PROXIMATE ANALYSIS OF BISCUITS PRODUCED FROM WHOLE WHEAT AND SHEA FRUIT (RAW AND OVEN DRIED) PULP

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ABSTRACT

Proximate quality of biscuits produced from the blends of whole wheat (Triticum vulgare), raw and oven–dried shea fruit (Vitellaria paradoxa) pulp was investigated. Biscuits were produced from raw and oven-dried shea fruit powder (RSFP) and (ODSFP) at 0g, 50g, 100g, 150g, 200g with whole wheat flour. From the results of proximate analysis of RSFP and ODSFP, it was observed that the moisture content% (MC) was (74.48 + 0.90) and (7. 91 + 0.9) respectively. The crude fibre % (CF) content of RSFP (2.58 + 0.08) was low compared to ODSFP (4. 72 + 0.34), the crude protein % (CP) content of the ODSFP (15.03+ 0.36) was higher compared to the RSFP (4.53 + 0.36). Crude fat (CF) % (8.24 + 0.08) in the RSFP is higher than the ODSFP (7.81), the % NFE (7.22 + 0.07) and (60.59+ 0.9), the energy (KCal/g) of ODSFP was 327.77 and that of RSFP was 121.08. The proximate composition of the biscuits produced from ODSFP and RSFP ranged from % MC (8.36±0.02 - 10.64±0.00), ASH (1.49±0.00 – 2.00±0.00), CP (10.50±0.01 – 12.25±0.00), FATS (17.51±0.02 – 21.11±0.00), CF (1.61±0.01 – 1.90±0.00), NFE (53.67±0.00 – 57.93±0.01) respectively. There was significant variation (P< 0.05) in the % MC, ASH, CP, Fats, CF and NFE, respectively. Shea fruit pulp contain wide arrays of nutritional qualities and of great energy given food, therefore there is need to be used in various culinary practices in order to enhance the health of the users.

Key Words: Proximate, Quality, Biscuits, Whole Wheat, Raw, Oven – dried, Shea fruit, Pulp

INTRODUCTION

Among ready to eat snacks, cookies and biscuits are widely consumed throughout the world. They are sold at markets, street shops and hawked at motor parks and schools where they could be bought and consumed by people of all ages (Usman Amen; Alifa & Babatunde, 2015; Adeoye; Alao; & Famurewa, 2017). The fact remains that wheat is the choice flour for baked products because of its gluten content which other cereals lack. It has been reported that wheat is

not sufficiently produced in most Tropical regions of the world, it is imported and expensive (Adeoye, *et. al*., 2017).

Wheat (*Triticum vulgare*) is considered as one of the main food crops in Sudan. It ranks after sorghum as a staple diet especially in urban countries. The importance of wheat is reflected in its relatively high consumption which was increased from 419, 000 MT per to 920, 000 MT per year during the period 1980 – 1992 (Mohammed, 2000). Wheat contributes considerably to the source of proteins in the diet; these proteins are unique among the cereal proteins because of their ability to form visco – elastic dough, which can be attributed to the formation of gluten when flour and water are mixed. The visco - elastic properties of the gluten in dough system are generally considered important in determining the baking properties of the wheat flour. In addition to using wheat flour in making bread, wheat entered into other use and encouraged the growth and development of many industries such as biscuits, cake, macaroni, pastas and others (Mohammed, 2000)

Products made from non-wheat flour or composite flours are the latest trend in producing baked goods. Users of composite aim at mitigating the poor qualities of flour produced from other non-wheat grains, legumes, oil seeds, tubers /roots among others. The substitute for wheat flour should be the flours that are readily available, cheap and able to replace wheat flour in terms of functionality. Sometimes, the interest in non-wheat product is based on their nutritional, health benefits and sensory properties. Celiac disease is a food induced immunological disease of the upper intestine triggered by the ingestion of gluten containing cereals in genetically susceptible individuals and these individuals often resort to gluten free baked goods (Gopinath, 2002). Researchers have developed gluten free biscuits and cookies comparable in quality to ones produced from wheat (Gopinath, 2002).

In order to eliminate food insecurity, hunger and malnutrition in developing countries, alternative sources of nutritious food in these areas need to be identified. One such indigenous fruit tree in Northeastern and Northwestern Uganda is the shea butter tree. The shea tree (*Vitellaria paradoxa*) is an indigenous fruit tree with enormous nutritional benefits (Maranz & Weisman, 2003). According to Anwange; Ajibola; and Oniye (2004), shea tree fruit pulp is a good source of essential nutrients, as an edible fruit, it is rich in vitamins, minerals, carbohydrates, crude fibre and protein. Anwange, *et al*., (2004) reported that the shea pulp is also rich minerals particularly potassium and calcium. It also contains good amount of vitamins and amino acids.

Nigeria being one of the tropical countries cannot grow the wheat in commercial quantity due to the country's total consumption of this grain, therefore the industry can only survive by utilization of this availability of local grain which can either partially or completely substitute wheat in the product without adversely affecting the quality of such product (Ugese; Baiyeri; & Mbah, 2008).This research was conducted to produced biscuits from blends of wheat and shea fruit (raw and oven- dried) pulp and to determine proximate composition of biscuits produced.

Problem Statement

Wheat is an imported cereal majorly grown in high temperate countries, so there is need to reduce the importation of wheat which has been costing so much on our foreign currency, by combining other crops and fruits to produce composite flour with high nutritional benefits, and

such fruit is shea fruit, which has been contributing to the economy of Nigeria and other countries (Ogundele, Idowu, Awonorin, Atanda, & Akpan, 2006).

Objectives

i. To produce biscuits from the blends of wheat and shea fruit (raw and oven dried) pulp
ii. To determine proximate composition of raw and oven-dried shea fruit pulp'
iii. To determine proximate composition of biscuits produced from wheat and raw shea fruit pulp and oven–dried shea fruit flour.

MATERIALS AND METHODS

The project work was done in Food Technology Department of Federal College of Freshwater Fisheries Technology, New – Bussa, Niger State. The shea fruit were picked from the trees at the school premises.

Materials Used

Materials used for the practical are as follows: shea fruit pulp, granulated sugar, baking fat, bowl, tray, wheat flour, biscuit cutter, oven, measuring spoon, whisker, turning stick, baking powder, packaging materials, mortar, pestle.

Method of Processing Shea Fruit Pulp

The shea fruits were picked from the shea tree in the school premises, the shea fruits were washed with cool water, was the divided into two platforms, the fruit pulp was slightly dehydrated in an oven, – oven dried and the raw shea fruit pulp.

Production of Shea Fruit Pulp Flour

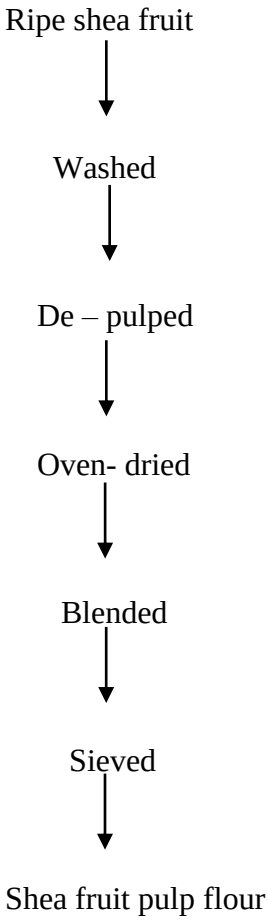

Figure I; Flow chart for shea fruit pulp flour

Production of Biscuits

The shea fruit pulp flour was sieved into a dry bowl and weighed; the wheat flour was also weighed. The baking fat and sugar was mixed thoroughly to obtain a fluffy consistency, now poured into the fluffy consistency of baking fat and granulated sugar and the mixture was mixed thoroughly. The already measured wheat flour was gradually added to the mixture together with the shea fruit pulp flour, the baking powder was added too and it was thoroughly mixed to obtain dough. The dough was spread on the chopping board and rolled with a rolling pin, after it has been rolled; the biscuit cutter was used to cut into desirable shapes. It was latter spread on the baking sheet which has already been battered with baking fat and the biscuit was in the oven at a temperature of 200°C for 20 – 25 minutes, it was later cooled to ambient temperature and package in packaging materials. This method was repeated for biscuits produced using raw shea fruit pulps.

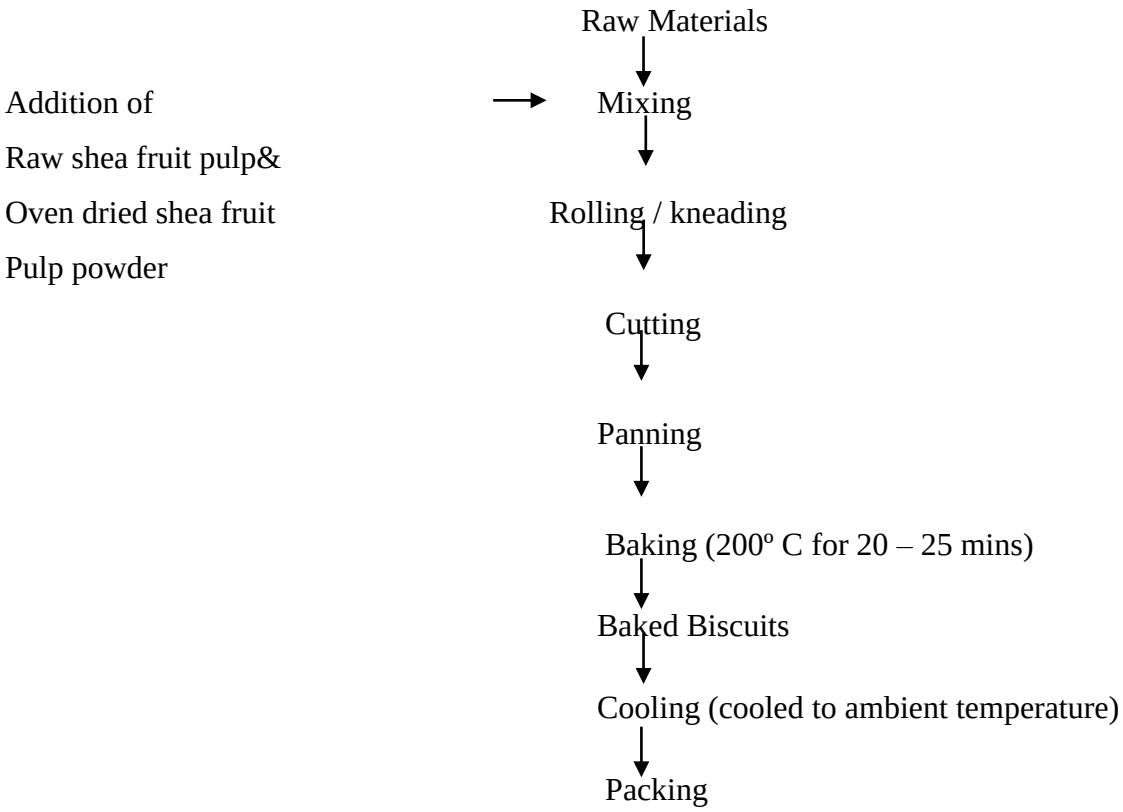

Figure II: Flow chart for biscuits production

Table I: Formulation of Biscuits Produced from Oven-Dried Shea Fruit Pulp Flour

Sample	Whole wheat flour (g)	Shea fruit pulp flour (g)	Sugar(g)	Margarine(g)	Baking powder(g)
Control	500	0	50	250	9
A	450	50	50	250	9
B	400	100	50	250	9
C	350	150	50	250	9
D	300	200	50	250	9

Table II: Formulation of Biscuits Produced from Raw Shea Fruit Pulp

Sample	Whole wheat flour (g)	Shea fruit pulp flour (g)	Sugar(g)	Margarine(g)	Baking powder(g)
Control	500	0	150	250	9
E	450	50	150	250	9
F	400	100	150	250	9
G	350	150	150	250	9
H	300	200	150	250	9

The proximate composition of the samples was determined in triplicate according to AOAC, (2005) methods. The data were subjected to ANOVA using SPSS 17.0, while the means were separated by Duncan's multiple range tests. Differences were accepted at 5% significant level.

Table III: Proximate Analysis of Raw and Oven-Dried Shea Fruit Pulp

Parameters	Sample RSFP%	Sample ODSFP%e O%
Moisture content	74.48 ± 0.09	7.91± 0.09
Ash content	2.97 ±0.12	3.96±0.12
Crude Fibre	2.58 ± 0.08	4.72±0.34
Crude protein	4.53 ± 0.15	15.0±0.36
Crude fat	8.24 ± 0.08	7.81± 0.31
NFE	7.22 ± 0.07	60.59 ± 0.99
Energy kCal/g	121.08	372.77
Energy kJ/g	504.28	1574

Means ± standard deviation with similar superscript in column did not differ significantly from each other at $p \leq 0.005$.

Table IV: Proximate Composition of Biscuits Produced from Oven-Dried and Raw Shea Fruit Pulps

SAMPLES	% MC	% ASH	%Crude Protein	% FATS	% Crude Fibre	% NFE
CONTROL	11.55±0.01^{a}	1.45±0.00^{g}	10.50±0.01	16.30±0.01^{i}	2.20±0.00^{a}	58.00±0.33^{a}
A	8.18±0.01^{i}	1.55±0.07^{e}	12.25±0.00^{b}	18.20±0.01^{g}	1.90±0.00^{b}	57.92±0.01^{b}
B	10.64±0.00^{c}	2.00±0.00^{a}	11.25±0.01^{d}	17.50±0.02^{h}	1.90±0.00^{b}	56.58±0.01^{c}
C	10.46±0.00^{c}	1.65±0.01^{c}	11.38±0.01^{cd}	18.50±0.02^{f}	1.62±0.02^{e}	56.41±0.01^{d}
D	10.50±0.02^{d}	1.61±0.01^{d}	10.80±0.30^{de}	18.90±0.00^{e}	1.70±0.02^{d}	56.80±0.00^{c}
E	10.41±0.02^{d}	1.51±0.01^{f}	11.07±0.28^{de}	19.10±0.00^{d}	1.61±0.01^{e}	56.07±0.02^{e}
F	11.47±0.03^{b}	1.49±0.00^{f}	11.37±0.01^{cd}	19.70±0.00^{c}	1.81±0.01^{c}	54.19±0.00^{f}
G	9.14±0.00^{g}	1.51±0.01^{f}	11.95±0.03^{bc}	20.90±0.00^{b}	1.80±0.00^{c}	54.41±0.01^{f}
H	8.36±0.02^{h}	1.86±0.01^{b}	12.85±0.28^{a}	21.11±0.00^{a}	1.90±0.00^{b}	53.67±0.00^{g}

Means ± standard deviation with similar superscript in column did not differ significantly from each other at $p \leq 0.005$.

DISCUSSION

From Table III, the results of proximate analysis from the raw (RSFP) and oven dried shea fruit pulp (ODSFP): it was indicated that the moisture content of RSFP and ODSFP was (74.48 ± 0.90%) and (7.91 ± 0.9%) respectively, which showed that the storage stability of raw shea fruit pulp will be low because the higher the moisture content the lower the shelf life and the lower the moisture content the higher the shelf (Okullo; Omujal; Agea; Vuzi; Namutedi; Okello & Nyanzi . 2010). The crude fibre content of RSFP(2.58 ± 0.08%) was low compared to ODSFP (4.72 ± 0.34), this shows that the crude fibre in RSFP was low and it may decreases the absorption of bile salt level in the body (Ramulu&Rao,2003). The values of crude fibre for shea fruit pulp is within the crude fibre values of most wild and domesticated fruits and higher than in legumes. As crude fibre helps in the maintenance of normal peristaltic movement of the intestinal tract, diets containing high fiber content could reduce occurrence of such disorders as constipation, colon disease, diabetes, cardiovascular diseases and obesity (Ramulu & Rao, 2003). This study, thus, has indicated that shea fruit pulp is a rich source of energy and capable of

supplying the daily energy requirements of the body. It also implies that promoting consumption of shea fruit is of great benefit to the human diet.The crude protein content of ODSFP (15.03 ± 0.36%) was higher compared to the raw shea fruit pulp (4.53 ± 0.15) this indicated that ODSFP was a good source of protein which can help in solution of malnutrition and other related diseases in developing countries (Marakoglu; Arslan; Ozcan; & Haciseferogullari. 2005; Prokarite, 2007). A significant variation was exhibited in the crude protein content ($P< 0.05$) and it fall within the range reported for most wild and edible fruits that are lower than 5(25). Even if the values of crude protein content reported for shea fruit are not different from that of other fruits (25), it is however lower than that reported for the shea fruit pulp samples from west Africa (26) such variations in crude protein is however normally associated with differences in environmental conditions. Crude fat (8.24 ± 0.08%) in the raw shea fruit pulp (RSFP) is higher than the oven dried shea fruit pulp (7.81± 0.31%) which is important in the absorption of some vitamins, it helps in reducing heart diseases due to high density proportion cholesterol (HDL) (UNSSCN, 2004).The Nitrogen free extract (NFE) for (RSFP) which is the carbohydrates (7.22 ± 0.07) and (60 .59 ± 0.99) of oven dried indicated that ODSFP flour contained more energy/ carbohydrates than RSFP (Anwange; Ajibola & Oniye,. 2004) The energy (KCal/g) of ODSFP was 327.77 and that of RSFP was 121 . 08, this indicated that the energy value in the ODSFP is higher than that of the RSFP (Ugese *et al*,.2008). Like other edible fruits, shea fruits are rich in different carbohydrates such as glucose, fructose, and galactose (Aremu ; Olonisaki; Bako; & Madu,, 2006). As the shea fruits' harvesting season normally coincides with high energy requirements for farm planting, energy demand would be met through consumption of shea fruits. Shea fruit has more carbohydrates that are vital in nutrition and are also good sources of energy (Aremu *et al*., 2006). The consumption of the shea fruit pulp after labor, thus, provides an immediate source of energy for the farmers. This, therefore, justifies the promotion of consumption and commercialization of shea fruits in the shea zones like Nigeria.

Table IV shows the proximate composition of biscuit produced from ODSFP and RSFP. The moisture content of biscuits produced from ODSFP powder ranged from 8.19±0.01- 10.64±0.01%, the percentage moisture content increases as the level of inclusion of ODSFP powder increases. The least moisture content is from biscuit produced from 100g of ODSFP powder. All the biscuits produced with oven-dried shea fruit pulps powder have lower moisture content as compared with the control sample (11.57±0.01%) without either raw or oven-dried shea fruit pulps. Water is present in virtually all foods, and it is important for a number of chemical reactions. Moisture determination is one of the most common tests in food since the water content in foods as an important relationship between conservation and the chemical, physical and microbiological changes during the storage (Aremu, *et al*., 2006). Also the % moisture content of the biscuit fortified with RSFP ranged from 8.36±0.02- 11.47±0.03, the least % moisture content was found in the biscuit produced from the 200g inclusion of RSFP and the highest % moisture content was found in the biscuit with 100g of RSFP. All the biscuits produced from RSFP had lower %moisture content than the control sample (11.55±0.01%). Okullo, Hall; and Obua, (2004), reported that the moisture content of different biscuits vary according to the type of biscuits produced. Furthermore, the % ash content of the biscuit produced from the inclusion of ODSFP powders ranged from 1.45±0.01-2.00±0.00%, the highest % ash content was from the biscuit produced from 100g inclusion of ODSFP and the least from the biscuit produced from inclusion of 50g of ODSFP powder. Although the % ash content of the biscuit from various level of inclusion of ODSFP have higher ash content than the control sample (1.45±0.00%). Also, the % ash content from the biscuit produced from the inclusion of

RSFP, ranged from 1.49±0.00-1.86±0.01%, the highest % ash content was found in the biscuit with 200g inclusion of raw shea fruit pulps and the least from the biscuit with 100g RSFP inclusion. All the biscuits produced with different level of inclusion of RSFP had higher % ash content than the control sample (1.45±0.00%). Ash content increases with increasing inclusion of the raw shea fruit pulps. Ash is a non-organic compounds containing mineral content of food and nutritionally it aids in the metabolism of other organic compounds such as fat and carbohydrates (Maranz, *et. al*,. 2004). The % crude proteins of the biscuit produced with the inclusion of ODSFP powder ranged from 10.80±0.03-12.25±0.00%, the highest% crude protein was found in the biscuit with 50g inclusion of ODSFP powder while the least was found with the biscuit produced from 200g inclusion of ODSFP powder. All the biscuits produced with the inclusion of ODSFP powder have higher % crude protein than the control samples (10.51±0.01), except the biscuit with 200g inclusion, having the same percent crude protein. Also, the % crude protein of biscuits produced from the inclusion of RSFP ranged from 11.07±0.28-12.85±0.28%, the highest %crude protein was found in the biscuits produced from the inclusion of 200g RSFP and the least from the biscuit produced with inclusion of 50g and 100g RSFP. It shows that the % crude protein increases as the level of inclusion increases. Moreso, all the biscuit produced from the RSFP had the highest % crude protein than the control samples (10.51±0.01%). The biscuits produced from the RSFP has higher value of crude protein than the ODSFP powder biscuit, it may be due to the breakdown of the protein during oven-dried and the baking process with the production of other lower metabolites e.g. amino acids, therefore, the biscuit produced using RSFP had a good source of protein which can equally provide lasting solution to problem of malnutrition and other related diseases in developing countries of the world (Usman, *et. al.*, 2015).In societies with critical protein meat such as Nigeria, the nutritional rating of biscuit produced from raw shea fruit pulp may be high than ordinary recognize when it protein content was (12.85±0.28%). It was rated against the zero protein content of mango fruit (Maranz, *et. al*., 2004). The % fat content of the biscuit produce with the inclusion of ODSFP powder ranged from 17.51±0.02 -18.90±0.00%, with the highest percent fat was from the biscuits with 200g inclusion, and the least from the biscuits produced with 100g inclusion. The % fat increases as the level of inclusion increases. All the biscuit produced with the level of inclusion of ODSFP powder has the higher % of fat than the control sample (16.30±0.01%). Likewise, biscuit produced from the inclusion of RSFP has the % fat ranged from 19.10±0.00 – 21.11±0.00%, the highest % fat was observed from the biscuits with 200g inclusion, while the least was from the biscuits produced with 50g inclusion. As the levels of inclusion increases the % fat content increases. The % fat content of the biscuit from raw shea fruit pulp was higher than the control biscuits (16.30±0.01%).It is important to know that the increased in the fat content may be due to the fat used during the processing. This is in accordance with UNSSCN, 2004, that described digestive biscuits to have 20.5% fat content. To determine the fat content of food is very important because high intake of saturated and trans fatty acid could contribute to development of coronary heart diseases, and trans fatty acids have been associated with adverse effects, such as raising low density lipoprotein cholesterol (LDL) and lowering high density lipoprotein cholesterol (HDL) (UNSSCN, 2004). The % crude fibre decreases as the level of inclusion increases. The % crude fibre in the control sample 2.20±0.00% was greater than in the biscuit produced from inclusion of oven dried shea fruit pulp. Also, the % crude fibre of biscuit produced from inclusion of raw shea fruit pulps ranged from 1.60±0.02 – 1.90±0.00%, the highest was found in the biscuit with 200g inclusion, and the least from the biscuits produced from 50g inclusion. The control sample has the highest % crude fibre compared with the levels of RSFP inclusion. The importance of fibre intake is largely due to its physiological effects that

have benefit health implications (Ramulu & Rao, 2003). Dietary fibre presence in food is of great interest for health (Usman, *et. al*., 2015). The reduction of blood cholesterol and glycemic are related to the consumption of soluble fibre (Ramulu & Rao, 2003), while insoluble fibre can reduced the risk of developing diabetes mellitus (Ramulu & Rao, 2003), are hypo-cholesterolmic, and have beneficial effects on intestinal health (Ramulu & Rao, 2003). Furthermore, the % NFE of the biscuits produced from the inclusion of ODSFP powder ranged from 56.41±0.01 – 57.93±0.01%, the highest % NFE is found in the biscuits with 50g ODSFP powder and the least by 150g inclusion. All the biscuits produced from the inclusion of the ODSFP powder had lower % NFE than the control sample (58.33±0.33%). Also, the % NFE of the biscuits produced from the inclusion of RSFP ranged from 53.67±0.00 – 56.80±0.00%, the highest was found in the biscuit with 50g inclusion, the least from 200g inclusion. All the biscuits produced from the shea fruit pulp inclusion had lower % NFE than the control sample (58.33±0.33%). According to Madu, (2006), the higher the protein, fat, ash content the less the carbohydrate.

CONCLUSION

From the results obtained in this study, the following conclusions can be drawn;

i. Shea fruit pulp contains wide arrays of nutritional qualities and of great energy giving food, therefore there is need to be used in various culinary practices in order to enhance the health of the users.
ii. Moisture contents of the biscuit increases as the levels of inclusion of oven dried shea fruit pulp increases, while it decreases as the level of inclusion of raw shea fruit pulp increases, likewise the crude proteins and crude fiber of both biscuits followed the same pattern
iii. 50g inclusion of raw and oven dried shea fruit pulp will produce biscuits and other baked products capable of meeting dietary requirement of its consumers.

RECOMMENDATIONS

These recommendations are made for further research;

i. A research effort should be made to determine the vitamin, amino acids, fatty acids, mineral profile and microbial load of the biscuits produced from raw and oven dried shea fruit pulps;
ii. Storage of biscuits at different conditions and use of different packaging materials, to evaluate their effects on its quality
iii. A research effort should also be made towards utilizing the shea fruit pulp for beverages because of its enormous nutritional qualities

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