ANTI NUTRITIONAL AND VITAMIN COMPOSITION OF SPONGE CAKE PRODUCED FROM COMPOSITE (CASSAVA AND SWEET POTATOES) FLOUR

BY

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CERTIFICATION

This is to certify that this project work was carried out by **OGEDEGBE PROGRESS** with Matriculation Number: **AST/2102050100** in the Department of Food Technology, Auchi Polytechnic, Auchi, Edo State.

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DEDICATION

This project work is dedicated to God Almighty for his mercies, protection and for the gift of life, and also for his divine wisdom for the successful completion of this project.

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I wish to express my profound gratitude to God Almighty for his infinite mercies and guidance throughout the successful completion of my study.

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ABSTRACT

The study was carried out to access the anti-nutrients and vitamins properties of sponge cake made from sweet potato and cassava flour. The production of sweet potato flour was carried out by washing, cleaning, peeling, slicing, draining, kiln dryer, milling, sieving and packaging, while the production of cassava flour was carried out by peeling washing, slicing, drying, milling, cooling, sieving and packaging. Four sample of the sponge cake were prepared from the composite flour labeled as sample A (0g of cassava flour + 125g of sweet potato flour). B (83g of cassava flour + 167g of sweet potato flour), C (50% of cassava flour + 50% of sweet potato flour), D (125g of cassava flour + 188g of sweet potato flour). The sponge cake was analyzed for anti-nutrient and vitamin. The results of phytate were 8.53mg/100g, 5.69mg/100g, 4.47mg/100g and 4.51mg/100g for sample OPA, OPB, OPC and OPD respectively. The result of oxalate recorded OPB, 9.73mg/100g for sample OPC, and 9.36mg/100g for sample OPD. The result of the tannin content recorded were 0.223mg/100g, 0.22mg/100g, 0.17mg/100g and 0.21mg/100g for sample OPA, OPB, OPC and OPD respectively. The result of the phenol content recorded were 5.85mg/100g for sample OPA, 5.51mg/100g for sample OPB, 4.30mg/100g for sample OPC and 5.14mg/100g for sample OPD. The result of phytic acid were 2.40mg/100g, 1.60mg/100g, 1.31mg/100g and 1.27mg/100g for sample OPA, OPB, OPC and OPD respectively. The result of HCN were; sample OPA 0.00mg, sample OBC, 1.3mg/100g, sample OPC 2.35mg/100g and sample OPD 1.25mg/100g. The vitamin properties includes vitB_1, vitB_2 and vit$C_{3..}$ The result of vitB_1 were 2.27mg/100g for sample OPA, 2.26mg/100g for sample OPB, 2.27mg/100g for sample OPC and 2.29mg/100 for sample OPD. The results for vitB_2 were 0.73mg/100g, 1.15mg/100g, 1.49mg/100g and 0.73mg/250g for sample OPA, OPC, and OPD. The result for vitB_3 were 0.58mg/100g for sample OPA, 0.28mg/100g for sample OPB, 0.76mg/100g for sample OPC and 0.98mg/100 for sample OPD. The result indicates that all cakes were of good quality. However, sample A (0g of cassava floor + 125g of sweet potato flour) was more preferred hence it was recommended. The results show that sweet potatoes flour and cassava flour are suitable for the baking industry and improve nutritional quality of product.

CHAPTER ONE

1.0 INTRODUCTION

Sweet potatoes (*Ipomoea batatas*) is a vital tuber crop, whose important role in improving household and national food security, health and livelihoods of poor families in sub-saharan Africa is becoming recognized gradually (Shasha, 2009; Cip, 2013). Several varieties exist with a wide range of skin and flesh color, from white to yellow – orange and deep purple (Cip, 2013). Sweet potatoes (*Ipomoea batatas*) roots are bulky and perishable unless they are cured. The bulkiness and perishable nature of the root are major constraint on the marketing and availability of the crop. This limits the distance over which sweet potato can be transported economically. Sweet potatoes as a crop has many good attributes such as high yield, wide ecological adaptability, low input requirements, and shorter growing period than other root crops, sweet potatoes roots are rich in carbohydrates and among the world's major food crops which produce the highest amount of edible energy per hectare per day (Adegunwa *et al*., 2010). Despite high carbohydrates content, sweet potato has a low glyremic index, indicating low digestibility of starch (ILSI, 2008). It is the only starchy staple cup, which contains appreciable amount of B-carotene, ascorbic acid and the amino acid, lysine that is deficient in cereal-based diets like rice. It also contains appreciable amount of soluble fibre which helps in reducing cholesterol level and anti-oxidant nutrient which can inhibit the development of coronary heart disease (Misra and Kulshrestha, 2003). Sweet potato is a perennial plant that is typically cultivated as an annual crop (Janssens, 2001). It is a root crop that provides food to a large segment of the world populations, especially in the tropics where the bulk of the crop are cultivated and consumed. Raw sweet potato roots can be processed into forms with a longer sheet life and characteristics, more in keeping with latent demand and emerging utilization patterns. However, based on diagnostic assessments carried out in developing countries, processing of sweet potato into forms such as dried chips, starch and flour were identified among the most promising options (Van Hall, 2000).

1.1 STATEMENT OF PROBLEM

Potato (tuber) is a good source of starch. However, it is underutilized despite it nutritive composition, health benefit as well as importance in human diet. This study is aimed at projecting the utilization of sweet potato flour for confectionery (cake), hence the determination of ant-nutrient and vitamin content of the sponge cake.

1.2 JUSTIFICATION

Increasing urbanization in African countries is changing the food habits and preferences of the population towards convenience food. Cake, bread, biscuits and other baked products are some of the foods now relished by the populace. Cakes are ready to eat, convenient and inexpensive food product. The principal ingredients are flour, fat, sugar and eggs while other ingredients include milk, salt, flouring agent and baking powder (Olaoye *et al.*, 2007).

The utilization of sweet potato flour provides cake with beta carotene, an antioxidant that helps the body to scavenge free radicals thereby limiting damages to cell membranes, DNA and protein and also helps reduce the risk of cardiovascular diseases (Adelete *et al.*, 2010).

1.3 AIMS OF THE STUDY

The aims of this research are:

- To produce sponge cake from cassava and sweet potatoes flour.
- To determinate anti-nutritional properties of the cake.
- To determine vitamins composition of sponge cake.

CHAPTER TWO

2.0 LITERATURE REVIEW

Sponge cake is a light cake made with egg, white's flour and sugar, sometimes leavened with baking powder. Sponge cakes, leavened with beaten eggs, originated during the Renaissance, possibly in Spain castellan *et al.*, (2010). The sponge cake is thought to be one of the first of the non-yeasted cakes, and the earliest attested sponge cake recipe in English found in a book by English poet Gervase Markham, (Davidson *et al.*, 2002). Still the cake was much more like a cracker: Hin and Crispy sponge cakes became the coke recognized today when bakers started using beaten eggs as a rising agent in the Mid-18th Century. The Victorian creation of baking powder by English food manufacturer Alfred Bird in 1843 allowed the addition of butter to the traditional sponge recipe, resulting in the creation of the Victoria sponge.

Cassava flour is a gluten-free floor made from the tuber cassava, which is a native to South America and grown in tropical and sub-tropical regions Shuboli *et al.*, (2017). Despite cassava's nutty flour, its flour has a light or neutral taste and a fine or smooth texture. It's predominantly white in color, although you may find some with a light red or yellow hue, depending on the cassava variety. (Nilusha 2021). Cassava flour as a highly versatile ingredient with numerous uses in the food industry including, in all sorts of baked foods, tortillas, porridge, pancakes, gluten free pasta and pizza.

Manufactures also sometimes use it as a thickener for ice-cram, sources and dressings. In low moisture content, gives cassava flour a long shelf-life as long as it's stored away from moisture. Nilusha *et al.*, 2021).

The sweet potato or sweet potato (*ipomoea batatas*) is a dicotyledonous plant that belongs to the bindweed or morning glory family, Convolvulaceae. As large, starchy, sweet-tasting tuberious roots are used as a root vegetable Woolfe *et al*., (1992). The young shoots and leaves are sometimes eaten as greens. Cultivars of the sweet potato have been bred to bear tubers with flesh and skin of various colors. Sweet potato is only distantly related to the common potato (solanum tuber osum), both being in the order solanales. Although darker sweet potatoes are often referred to as "Yams" in parts of North America, the species is not a true Yam, which are monocots in the order pioscoreales, Emory Dean Keoke *et al.,* (2009). Sweet potato is native to the tropical regions of the Americas of the approximately 50 gener and more than 1,000 species of Convolvulaceae, I. batatas is the only crop plant of major importance some others are used locally (e.g., I. aquatie "Kangkong"), but many are poisonous. The genus ipomoea that contain the sweet potato also includes several garden flowers called morning glories, although some cultivars of .I. batatas are grown as ornamental plants under the name tuberous morning glory, and used in horticultural context.

2.1 HEALTH BENEFITS OF CASSAVA FLOUR

The benefits of consuming cassava flour products come from their high resistant starch content.

2.1.1 May help Improve Metabolic Markets:

Human and animal studies suggest that resistance starch may improve metabolic marketers, such as blood sugar and cholesterol levels, which are linked to non-communicable diseases (NCDs), (Erika Cione *et al*., 2021). NCDs are chronic disorders that appear due to a combination of genetic, physiological environmental and behavioral factors. Some of the most common NCDs are type 2-diabetes and heart disease due to high blood pressure and cholesterol levels. (Xiaoping Yang *et al*., 2017).

Nevertheless, resistant starch may help improve your blood control, (Laure *et al*., 2015).

- Slowing down the rate of digestion of foods, leading to a slower rise in blood glucose levels.
- Improving insulin sensitivity, meaning that your cells respond better to the hormone insulin studies also shows that it may help lower blood cholesterol level. (Laure *et al*., 2015).

2.1.2 May Aid Weight Loss

Resistant starch in cassava flour may aid weight loss by regulating your appetite and reducing fat mass. Human and animal, studies show that when bacteria in your gut digest resistant starch, they produce short chain fatty acids (SCFAS). This trigger the release of the hunger – reducing hormones petide YY (PYY) and glucagon – like peptide 1 (Glp – 1) (Zhou *et al*., 2015).

As for the effect of resistant starch on the body fat, a 4 – week study in 19 adults found that taking 40 grams of resistant starch per day significantly reduced two types of belly fat – the fat just under the skin and the visceral fat that lies between the organ, (Lei *et al*., 2019).

2.1.3 May Improve Gut Health

Cassava flour resistant starch content can benefit gut health in more than one way (Tao *et al*., 2021), because resistant starch gets fermented in the large intestine, it serves as a prebiotic or food for gut's friendly bacteria. As a prebiotic, resistant starch promotes microbial growth, helping counteract gut dysbiosis – an altered microbiota – which has been associated with disease such as obesity, diabetes, inflammatory bowel diseases and colorectal cancer. (Xiaoping *et al*., 2017). In addition, resistant starch in cassava flour may have a protective effect of guts mucosal epithelium or lining by increasing production of an SCFA called butyric acid. Damage to gut lining may increase intestinal permeability, increasing the risk of diseases such as inflammatory bowel disease; (Tao *et al*., 2021).

2.2 NUTRITIONAL BENEFITS OF SWEET POTATO

The nutritional composition of sweet potato are important in meeting human nutritional needs including carbohydrates, fibers, Grothes, thramina, riboflavin, niacin, potassium, zinc, calcium, iron, vitamins A and C and high quality protein. Sweet potato provides energy in the human diet in the form of carbohydrates, they are also rich in dietary fiber and have high water content and also provide 35kj energy with low total liquid content, which is only about 0.05g per 100g and low in cholesterol. The carbohydrate content of the storage roots varies from 25%, while the rest is composed of water (50% - 72%) in addition, sweet potatoes also are high in minerals such as potassium, calcium, magnesium, sodium, phosphorus and iron (USDA, 2009). Some varieties of sweet potatoes contain colored pigments such as B-carotene, anthocyanin and phenolic compounds. Nutritionally, sweet potatoes usually have higher protein content than other tubers such as cassava and yam (Ray and Ward, 2006). Sweet potatoes are comparatively a nutritional heavy weight rich in complete carbohydrates, vitamin C and E, and also contains good quantities of vitamins A and B, calcium and iron. The tubers can be steamed, roasted, boiled, baked and fried (Nungo *et al*., 2007). In nutritional terms, sweet potato, particularly the yellow fleshed varieties are good sources of vitamin A (300 micrograms/100grams, fresh weight). A comparison with other food crops shows that it yields more calories per unit area than maize, it yields more calories per unit area than maize and nearly as much as cassava, while its portion yields is far higher than the tubers. On worldwide scale, the economic importance of sweet potato among all food crops is exceeded only by cereals (wheat, rice, maize and barley) (Opiyo, 2011).

Sweet potato skin colour come in various shades of creamy white, yellow-orange, tan, reddish-purple and red. Sweet potato has also been used in the production of purees and these can be used as an ingredient in various products including baby food, casseroles, puddings, pies, cakes, bread, restructured fries, pathes, soups and beverages (Walter *et al*., 2001).

Table 2: Nutritional Value of Raw Sweet Potato per 100g

NUTRIENTS	Unit Value Per 100g
Water	77.28g
Energy	359.00kj
Protein	1.57g
FGT	0.05g
Ash	0.99g
Carbohydrate	20.12g
Fiber	3.00g
Calcium	30.00g
Iron	0.61mg
Magnesium	25.00mg
Phosphorus	47.00.mg
Potassium	337.00mg
Sodium	55.001mg
Vitamin	2.40mg
Pantothenic acid	0.80mg
Vitamin B6	0.21mg
Vitamin A	141.87Iu

Source: USDA National Nutrient Data Base (2009)

2.3 USES OF CASSAVA FLOUR

One of the most popular uses of cassava flour in the world is in the manufacturing of baked products such as bread, cakes and pastries. Cassava flour as raw material for the bakery and pastry industries is a substitute for wheat flour and can be used in the elaboration of products such as thickeners, dehydrated soups, noodles, extruded products, seasonings, breaded body food, sweets and processed meal (Adebayo *et al*., 2010). A number of studies have been conducted to sue cassava flour in bread making. Most of the studies revealed that wheat flour can be replace by 5 to 10% cassava flour without significant effect on processing and the quality of bread. Substitutions of up to 30% have been made to obtain acceptable breads. Some factors that influence the quality of products made with wheat cassava composition have been studies such as the types of varieties of cassava (Eduardo *et al*., 2013).

2.4 HEALTH BENEFIT OF SWEET POTATOE

2.4.1 Support Health Vision

Sweet potatoes are incredible rich in beta, Carotene the antioxidant responsible for the vegetable's bright orange color. In fact, one cup (200 grams) of baked orange sweet potato with skin provides more than seven times the amount of beta carotene that the average adult needs per day. Beta-carotene is converted to vitamin A in your body and used to form light-defecting receptors inside your eye.

Dawson, (2000) stated that several vitamin A deficiencies is a concern in developing countries and can lead to a special type of blindness known as xerophihalmia. Eating foods rich in beta, Carotene, may help prevent this condition (Mini *et al*., 2016). Test tube studies have found that the anthocyanin they provide can protect eye cells from damage, which may be significant to overall eye health. (Zakpa, 2010).

2.4.2 May support Immune System

Orange – fleshed sweet potatoe are one of the richest natural sources of beta – carotene, a plant based compound that is converted to vitamin A in your body. Vitamin A is critical to a healthy immune system, and low blood levels have been linked to reduced immunity (Rodrigo *et al*., 2008). It's also for maintaining healthy muocos membranes especially in the lining of your gut. The gut is where your body is exposed to many potential diseases – causing pathogens. Therefore, a healthy gut is an important part of a healthy system. Studies have shown that vitamin A deficiency, increases gut inflammation and reduces the ability of your immune system to respond properly to potential threats.

2.4.3 May Enhance Brain Function

Consuming purple sweet potatoes may improve brain function. Animal studies have found that the anthocyanins in purple sweet potatoes can protect the brain by reducing inflammation and preventing free radical damage. Gun Shan *et al.,* (2009). Supplementing with anthocyanin-rich sweet potato extract has been shown to improve learning and memory in mice, possibly due to its antioxidant properties. No studies have been done to test these effects in humans, but in general, diets rich in fruits, vegetables and antioxidants are associated with a 13% lower risk as mental decline and dementia (Raboy, 2009)

2.4.4 May have Cancer – Fighting Properties

Sweet potatoes offer various antioxidants, which may help potatoes against certain types of cancers. Anthocyanins – a group of antioxidants found in purple sweet potatoes – have been found to slow the growth of certain types of cancer cells in test-tube studies, including those of the bladder, colon, stomach and breast.

Similarly, mice feed diets rich in purple sweet potatoes showed lower rates of early-stage colon cancer-suggesting that the anthocyanins in the potatoes may have a protective effect.

Lim *et al.,* (2013) reported extracts of orange sweet potato peels have also been found to have anti-cancer properties in test tube studies. However, studies have get to test these effect in humans.

2.4.5 Promote Gut Health

The fiber and antioxidants in sweet potatoes are advantageous to gut health. Sweet potatoe contain two types of fiber: soluble and insoluble. Your body cannot digest either type. Therefore, fiber stays within your digestive tract and provides a variety of gut related health benefits. Certain types of soluble fiber – known as viscous fibers – absorb water and soften your stool. On the other hand, non-viscous, insoluble fibers don’t absorb water and add bulk. Some soluble and insoluble fibers can also be fermented by the bacteria in colon, creating compounds called short-chain fatty acids that feel the cells of your intestinal lining and keep them in healthy and strong condition. (Topping *et al.,* 2001).

Fiber rich diets containing 20-33 grams per day have been kinked to a lower risk of colon cancer and more reglar bowel movements. The antioxidant in sweet potatoes may provide gut benefit as well. Test-tube studies have found that antioxidant’s in purple sweet – potatoes promote the growth of healthy gut bacteria, including certain bifidbacterium and lactobacillus species (Sun *et al.,* 2018).

2.5 TYPES OF SWEET POTATOES

Varieties of sweet potatoes include: Beauregard, Jewel, Red Garnet, Covington, Centennial, Hernandez, O’ Henry, Japanese white (Satsuma imo, koto buki or oriental), Hurasaki (Japanese sweet potatoes), Hannah, Batota, Okinowa (Hawaiian sweet potatoes), Stokes purple (Adejunwa et al., 2010).

Jewel: It has copper skin and light orange flash very similar to the Beauregard. It has a more robust flavor, but not as sweet, with a soft and moist texture. Great for casseroles, mashes pies, baking and roasting. (Castella, 2010).

Red Garnet: This deep reddish – orange skin and bright orange flesh has a more savory taste and is the least sweet compared to other varieties. It also can be higher in moisture level, giving a softer texture. Great for mashing into a puree for casseroles, baked or roasted, or used for dessert that has added sweeteners. (Singh *et al*., 2008)

Covington: The orange – colored skin with speckled dark brown spots has a matting sweetness. The Texture is moist and creamy, a favorite variety I the south to make casseroles and desserts or just slice and roast (Mimi *et al*., 2016).

Centennial: Copper orange skin and bright orange flesh. Sweet with a moist texture, also known as Baby bakers. Great for baking and slicing for fries (Olaoye *et al*., 2007).

Hernandez: The red skin moist orange flesh, sweeter composed to Beauregard's, bake, roast, or dice for soups and stew (Adeleke and Odedeji, 2010).

O' Henry: Their tan skin and cream – colored flesh have a slightly sweet taste. The texture is more firm and dense yet creamy. Good for mashing, boiling, roasting, baking, soups and stews (Adeleke and Odedeji, 2010).

Jersey: The tan – colored skin with while flesh is moderate in sweetness. The dry texture works well for keeping it's shape when made into fries and is added to soups, stew and curies (Raboy, 2009).

Japanese white: Beneath the dark purple skin, there is a creamy yellow flesh that gets deeper in color when cooked. This variety is very sweet, starchy, dense, and moist. It has a lovely chestnut flavor, with a smooth and velvety texture, great baked, roasted, or steamed (Zakpa, 2010).

Murasaki: Originated in Louisiana and primarily grown in California. A reddish purple skin with white flesh that turns golden in color when cooked very sweet in flavor with vanilla, brown sugar, and nutty notes. The texture is starchy and moist. Great for roasting or mashing and adding of casseroles or desserts (Eadesse *et al*., 2015).

Hannah: With a smooth, tan – colored skin and Ivory flesh, as it cooks, the color gets more golden. The texture is firm, dense and dry, similar to reset potatoes with a light sweetness. Good for mashing, roasting into cubes, making into fries or frying for the lower amount of sugar (Rodrigo *et al*., 2008).

Batata: Pale yellow skin and white flesh grown in the Caribbean. It has a mild sweetness and starchy flavor. Great for boiling, mashing, or adding in chunks to soups and stews (Rodrigo, 2008).

Okinowa: The tan outer skin isn't impressive until you cut open and see the gorgeous purple flesh. The dark pigments make his variety one of the hearthest. The texture is more dense, dry and mealy, with a sweet and nutty flavor, often used in Japanese desserts or Hawaiian dishes. It can be roasted, baked boiled, steamed, or added to soups, stews, and braises (Shubo *et al.,* 2017).

Stokes purple: Cultivated in North Carolina, use light purple skin reveals a deep purple flesh. It has a moldy sweet taste, floral notes and a more firm and dry texture suitable for baking boiling and steaming (Tadesse *et al*., 2015).

2.6 USES OF SWEET POTATO

Sweet potato is an important crop in many part of world. The storage roots of sweet potato serve as staple food, animal feed, and to a limited extent as a raw material for industrial purposes as a starch source and for alcohol production. In Japan dehydrated sweet potato is ground into flour, which is cooked for human consumption. Sweet potato starch is used for the manufacture of adhesives, textile and paper sizing and in the confectionery and baking industries in most part of the tropics, roasted or fried; preparation practices vary according to the location (Singh *et al*., 2008).

2.7 IMPORTANCE OF SWEET POTATO

Sweet potato (*ipomoea batatas lam*) is the seventh most important food crop in the world. It is grown in many tropical and subtropical regions among the world major food crops, sweet potato produces the highest amount of edible energy per hectare per day (Singh *et al*., 2008)

Sweet potato varieties with dark orange flesh are richer in B-carotene than light fleshed varieties their increased cultivation is being encourage in Africa where vitamin A deficiency is a serious public health problem. Sweet potato are an excellent source of carbohydrates for those with blood sugar problems. These fibrous root vegetables can help regulate blood sugar levels and prevent conditions like insulin resistance. It is healthy for the digestion tract. Being rich in digestive fibre, especially when the skin is also consumed; it helps to relieve constipation and may prevent colon cancer (Van Jaarsveld *et al*., 2005). It is good for those who are pregnant or trying to conceive because they are high in foliate, which is essential for the healthy development of fetal cell and tissue. Eating sweet potato can boost immunity by supporting the need of the body and it is good for preventing heart disease. High in potassium, sweet potatoes can helps prevent the onset of heart attack and stroke. Potassium also helps to maintain fluid and electrolyte balance in the body, which is important for stabilizing blood pressure and regulating heart function. Sweet potatoes are good for alleviating muscle cramps.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 MATERIALS

Sweet potato flour, cassava flour, sugar, egg, baking powder, butter, nutmeg, salt, flavor and milk were purchased from Uchi market in Auchi, Edo State. Other equipment used were knives, plastic bowls, cabinet drier, hot air oven, baking tray, sieve, spoons, slicer, measuring cup were gotten from the market.

3.2 METHODOLOGY

3.2.1 Production of Cassava Flour

Cassava flour used was produced using two different methods as described by (Eke and Kabari, 2010). Cassava tubers were sorted and washed to remove sand, dirt and other adhering materials. The tubers were peeled using a sharp stainless knife into portable water. The cassava was sliced with a slicer (2mm thick) into clean water. This was drained from the cassava using a sieve. It was spread out on a foil paper and placed in the kiln dryer at 65^0C - 70^0C for 3-5 hours. The dried cassava was milled to powder using hammer mill, it was allowed to cool and the milled cassava flour was sieved to remove lumps/coarse flour particles.

Cassava root

↓

Peeling

↓

Washing

↓

Slicing

↓

Drying (Kiln dryer at 3-5 hours)

↓

Milling

↓

Cooling

↓

Sieving

↓

Packaging

Figure 3.1: Flow chart for the production of cassava flour.

3.2.2 PRODUCTION OF SWEET POTATO FLOUR

Fresh potato was washed thoroughly to remove sand and dirt the potato was peeled with sharp stainless steel knife into clean water. The potato was slice with slicer (2mm thick) manually into clean water, the water was drained from the potato using a sieve. It was spread out on a foil paper and layed in the kiln dryer at 65^0C -70^0C for 3-5hours. The dried potato was milled to powder using hammer mill, it was allowed to cool and the milled potato flour was sieved to remove lumps/coarse flour particles and it was package using polyethylene nylon.

Sweet potato tuber

↓

Washing and cleaning

↓

Peeling

↓

Slicing

↓

Draining

↓

Drying (Kiln dryer 3-5 hours)

↓

Milling

↓

Sieving

↓

Packaging

Figure 3.2: Flow chart for the production of sweet potato flour.

3.3 COMPOSITE FLOUR FORMULATION

The composite flour samples were prepared by combining sweet potato flour and cassava flour.

Code	Sweet potato flour%	Cassava flour%
OPC	50	50
OPA	0	100
OPB	80	20
OPD	90	10

3.4 PRODUCTION OF SPONGE CAKE

The production of sponge cake sugar was added to margarine in a mixing bowl and mixed until its become fluffy (for about 30minutes). Egg, vanilla flavor, and milk were added while mixing and then for a total approximately 5minutes. Sweet potato flour and baking powder was added into the mixture until everything blend together. The cake pan was grease and then the mixture was poured into it and baked at 180^0C for about 45minutes.

Butter

↓

Sugar

↓

Egg

↓

Flour

↓

Mixing

↓

Greasing

↓

Baking (for 45minutes)

↓

Cooling

↓

Packaging

3.5 ANALYSIS CARRIED OUT

3.5.1 Anti nutritional factors determination

The anti nutrient (oxalate, phytate, trypsin and tannin) content of the samples was determined by the spectrophotometric method; 5g sample was dispersed in 50ml of distilled water and shaken. The mixture was allowed to stand for 30mins at 28^0C before it was filtered and dispersed into a 50ml volumetric flask. Reagent was added to each of the flask and then 2.5ml of saturated Na_2 CO_3 solution was added and allowed to incubate at 28^0C for 90mins, their respective absorbance was measured in a spectrophometer at 260mm using the reagent blank to calibrate the instrument at zero (AOAC, 2010).

3.5.2 Determination of Vitamins

Colorimeter was adopted for the determination of vitamins content of samples. The vitamins content (vitamin B1, vitamin B2 and vitamin B3) were determined. Samples of 2g were weighed into 25ml. volumetric flask mixed with 10ml, the samples solution obtained was filtered through filter paper containing 5g anhydrous Na_2SO_4 into volumetric flask. The readings of the solution and the blank were taken from the colorimeter and adjusted to zero absorbance or 100%.

CHAPTER FOUR

4.0 RESULT AND DISCUSSION

4.1 RESULTS

Table 4.1.1: Antinutirentional content of sponge cake produced from cassava sweet potato flour.

	SAMPLES			
Antinutrient	OPA	OPB	OPC	OPD
Phytate	$8.53±0.11^{a}$	$5..69±0.22^{b}$	$4.67±.0.04^{c}$	$4.51±.001^{c}$
Oxalate	$10.01±0.01^{a}$	$9.73±0.02^{b}$	$9.54±.0.00^{c}$	$9.36±.002^{d}$
Tannins	$0.23±0.00^{a}$	$0.33±0.01^{b}$	$0.17±.0.01^{d}$	$0.21±.0.00^{c}$
Phenols	$5.85±0.09^{a}$	$5.51±0.02^{b}$	$4.30±.0.17^{d}$	$5.14±0.07^{c}$
Phytic acids	$2.40±0.03^{a}$	$1.60±0.06^{b}$	$1.31±.0.01^{c}$	$1.27±.000^{c}$
HNC	$3.23±0.11^{d}$	$1.43±0.00^{b}$	$2.35±.0.04^{a}$	$1.27±0.00^{c}$

Value with the same superscript in the same row are not significant different ($P \leq 0.05$)

Note:

OPA = 100% of sweet potato flour and 0% cassava flour

OPB = 80% of sweet potato flour and 20% cassava flour

OPC = 50% of sweet potato flour and 50% of cassava

OPD = 90% of sweet potato flour and 10% of cassava flour.

Table 4.1.2: Vitamins of Sponge Cake from Cassava Flour

	SAMPLES			
Vitamins	OPA	OPB	OPC	OPD
$VITB_1$	$2.27±0.00^{b}$	$2.26±0.00^{b}$	$2.27 ± 0.00^{b}$	$2.29±.000^{b}$
$VITB_2$	$1.12±0.00^{c}$	$0.73±0.00^{d}$	$1.15±.0.00^{b}$	$1.47±.0.00^{a}$
$VITB_3$	$0.58±0.00^{c}$	$0.28±0.00^{d}$	$0.76±.0.00^{b}$	$0.98±.0.00^{a}$

Value with the same superscript in the same row are not significant different ($P \leq 0.05$)

Note:

OPA = 100% of sweet potato flour and 0% cassava flour

OPB = 80% of sweet potato flour and 20% cassava flour

OPC = 50% of sweet potato flour and 50% of cassava

OPD = 90% of sweet potato flour and 10% of cassava flour

4.2 DISCUSSION

4.2.1 Anti-Nutrients

Table 4.1 shows the mean anti-nutrient content score of four samples from this study, state the value for each sample before it is observed that the phytate content was higher in sample OPA than in sample OPB,OPC and OPD and there was no significant difference ($P \geq 0.05$) between sample OPC and OPD. A decreasing trend in the phytate content was observed as sweet potato was minimal in the samples (Savage *et al*., 2007) reported that high content of phytate in food is of nutritional significance to human.

Oxalate content of the samples showed significant differences ($P \leq 0.05$) between the samples. A decreasing trend was also observed in the oxalate content of the different samples. The result showed that samples OPA had the highest score 10.01mg/100g while sample OPD had the lowest score (9.35mg/100g). This study reveals that sweet potato is richer in oxalate than cassava.

The tannin content of the samples showed significant different ($P \leq 0.05$) and from 0.17mg/100g, 0.23mg/100g with sample OPA having the highest score and sample OPC having the lowest score. Foods containing high tannin content are considered to be of 100 nutritional quality (Tinko and Uyono, 2001) references to this, the samples in this study are of good nutritional quality.

The phenol content of the samples showed significant difference between the samples ($P \leq 0.05$) sample OPA had the highest value 5.85mg/100g while sample OPC the least value 4.30mg/100g. Phenol increased with increasing substitution of sweet potato flour. This suggests that the substitution of sweet potato and cassava flour can boost the ability of baked food products to protect the body from harmful effects (Takemoto *et al*., 2009) and oxidative stress related chronic diseases (Ward *et al*., 2008)

The phytic acid content of the sample showed significant difference ($p<0.05$). it was observed that sample OPA had the highest phytic acid and while sample OPD had the least. It varied from 1.27mg/100g to 2.40mg/100g in a descending trend as sweet potato became minimal. Sweet potato flour was richer in phytic acid than cassava phytic acid is the primary storage compound of phosphorus in plant according up to 80% (Raboy, 2001)

The HCN content varied from 0.00mg/100g to 2.35mg/100g. It was observed that there was significant difference between the samples. Sample OPC had the highest HCN content while OPA had the lowest HCN content. The highest level of HCN obtained for 125g sweet potato and 125g cassava flour could be attributed to the highest content of HCN in cassava. The recommended world Health Organization (WHO) maximum acceptable level of cyanide in food meant for human consumption is below 10mg/kg (FAO 2007), thus the samples in this study is suitable for human consumption.

4.2.2 VITAMIN CONTENT

Table 4.2 shows the mean $VITB_1$ content score of four samples from this study. It was observed that all four samples contained closely the same amount of $VITB_1$ content, but showed higher amount in sample OPD (2.29mg/100g) which was flour blend of 188g sweet potato flour, 62g cassava flour and there was no significant difference ($P \geq 0.05$) between sample OPA, OPB, and OPC.

The $VITB_2$ showed significant differences between the four samples ($P \leq 0.05$). The highest was observed in sample OPD 1.49mg/100g and the lowest sample OPB 0.73/100g. $VITB_2$ helps to break down proteins, fat and carbohydrates and plays a vital role in the maintenance of the body energy supply. As stated by (Zakpa, 2010), the recommended daily intake of $VITB_2$ is 0.3 to 1.6mg/100g, thus the $VITB_2$ content of this study falls in a safe range.

The VITB3 showed significant difference ($P \leq 0.05$) between the samples. From the result of the study sample OPD contained higher amount of vitB3 while sample OPB contained lower amount. It varied from 0.28mg/100g to 0.98mg/100g. Vitamins are required for the proper functioning of the body fluid system (Tadesse *et al*., 2015).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The study investigated the antinutriential and vitamin content of sponge cake produced from cassava sweet potato flour. The result of the study revealed that cassava flour is not a good source of antinutritional properties but can help reduce the anti nutrient in sweet in sweet potato flour. Substitution of cassava flour with sweet potato flour (sample OPA) resulted check phytate, phytic acid, tannin, $VITB_3$ and $VITB_1$. However flour blend of sweet potato and cassava can be used as a replacement for wheat flour use to baking sponge cake.

5.2 RECOMMENDATION

It is recommended that the utilization of sweet potato flour and cassava flour should be encouraged in the production of sponge cake, to help reduce the importation of wheat flour. Further studies should be carried out to determine the antioxidant and microbial quality of the product.

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