adult communities worldwide. Within the age range of 30-64 years, diabetes was found to be absent or rare in some traditional communities in Melanesia, East Africa and South America. In communities of Europeanorigin, the prevalence of diabetes were in the range of 3-10% but migrant indian, Chinese and Hispanic American groups were at higher risk (15-20%). (Adetokunbo, *et.al.,*2003)

A 2008 study completed in U.S. found the number of America women entering pregnancy with pre-exisiting diabetes is increasing. In fact, the rate of diabetes in expectant mothers has more than doubled in the past six years. (Lawrence, *et.al.,*2008). This is particularly problematic as diabetes raises the risk of complications during pregnancy, as well as increasing the potential for the children of diabetic mothers to become diabetic in the future

* 1. **STATEMENT OF THE PROBLEM**

Malnutrition is define as the lack of sufficient nutrients, which are essential for the body’s normal functioning. Over time it affects the bodily organs and results in mild to severe medical problems. One of the malnutrition facts is that the number of hungry people is more in the developing countries. If a pregnant woman is malnourished, it is understandable that the baby in the mother’s womb is not receiving enough nutrient.

Pregnant women who have been through malnutrition, deliver babies with low birth weight. Such children are prone to retarded growth, less coordination, poor vision, learning difficulty, and many other diseases. Anemia is one of the malnutrition dises that affects several pregnant women worldwide.

* 1. **AIM OF THE STUDY**

To investigate the effect of high sucrose fed pregnant rats in their offsprings and know their pancreatic effect. And also the effect of *Buccholozia Coriacea*

**1.4 OBJECTIVES OF THE STUDY**

Induce diabetes by administering sucrose

Administering plants for lowering blood sugar level

Measure the blood and leptin level

**CHAPTER TWO**

1. **LITERATURE REVIEW**
   1. **DIABETES MELLITUS**

Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. (David G. 2011). This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increase thirst) and polyphagia (increase hunger)

* + 1. **CLASSIFICATION OF DIABETES MELLITUS**

**TYPE 1 DIABETES MELLITUS**

Type 1 diabetes mellitus is characterized by loss of the insulin- producing beta cells of the islets of Langerhans in the pancreas, leading to insulin deficiency. This type can be further classified as immune- mediated or idiopathic. The majority of type 1 diabetes is of the immune mediated nature, in which beta cells loss is a T- cell mediated autoimmune attack. (Rother, k. I. April 2007).

There is no known preventive measure against type 1 diabetes, which causes approximately 10% of diabetes mellitus causes in North America and Europe. Most affected people are otherwise health and of a healthy weight when onset occurs. Sensitivity and responsiveness to insulin are usually normal, especially in the early stages. Type 1 diabetes can affect children or adults, but was traditionally termed “juvenile diabetes” because a majority of these diabetes cases were in children.

Brittle diabetes also known as unstable diabetes or labile diabetes is a term that was traditionally used to describe a dramatic and recurrent swing in glucose levels, often occurring for no apparent reason in insulin- dependent diabetes. This term however, has no biologic basis and should not be used (Diabetes Mellitus, 2010). There are many reasons for type 1 diabetes to be accompanied by irregular and unpredictable hyperglycaemia, frequently with ketosis, and sometime serious hypoglycaemia, including an impaired counter regulatory responds to hypoglycaemia, occult infection, gastroparesis ( which leads to eratic absorption of dietary carbohydrates), and endocrinopathies e.g., Addison’s disease (Diabetes Mellitus, 2010). These phenomena are believed to occur no more frequently than in 1% to 2% of persons with type 1 diabetes (Dorner M, *et.al.,* 1977)

**TYPE 2 DIABETES MELLITUS**

This is the most prevalent and common type of diabetes. It is known as maturity-onset diabetes or non-insulin- dependent diabetes mellitus or adult-onset diabetes accounting for 80-90% of all cases of diabetes. According to the article by (Type II Diabetes, 2011), one’s risk of having type 11 diabetes goes markedly high if you have excess weight, leads a sedentary lifestyle and have a family history of type II diabetes. According to (O’Rourke, 2009; Tanti and Jarger, 2009), insulin resistance, common in people over the age of 40, is the reduced sensitivity of tissues to circulating insulin in reduced glucose consumption by tissues, causing hyperglycaemia and eventually leading to metabolic syndrome and diabetes. This disease is characterized by insulin resistance, which may be combinedwith relatively reduced insulin secretion (David *et al.,*2011). In most cases of Type II diabetes, there is production of insulin more than required at the early stages of the illness. This is caused by cholesterol and dietary fat infiltration the blood as well as blocking insulin from making glucose available to cells. But as the disorder grows leading to weakening of the pancreas, the production of insulin decreases until insulin supplements are required.

Due to the fact that glucose is not consumed by cells, eventually blood sugar becomes unusually high. The result of this is excessive urination and constant thirst and hunger. The cells are instantly served of the fuel and powers their action. Therefore the patient experiences fatigue. According to (Type II Diabetes, 2011). If allowed to proceed to unchecked this can ultimately lead to death of cells and the body itself.

**GESTATIONAL DIABETES**

Gestational diabetes mellitus (GDM) resembles type 2 diabetes in several respects, involving a combination of relatively inadequate insulin secretion and responsiveness. It occurs in about 2%-5% of all pregnancies and may improve or disappear after delivery. Gestational diabetes is fully treatable, but requires careful medical supervision throughout the pregnancy. About 20%-50% of affected women develop type 2 diabetes later in life. (Couri *et al.,* 2009)

Though it may be transient, untreated gestational diabetes can damage the health of the foetus or mother. Risks to the baby include macrosomia (high birth weight), congential cardiac and central nervous system anomalies, and skeletal muscle malformations. Increased fetal insulin may inhibit fetal surfactant production and cause respiratory distress syndrome. Hyperbilirubinemia may result from red blood cell destruction (Lawrence *et al.,* 2008)

**2.1.2 SYMPTOMS OF DIABETES MELLITUS**

The classic symptoms of untreated diabetes are loss of weight, polyuria (frequent urination), polydipsia (increase thirst) and polyghagia(increase hunger). (Cooke et al., 2008) symptoms may develop rapidly (weeks or months) in type 1 diabetes, while they usually develop much more slowly and may be subtle or absent in type 2 diabetes.

Prolonged high blood glucose can cause glucose absorption in the lens of the eye, which leads to change in its shape, resulting in vision changes. Blurred vision is common complaint leading to a diabetes diagnosis. A number of skin rashes that can occur in diabetes are collectively known as diabetic dermadromes. (cooke*et al.,2008)*

**2.1.3 CAUSES OR RISK FACTORS**

Several predisposing factors contribute to the development of type II diabetes including advanced age, a family history, excessive body weight and alcohol consumption, physical inactivity, stress and consumption of an unhealthy diet (MPHS, 2010).

These factors include: consumption of refined carbohydrate; consumption of high-fat diets; lack of physical activity due to sedentary lifestyles, lack of exercise or circumstantial reduction of physical exercise occasioned by the availability of motorized transport, watching television and computer games for long hours (MPHS,2010)

Genetics (inheritance); Type 2 diabetes has a higher inheritance risk more than type 1 diabetes. In some cases individuals who have this disease was as a result of either their parents or grandparents. In this case of identical twins, if one twin develops type 2 diabetes, the other twin has 80 percent chance of also developing the disease (in type 1, an identical twin has 35-50 percent chance)(chase *et al.,* 2017)

Sedentary lifestyle; One of the leading causes of diabetes mellitus is lifestyle, caused by societal values, industrialization. This can be seen from food we eat, what we drink and what we engage ourselves in. The intake of unwholesome diet and drink contribute greatly to this.

Typically some people with diabetes mellitus are overweight, resulting to more fat in the muscle and tissues. The body synthesizes fat stored in the muscles instead of glucose, the eventually leads to high level of glucose in the blood plasma, which on the long run leads to diabetes.

Lack of exercise and fitness; Decreased physical fitness contributes to the development of diabetes

**2.1.4 PREVENTION**

Diabetes mellitus risk can be reduced by increased physical activites, proper breastfeeding and moderate supply of vitamin D during early stage of life (Stuebe *et al.,* 2005)

American diabetes Association recommends maintaining a healthy weight, getting at least two and half hours of exercise per week and eating sufficient fiber. Alcohol consumption reduces risk of type 2 diabetes though heavy consumption absolutely and clearly increases damage to body systems significantly, owing to this, American diabetes association does not recommend consumption of alcohol (Bantle*et al.,* 2006).

**2.1.5 TREATMENT AND MANAGEMENT OF DIABETES MELLITUS**

Treatment of type 2 diabetes typically includes appropriate diet, exercise, home glucose testing, oral medication and/or insulin.

The three methods of treatment are diet alone; diet and oral hypoglycaemic drugs; diet and insulin. Approximately 40% of new cases of diabetes can be controlled adequately by diet alone. About 30 % need an oral hypoglycaemic drug.

There are different classes of anti-diabetic drugs, and their selection depends on the nature of the diabetes, age and situation of the person, as well as other factors (Wikipedia, 2011)

Treatments include (1) agents which increase the amount of insulin secreted by the pancreas, (2) agents which increase the sensitivity of target organs to insulin and (3) agents which decrease the rate at which glucose is absorbed from the gastrointestinal tract (Dugan, 2010)

1. Sensitizers

Insulin sensitizers address the core problem in type 11 diabetes- insulin resistance.

Biguanides: these reduce hapatic glucose output and increase uptake of glucose by the periphery, including skeletal muscle. Metformin, a biguanide, has become the most commonly used agent for type 11 diabetes in children and teenagers and is the only widely used oral drug that does not cause weight gain. Typical reductions in HbALc values metformin are 1.5-2.0% (Higgins, 2010).

Thiazolidinedione: Thiazolidinedione such as Avandia ( Rosiglitazone) reverse insulin resistance by acting on acting on muscle, fat and to a lesser extent liver to increase glucose utilization and diminish glucose production (Higgins 2010)

1. Secretagogues

Insulin secretagogues trigger insulin release by inhibition the KATP channel of the pancreatic beta cells. Sulfonylureas: these work by stimulating endogenous release of insulin. They work best for patients over 40 years old having diabetes mellitus for under ten years.

Typical reduction in HbALc values for second generation sulfonylureas are1.0-2.0%

First generation agents include: tolbutamide, acetohexamide, tolazamide and chloropropamide.

1. Alpha- glucosidase inhibitors

They inhibit the enzyme alpha glucosidase, which helps to absorb glucose into blood stream in the level of intestine cells. Thus, it is possible to slow or inhibit glucose absorption, and reduced blood sugar level after meals ( All about beating diabetes.com 2010). These agents are effective by themselves only in the earliest stages of impaired glucose tolerance, but can be helpful in combination with other agents in type 11 diabetes (Wikipedia 2011). Typical reductions in HbAlc values are 0.5-1.0%. Examples of these agents include: miglitl (Glyset) and acarbose (precose/glucobay). They do have the potential to cause weight loss by lowering the amount of sugar metabolized (Wikipedia 2011).

Management of diabetes mellitus

Life style management is apparently the cornerstone of the management of diabetes mellitus. It is recognized as being an essential part of diabetes and cardiovascular disease prevention. Meta analyses demonstrate that lifestyle interventions, including diet and physical activity. Led to 63% reduction in diabetes

**2.1.6 COMPLICATIONS OF DIABETES MELLITUS**

All forms of diabetes increase the risk of long term complication. These typically develop after many years (10-20), but may be the first symptom in those who have otherwise not received a diagnosis before that time. The major long term complications relate to damage to blood vessels. Diabetes double the risk of cardiovascular disease. (Emerging risk factors collaboration, 2010). The main macrovascular diseases (related to atherosclerosis of larger arteries) are ischemic heart disease (angina and myocardial infraction), stroke and peripheral vascular disease.

Diabetes also damages the capillaries (cause microangiopathy). (Boussgeon*et al.,* 2011). Diabetic retinopathy, which affects blood vessels formation in the retina of the eye, can lead to visual symptoms, reduce vision, and potentially blindness. Diabetic nephropathy, the impact of diabetes on the kidneys, can lead to scarring changes in the kidney tissue, loss of small or progressively larger amounts of protein in the urine, and eventually chronic kidney disease requiring dialysis. Diabetic neuropathy is the impact of diabetes on the nervous system, most commonly causing numbness, tingling and pain in the feet and also increasing the risk of skin damage due to altered sensation. Together with vascular disease in the legs, neuropathy contributes to the risk of diabetes- related foot problems (such as diabetic foot ulcers) that can be difficult to treat and occasionally required amputation

**2.2 GEOGRAPHICAL RANGE OF BUCHHIOLZIA CORIACEA**

Buchholzia coriacea belongs to the capparaceae family and was named after R.W Buchholz, who collected plants in Cameroon in the late 19th century (keay*et al.,* 1989). These seeds gave the plants its common name of “wonderful kola” because of its usage in traditional medicine. Buchholzia coriacea is a wonderful herb with incredible healing powers. It was discovered in Yoruba land, the western part of Nigeria. In yoruba dialect, it is referred to as *“obi awogbaarun”* meaning “A kola that can cure two hundred diseases”. In igbo dialect, it is referred to as “*ogwonnuoria”* meaning “a kola that cures many illnesses”

**2.3 TAXONOMY OF BUCHHOLZIA CORIACEA**

Domain …………………………………………………….Eukaryota

Kingdom ……………………………………………………Plantae

Subkingdom……………………………………………….Viridaeplantae

Phylum ……………………………………………………..Tracheophyta

Subphylum………………………………………………..Euphyllophytina

Infraphylum………………………………………………Radiatopses

Class…………………………………………………………Magnolipsida

Subclass …………………………………………………..Rosisdae

Superorder………………………………………………Violanae

Order ……………………………………………………..Brassicales

Suborder ……………………………………………….capparineae

Family ……………………………………………………capparineae

Genus ……………………………………………………Buchholzia

Specific Epithet………………………………………Coriacea

Specie …………………………………………………..BuchholziaCoriacae

**2.4 COMMON NAMES OF BUCHHOLZIA CORIACEA**

In Nigeria

Igbo Oji Uke

Yoruba Uworo

Edo Owi

Popular name Wonderful kola

Sierra leone

MendeNdo

Cameroun

Munga Bands

French kola pimento

Liberia

Kru Base Doe-fiah

Central Africa Essonbossi

English Musk tree

Other names include cola pimento, elephant kola, oignon de Gorille, okpokolo (Palombo, 2006, Andrews, 1982 and Agnes, 1986).

**2.5 GENERAL DESCRIPTION OF THE PLANT**

The plant Buchholzia Coriacea is a shrub or medium-sized tree, evergreen, with a dense crown, large glossy leathery leaves arranged spirally and clustered at the ends of the branches, and conspicuous cream white flowers in recemes at the end of the branches. The bark of the plant Buchholzia Coriacea is smooth, blackish brown or dark green. Slashes are deep red turning dark brown. (Akpayung, *et.al.,* 1995 and Awouters, *et, al.,* 1978)

The leaves of the plant Buchholzia Coriacea can be described as follows: large, obovate, lanceolte to elliptic, shortly acuminate or acute at apex, cuneate at base, 15-30 x 5-11 cm, thinly coriaceous, glabrous, midrib very prominent below, about 10 lateral nerves, each running directly into the one above and forming distinct loops close to the margin, prominent below, stalk 10-15 cm long, swollen for about 1 cm at both ends, pale green.

The flowers of the plant Buchholzia Coriacea can be described as follows: in simply or lightly branched lax racemes among the leaves at the ends of the shoots, up to 24 cm long, individual flowers with a stalk less than 13cm. 4 small rounded sepals bent right back exposing the thick saucer shaped purplish receptacle, without petals, 40to 45 stamens with cream yellow filaments and small purplish black anthers and a narrow elongated ovary projecting beyond the stamens at the end of a thin stalk.

The fruits of the plant Buchholzia Coriacea can be described as follows: large, long stalked, ellipsoid, resembling avocado pears, 12 x 58 cm endocarp up to 1.3 cm thick and woody, yellowish when ripe, flesh yellow, edible, containing few large blackish seeds, about 2.5 cm long (Culpeper, 1995 and Grieve maud 1984)

**2.6 PHARMACOLOGICAL ACTIVE INGREDIENTS OF BUCHHOLZIA CORIACEA**

Phytochemical are chemical compounds that occurs naturally in plants. Some are responsible for color, taste, smell and other properties in plant, such as the deep red color found in tomatoes and the smell of garlic. The term is generally used to refer to those chemicals that may have biological significance, for example antibacterial, antifungal, antioxidants, anti-inflammatory, antiplasmodial and antidiabetic, but are not established as essential nutrients. Previous phytochemical analysis have reported the presence of lkaloids, saponins, cardic glycosides and flavone glycosides (Adis, *etal.,*2010) saponins, anthraquinones, alkaloids, cyanogenetic glycosides (fred-jayesimi, *et al.,* 2011) tannis and cardiac glycosides. (mbata, *et al.,* 2009) in the seed of Buchholzia Coriacae

**2.7 MEDICINAL APPLICATIONS OF BUCHHOLZIA CORIACEA**

Buchholzia Coriacea is one of the valued medicinal plants in Nigeria folk medicine. The plant is widely used all over the world for different medicinal purposes. In cameroun, the seeds are used as remedy to relieve chest pain (Adjanohoun, *et al.,* 1996). In ivory coast, the bark is made into pulpfor inhalation (Burkill, 1985) or into a snuff to relieve headache, sinusitis and nasal congestion in head colds, also otitis andopthalmiasis(kerharo, *et al.,* 1950). The gagon of ivory coast administer the bark spa as an enemy for kidney-pains (kerharo*et al.,* 1950). The Guere of Ivory Coast incorporates the bark in arrow-posions and it is highly effective. In Sierra Leone, the leaves, whole are applied to boil and for a minute or two to bruised limbs as a repulsive – this treatment is said to be hot. (Burkill, 1985). In Sierra Leone, the leaves and fruit are pounded with (Gojimende) clay and rubbed on the body for the treatment of fever (Burkil, 1985). In Ghana, the fresh bark is used in the treatment of earache. In Gabon, the crushed bark is used in frictions on skin-itch, (Walker, 1953) and a bark decoction is used to wash persons with small-pox. (Bouquet, *et al.,* 1974). Also in gabon, the wood is used in the construction of house buildings. In south Nigeria, the Edo boils and eats the fruit after a few days of storage (Burkill, 1985). In eastern Nigeria, the seeds are used in the treatment of fever. (Nweze, *et al.,* 2009).

**2.8 SUCROSE**

Sucrose is common table sugar. It is a disaccharide, a molecule composed of two monosaccharides: glucose and fructose. Sucrose is produced naturally in plants, from which table sugar is refined. It has the formula C12H22O11.

For human consumption, sucrose is extracted, and refined, from either sugar cane or sugar beet. Sugar mills are located where sugar cane is grown to crush the cane and produce raw sugar which is shipped around the world for refining into pure sucrose. Some sugar mills also process the raw sugar into pure sucrose. Sugar beet factories are located in colder climates where the beet is grown and process the beets directly into refined sugar. The sugar refining process involves washing the raw sugar crystals before dissolving them into a sugar syrup which is filtered and then passed over carbon to remove any residual colour. The by-now clear sugar syrup is then concentrated by boiling under a vacuum and crystallized as the final purification process to produce crystals of pure sucrose. These crystals are clear, odourless, and have a sweet taste. The crystals appear white.

Sugar is often an added ingredient in food production and food recipes. About 175 million tonnes of sugar were produced worldwide in 2013.

**2.8.1 HYDROLYSIS OF SUGAR**

Hydrolysis breaks the glycosidic bond converting sucrose into glucose and fructose hydrology is, however, so slow that solutions of fructose can sit for years with negligible change. If the enzyme sucrose is added, however, the reaction will proceed rapidly. Hydrolysis can also be accelerated with acids, such weak acids likewise, gastric acidity converts sucrose to glucose and fructose during digestion, the bond between them being an actual bond fructose during digestion, the bond between them being an actual bond which can be broken by an acid.

**2.8.2 SYNTHESIS AND BIOSYNTHESIS OF SUCROSE**

The biosynthesis of sucrose proceeds via the precursors UDP glucose and fructose-6-phosphate, synthase. The energy for the reaction is gained by the cleavage of undine phosphate sucrose is formed by plants and cyanobacteria but not by other organisms sucrose is found naturally in many food plant along with the monosaccharide fructose. In many fruits, such as pineapple and apricot, sucrose is the main sugar. In other such as grapes and pears, fructose is the main sugar.

In nature sucrose is present in many plants, and in particular their roots, fruits and nectars because it serves as a way to store energy, primarily from photosynthesis.

Honeybees are especially important because they accumulate sucrose and produce honey, important food stuff all over the world. The carbohydrates in honey itself primarily consist of fructose and glucose with the trace amounts of sucrose only. As fruits ripen, their sucrose content usually rise sharply.

**2.9 MATERNAL MALNUTRITION**

The term "maternal nutrition" focuses attention on women as mothers, on their nutritional status as it relates to the bearing and nurturing of children. Lack of sufficient food or the deficiency of a specific nutrient, such as iron, is clearly implicated in contemporary maternal malnutrition.

Marternal malnutrition increases the risk of poor pregnancy outcomes including obstructed labour, premature or low-birth-weight babies and postpartum haemorrhage. Severe anaemia during pregnancy is linked to increased mortality at labour. Low-birth-weight is a significant contributor to infant mortality.

**2.10 PANCREAS**

The pancreas is a glandular organ in the digestive system and endocrine system of vertebrates. In humans, it is located in the abdominal cavity behind the stomach. It is an endocrine gland producing several important hormones, including insulin, glucagon, somatostatin, and pancreatic polypeptide, all of which circulate in the blood. (felizola *et.al* 2014) *The* pancreas is also a digestive organ, secreting pancreatic juice containing bicarbonate to neutralize acidity of chyme moving in from the stomach, as well as digestive enzymes that assist digestion and absorption of nutrients in the small intestine. These enzymes help to further break down the carbohydrates, proteins, and lipids in the chyme. The pancreas is known as a mixed gland.

The pancreas is involved in blood sugar control and metabolism within the body, and also in the secretion of substances (collectively pancreatic juice) which help digestion. (felizola *et.al* 2014) Classically, these are divided into an "endocrine" role, relating to the secretion of insulin and other substances within pancreatic islets and helping control blood sugar levels and metabolism within the body, and an "exocrine" role, relating to the secretion of enzymes involved in digesting substances from outside of the body.

**2.11 METABOLIC SYNDROME**

Metabolic syndrome, sometimes known by other names, is a clustering of at least three of the five following medical conditions: abdominal obesity, high blood pressure, high blood sugar, high serum triglycerides and low high-density lipoprotein (HDL) levels.

Metabolic syndrome is associated with the risk of developing cardiovascular disease and type 2 diabetes.(Kaur.J 2014) In the US about a quarter of the adult population has metabolic syndrome, and the prevalence increases with age, with racial and ethnic minorities being particularly affected.(Falkner, B, Cossrow 2014) (Beltran-Sanchez *et al*., 2013)

Insulin resistance, metabolic syndrome, and prediabetes are closely related to one another and have overlapping aspects.

The syndrome is thought to be caused by an underlying disorder of energy utilization and storage. The cause of the syndrome is an area of ongoing medical research

The metabolic syndrome quintuples the risk of type 2 diabetes mellitus. Type 2 diabetes is considered a complication of metabolic syndrome. In people with impaired glucose tolerance or impaired fasting glucose, presence of metabolic syndrome doubles the risk of developing type 2 diabetes.(Goldberg *et al*.,2012) It is likely that prediabetes and metabolic syndrome denote the same disorder, defining it by the different sets of biological markers.

The presence of metabolic syndrome is associated with a higher prevalence of CVD than found in patients with type 2 diabetes or IGT without the syndrome.(Fauci.2008) Hypoadiponectinemia has been shown to increase insulin resistance, (Lara *et al*., 2007) and is considered to be a risk factor for developing metabolic syndrome.(Renaldi*et al.,*2009)

**2.12.1 OXIDATIVE STRESS**

At the beginning of life, the organisms obtained their energy (ATP) by anoxygenic photosynthesis, for which oxygen was toxic. Most of the metabolic pathways were developed during this anaerobic stage of life, in which oxygen came later. Cyanobacteria started producing oxygen from photosynthesis, which raised the atmospheric oxygen, and favored those organisms which have evolved into eukaryotic cells with mitochondria, able to use oxygen for more efficient energy production (Naviaux, 2012).

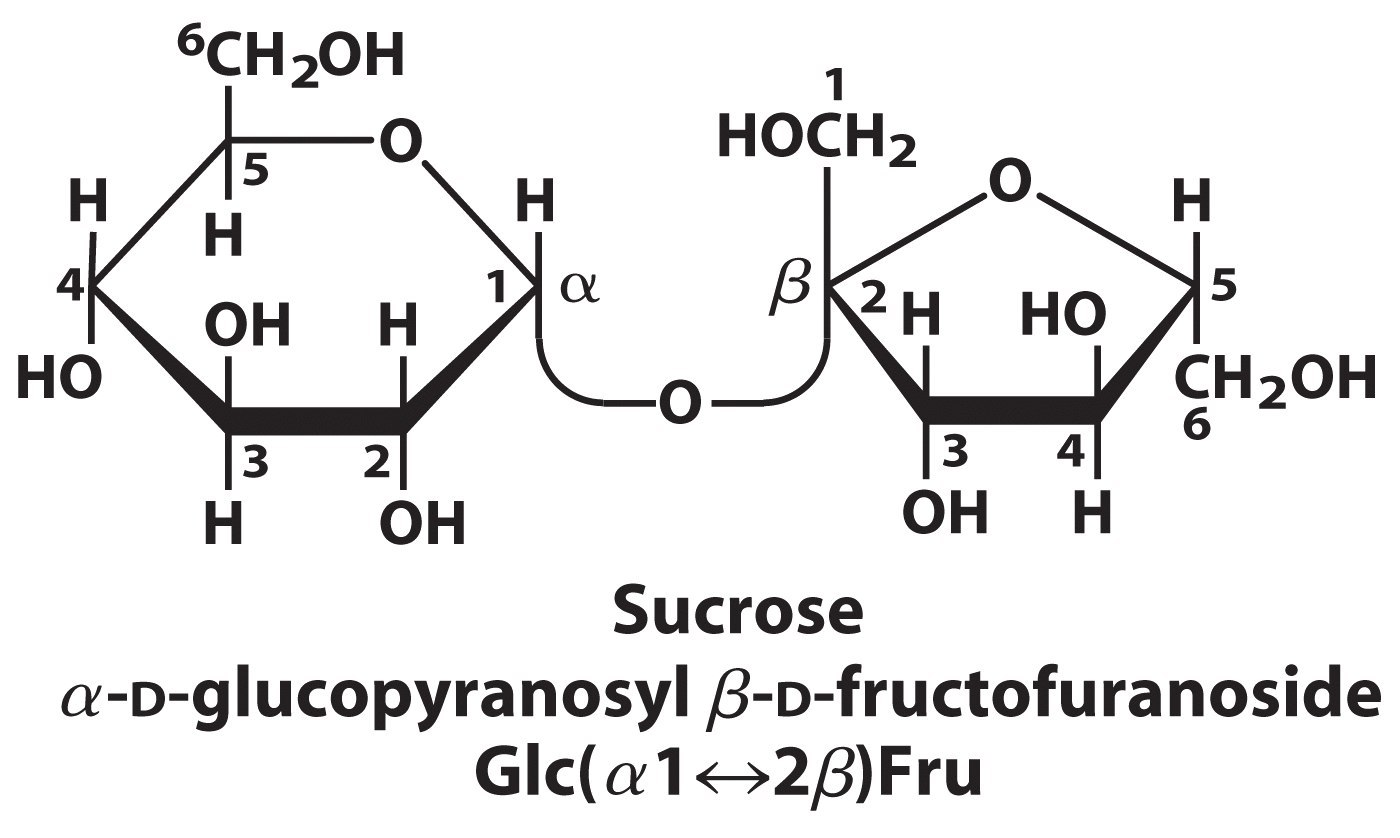
Whenever a cell’s internal environment is perturbed by infections, disease, toxins or nutritional imbalance, mitochondria diverts electron flow away from itself, forming reactive oxygen species (ROS) and reactive nitrogen species (RNS), thus lowering oxygen consumption.

This oxidative shielding acts as a defence mechanism for either decreasing cellular uptake of toxic pathogens or chemicals from the environment, or to kill the cell by apoptosis and thus avoid the spreading to neighboring cells (Naviaux,2012). Therefore, ROS formation is a physiological response to stress.

The term “oxidative stress” has been used to define a state in which ROS and RNS reach excessive levels, either by excess production or insufficient removal. Being highly reactive molecules, the pathological consequence of ROS and RNS excess is damage to proteins, lipids and DNA (Johansen *et al.,* 2005). Consistent with the primary role of ROS and RNS formation, this oxidative stress damage may lead to physiological dysfunction, cell death, pathologies such as diabetes and cancer, and aging of the organism (Ceriello, 2006)

**2.12.2 OXIDATIVE STRESS IN METABOLIC SYNDROME**

Metabolic syndrome is a collection of cardiometabolic risk factors that includes obesity, insulin resistance, hypertension and dyslipidemia. Although there has been significant debate regarding the criteria and concept of the syndrome, the clustering of risk factors is unequivocally linked to an increased risk of developing type 2 diabetes and cardiovascular disease. Metabolic syndrome is often characterized by oxidative stress, a condition in which an imbalance results between the production and inactivation of reactive oxygen species. Reactive oxygen can be best be described as double-edged swords; while they play an essential role in multiple physiological systems, under conditions of oxidative stress, they contribute to cellular dysfunction. Oxidative stress is thought to play a major role in the pathogenesis of a variety of human diseases, including atherosclerosis, diabetes, hypertension, aging, alzheimer’s disease, kidney disease and cancer.



**CHAPTER THREE**

1. **MATERIALS AND METHOD**

**3.1 MATERIALS**

Glucose strips

Glass wares

Animal cages

Stainless plates

Hand towels

Razor blade

Latex gloves

Syringes

Sample Collection tubes

Blood collection tubes

**3.1.1 CHEMICAL AND REAGENTS**

TCA (trichlroacetic acid)

HCL

Potassium chloride

Petroleum ether

Na2Hpo4

Sodium chloride

Sodium aride

DTMB

H2O2

CuSo4

Fobric reagent

BSA (borinesermin albumin)

Metaphosphore acid

Tris base

**3.1.2 EQUIPMENTS**

Glucometer

Electrical weighing balance

Centrifuge

Pipette

Beaker

Spectrophotometer

**3.1.3 BIOLOGICAL MATERIALS**

Fresh seeds of *BuchholziaCoriacae*

30 albino Wister rats (26 female and 4 male)

Sucrose

**3.2 METHODS**

**3.2.1 COLLECTION AND IDENTIFICATION OF SAMPLES**

**3.2.1: PREPARATION OF DIETS**

The seeds of B. coriacea were washed and cleaned thoroughly to remove all detritus; it was dried in the oven (40oC) for two weeks and ground into powder using a miller grinder. 10g of the ground powder was mixed with the rat pellet and served as the BCFD.

**3.2.2 COLLECTION OF PLANT MATERIAL**

Fresh seeds of *Buchholzia Coricea* were plucked fom a tree in Aku, Igbo- Ekiti North Local Government Area of Nsukka in Enugu state. The seeds were washed, cut into small bits and sun dried for 1 week. They were grounded into powder with an electric mill machine and stored in airtight container until use.

**3.2.3 HANDLING OF THE ANIMALS**

Twenty-four adult female and Six adult male albino rats (Wistar strains), weighing between 180-250g were purchased from the animal house; University of Nigeria Nsukka, Enugu State.The rats were housed in the experimental animal handling facility of Godfrey Okoye University under controlled conditions with a 12 hour light/12 hour dark schedule and fed with commercially available rat pelleted diet (Ladokun feeds, Nigeria) and water ad libitum throughout the period of acclamitization. Virgin female albino rats were randomly assigned to three dietary groups. They were fed ad libitum with

(1) high-CHO water (sucrose) and BCFD (B.coriacea formulated Diet),

(2) high-CHO water (sucrose) and rat pellets

(3) BCFD (B.coriacea formulated Diet) for 2 wks before conception. After 2 wks, all animals were time-mated, and pregnancy was determined by the presence of vaginal plug. The diet assigned to an animal before conception was also given throughout the gestation and lactation period. Food intake and body weights of the dams were measured every 3 days until their offspring had been weaned. All offspring were weaned at 3 weeks of age onto the standard chow diet and maintained on this diet ad libitum until the point of sacrifice. All mice had free access to water throughout the study. We refer to the adult offspring born to dams fed the BCFD diet during gestation and lactation as “BCFD offspring,” and to the adult offspring born to dams fed sucrose diet as “negative offspring.” While offsprings that received sucrose + BCFD were called sucrose + BCFD offsprings. Offspring (at 3 weeks old, were fasted for 12 h and euthanized the next day by petroleum ether inhalation and cervical dislocation. Blood was collected by cardiac puncture, and pancreas tissue was collected, snap-frozen in icecold sucrose, and stored at 80°C for later analysis. Plasma glucose, Leptin were determined with the use of an autoanalyzer (Konelab 20, Thermo Electron) and lipid peroxidation was performed on the organ.

**3.3 PREPARATION OF SUCROSE SOLUTION**

Sucrose solution (20%) was prepared daily by dissolving 20 g of Sucrose in 100 ml of tap water. The animals were fed with the 20% Sucrose solution ad libitum throughout the period of theSucrose solution (20%) was prepared daily by dissolving 20 g of Sucrose in 100 ml of tap water. The animals were fed with the 20% Sucrose solution ad libitum throughout the period of the experiment. The control groups received normal drinking water ad libitum throughout the period of the experiment.

**3.4 STUDY DESIGN**

The animals were divided into 4 groups of 6 rats each as follows:

Group A served as the normal group

Group B served as the Buchholzia Coricea and Sucrose group

Group C served as the sucrose group

Group D served as the Buchholzia Coricea group

The rats ate normal food after two weeks before the introduction of the wonderful kola and sucrose.

Out of all the groups 2 were administered sucrose.

**3.5 PREPARATION OF THE SUCROSE AND BUCHHOLZIA CORICEA FOR ADMINISTRATION**

10g of sucrose in 100ml of water in the sucrose group.10g of sucrose in 100ml of water, 2og of wonderful in 80g of feed in the sucrose and wonderful kola group.20g of wonderful kola in the wonderful kola group.

**3.6 TEST FOR GLUCOSE:**

Animals were subjected to overnight fast and blood samples were collected by slightly cutting the tip of the tail with a blade, and then gently squeeze the tail to let out drops of fresh venous whole blood on a glucometer strip properly inserted in a glucometer.

**3.6.1 PRINCIPLE:**

When blood is dropped on the red squared spot on the test strips inserted inside the glucometer, glucose in the blood reacts with the chemical reagent on the test strip.

Glucometer test strip is based on double sequential enzyme reaction in which an enzyme, glucose oxidase (GOD) converts glucose to hydrogen peroxide and glucuronic acid while peroxidase oxidizes the dye in the test strip to produce a color. The blood glucose level in mg/dl will be displayed on the screen after 15 seconds. The reduction equations are shown below:

Glucose +O2 Glucose Oxidase Glucose +H2O2

H2O2 + dye peroxidase oxidized does + H2O2 + H2O

**3.7 LEPTIN ASSAY PROCEDURES**

All reagents reached room temperature before use. Calibrators, control, and samples were assayed in duplicate. Once the procedure has been started, all the steps were completed without interruption. Streptavidin- ARP conjugate and wash buffer working solutions were prepared.

20 µL of each calibrator, control and serum sample were pipeffed into the corres ponding labeled walls in duplicate and also 80µL of the monoclonal anti-leptin between conjugate was pipette into each wall. A plata shaker was incubated for I hour at room temperature. The wells were washed 3 times with dilute wash buffer and the plate tapped firmly against absorbent paper to ensure that it is dry. Plate shaker was incubated for 30 minutes at room temperament. The well was washed three times with dilute wash buffer. 100µL of TMB substrate into each well at timed intervals. Plate shaker was incubated for 10-15 minutes at room temperature. 50µL of stop solution was pipette into each well. The plate on a micro well plate reader was read at 450 nm within 20 minutes after the addition of the stop solution.

The level of oxidative damage on the tissues was estimated by quantifying the amount of thiobarbituric acid reactive substances (TBARS) present in the sample following the method described by Varshney and Kale (1990).

**ASSESSMENT OF LIPID PEROXIDATION**

The level of oxidative damage on the tissues was estimated by quantifying the amount of thiobarbituric acid reactive substances (TBARS) present in the sample following the method described by Varshney and Kale (1990).

**Principle**

Malondialdehyde (MDA) which is produced from the peroxidation of membrane fatty acid and food products under acidic condition reacts with chromogenic reagent, 2-thiobarbituric acid (TBA), to give off a pink coloured complex with maximum absorbance at 532 nm.

**Reagents**

1. Trichloroaceticacid (TCA 30%): TCA(9 g) was dissolved in distilled water and made up to 30ml with same.
2. Thiobarbtituric acid (0.75%): this was prepared by dissolving 0.225g of thiobarbituric acid (TBA) in 0.1 M HCL and made up to 30ml with same.
3. Tris-KCL buffer (0.15 M, pH 7.4): KCL (1.12 g) and 2.36 g of Tris base were dissolved separately in distilled water and made up to 100 ml with same and pH was then adjusted to 7.4.

**Procedure**

In a test tube containing 0.4 ml of the homogenate (cytospine) add 1.6 ml of Tris-KCL buffer followed by 0.5 ml of 30% TCA. Then add 0.5ml of0.75/% TBA was added and placed in a water bath for 45minutes at 80 C. remove and place on ice and separate using a centrifuge at 3000 g, using a pipette, collect the clear supernatant and record the absorbance measured against a reference blank of distilled water at 532 nm. The level of MDA was determined according to the method of Adam-Vizi and Seregi (1982).

**3.8 STASTICAL ANALYSIS**

Results were represented as mean ± standard error of mean(SEM) of triplicate readings. Differences between groups was determined by one- way analysis of variance (ANOVA) using statistical package for social sciences (SPSS, version 21.0) followed by post hoc testing performed for inter group comparisons using the least significance difference (LSD). Significance level was set at p0.05.

**CHAPTER FOUR**

**4.0 RESULTS**

**4.1 BLOOD GLUCOSE LEVEL**

**Figure 1**

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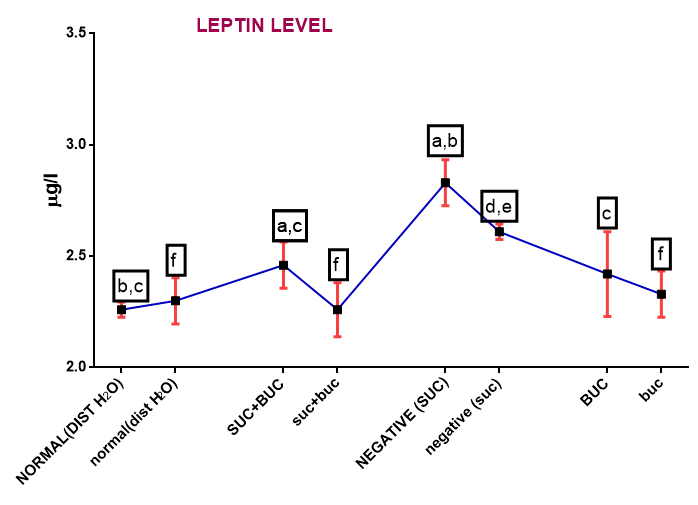
figure 1 Effects of *b.coriacea formulated diet* on Blood glucose levels of normal and sucrose induced pregnant Wistar rats and their offsprings. Results represented as Mean±SEM. n= 3. ap< 0.05 when compared with normal control group. bp< 0.05 when compared with control SUC + BCFD group. cp< 0.05 when compared with negative control group. dp< 0.05 when compared with control normal group (offspring). ep< 0.05 when compared with control SUC + BCFD group (offspring). fp< 0.05 when compared with control negative group (offspring). BCFD: *b.coriacea formulated diet,* SUC: Sucrose, DIST H2O: Distilled Water.

**Blood Glucose Level**

Effects of b.coriacea formulated diet on Blood glucose levels of normal and sucrose induced pregnant Wistar rats and their offsprings. SUC (20%) (untreated) significantly elevated blood glucose levels by at least 3 folds (as compared with normal control group) when compared with the baseline. However, following treatment with BCFD, the Blood glucose level in treated rats were significantly reduced when compared with the baseline. Interestingly, all offspring showed reduced blood glucose level except for the negative control whose offspring showed significant increase (p<0.05) in the blood glucose level when compared with the normal group.

**4.2 LEPTIN**

**Figure 2**

****

Effects of b.coriacea formulated diet on serum leptin levels of normal and sucrose induced pregnant Wistar rats and their offsprings. Results represented as Mean±SEM. n= 3. ap< 0.05 when compared with normal control group. bp< 0.05 when compared with control SUC + BCFD group. cp< 0.05 when compared with negative control group. dp< 0.05 when compared with control normal group (offspring). ep< 0.05 when compared with control SUC + BCFD group (offspring). p< 0.05 when compared with control negative group (offspring). BCFD: b.coriacea formulated diet, SUC: Sucrose, DIST H2O: Distilled Water.

**SERUM LEPTIN**

Effects of b.coriacea formulated diet on serum leptin levels of normal and sucrose induced pregnant Wistar rats and their offsprings using enzyme linked immunosorbent assay (ELISA) method. An administration of SUC (untreated) to animals produced a significant increase in serum leptin levels when compared with normal group. However, following treatment with BCFD, the leptin in treated rats were significantly reduced when compared with the untreated. All offspring showed reduced serum leptin levels except for the negative control whose offspring showed a significant increase (p<0.05) in the serum leptin levels when compared with the normal group.

**4.3 LIPID PEROXIDATION (PANCREAS)**

**Figure 3** 

Effects of *b.coriacea formulated diet* on Pancreas lipid peroxidation of normal and sucrose induced pregnant Wistar rats and their offsprings. Results represented as

Mean±SEM. n= 3. ap< 0.05 when compared with normal control group. bp< 0.05 when compared with control SUC + BCFD group. cp< 0.05 when compared with negative control group. dp< 0.05 when compared with control normal group (offspring). ep< 0.05 when compared with control SUC + BCFD group (offspring). fp< 0.05 when compared with control negative group (offspring). BCFD: *b.coriacea formulated diet,* SUC: Sucrose, DIST H2O: Distilled Water.

**LIPID PEROXIDATION (PANCREAS)**

Effects of b.coriacea formulated diet on normal and sucrose induced pregnant wistar rats and their offsprings on lipid peroxidation levels in the kidney. Untreated rats significantly increased (p< 0.05) lipid peroxidation levels measured as malondialdehyde (MDA) in the kidney when compared with normal control group. Also, MDA levels significantly reduced when compared between normal control and BCFD treated group. All offspring showed lowered MDA levels when compared with normal control groups.

**CHAPTER FIVE**

1. **DISCUSSION AND CONCLUSION** 
   1. **DISCUSSION**

*Buccholozia Coriacea* is a wonderful herb with incredible healing powers. The plant is widely used all over the world for different medicinal purposes. In Nigeria it is used for treating fever. Sucrose is produced naturally in plants form which table is refined. Sugar is often an added ingredient in food production and food recopies.

In the study in the test for glucose level, in group A, B,D. In group C there was an increase in blood glucose level, there was a significant value because the glucose level was high compared to the other group. The leptin level, an administration of sucrose to animal produce a significant increase in serum leptin levels when compared with normal group. The lipid peroxidation, the untreated group increased lipid peroxidation levels measured as malondialdehyde in the pancreas, when compared with normal group.

However, in group B which was induced both *bucholozia coricea* and sucrose. It was observed that *bucholozia coricea* helped in regulating the glucose, lipid peroxidation and leptin level.

After the treatment there was a significant reduction (p< 0.05 ) in the glucose concentration of the treated group.

**5.2 CONCLUSION**

In conclusion, I have presented a novel data showing that a maternal diet enriched with high energy(sucrose) during gestation and lactation increases blood glucose and leptin concentration in their offspring and the high level of leptin leads to leptin resistance thus the satiety level will never be reached and the organisms will countinue eating till they become obsessed.

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