Quality Evaluation of Bread Made By Substitution of Bakery Fat with Bullet Pear (*Canarium Schweinfurthii*) Fruit Oil

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Abstract: *Bullet pear (Canarium schweinfurthii) fruit oil was used as a replacement for bakery fat in bread production. Five loaves of bread samples were baked, the control sample was baked with 100% bakery fat and the other four loaves were baked with bullet pear fruit (BPF) oils as substitute for the bakery fat at 25, 50, 75 and 100% levels. The proximate, physical parameters and sensory quality analyses were carried on of these five loaves samples. The results showed some significant differences (P<0.05) in the proximate compositions between the control and the samples and within the samples. The proximate composition of the bread samples substituted with BPF oil ranged from 34.48 - 31.83% (moisture); 2.61 – 2.48% (ash); 8.14 – 8.60% (crude fat); 0.19 – 0.27% (crude fibre); 7.57 – 7.58% (crude protein); 49.02 – 49.11% (total carbohydrate) and 299.61 – 305.71Kcal/100g (energy). Significant differences (P<0.05) exist in the loaf heights, weights, volumes and specific volumes with the control sample having the highest specific volume of 5.27cm^3/g. Also, there were no significant differences (P>0.05) in appearance, flavor, texture, mouth feel and overall acceptability of the bread samples. However, the substitutions of the bakery fat with BPF oil up to 50% level were acceptable.*

Keywords: *Bakery fat, bread, Bullet pear, physical parameters, proximate composition, sensory quality.*

I.   Introduction

Bread has been produced and consumed by people as a staple food for a long time. It may be described as a fermented confectionary produced mainly from wheat, water, yeast and salt by a series of process involving mixing, kneading, proofing, shaping and baking [1]. Cereal food products, especially bread has become very popular in Nigeria among children and adolescents [2]. Bread consumption has increased tremendously in recent times in the developing countries among them is Nigeria where it is consumed in every household. It is a common food which is sold in the markets, motor parks, shops and even in super markets.

Virtually, any cereal flour could be used to produce bread but the quality of such bread is lower than that of the normal wheat flour bread, primarily due to the presence of gluten in the wheat [3]. Several ingredients are used for bread making. The mandatory ingredients include flour, water, yeast and salt. Other optional ingredients such as sugar, fat, milk, emulsifier, fruits, flavors, etc may be added [4]. Previous researches in bread making technology in Nigeria have focused on complementation of bread protein with legumes or oil seed protein and the use of composite flour in place of wheat flour. Onabolu *et al*. [5] have reported successful use of composite wheat-cassava flour in bread making. Nigeria found cassava the best substitute for wheat flour. Consequently, the Federal Government of Nigeria directed the incorporation of 10% cassava flour to wheat flour [6].

Though, fat was described as optional bread ingredient, bread made with little or no fat has low quality. Therefore, fat is very important ingredient in bread as it helps to improve loaf volume, crumb softness and keeping quality. Unfortunately, fat used in Nigerian baking industries are all imported. The country is blessed with a lot of oil bearing crops and tropical tree fruits. The oils from these sources are of good quality. Their use as substitute or replacement for imported bakery fat will go a long way to conserving the country's scarce foreign exchange.

African pear (*Dacryodes edulis*) fruit pulp and oil has been successfully utilized as replacement for bakery fat in biscuit recipe [7]. Recently, Onuegbu *et al*. [8] evaluated the use of African pear pulp and oil as ingredients in bread production. In this work, bullet pear (*Canarium schweinfurthii*) fruit oil is used as a substitute for bakery fat in bread. Bullet pear fruit is very nutritious with oil content of 38% [9]. The oil is highly unsaturated and contains 36% oleic acid, 28% linoleic acid, 26% palmitic acid and 7% stearic acid [10]. This work therefore is aimed at evaluating the quality of bread loaves made by substituting the bakery fat with bullet pear fruit oil.

II   Materials and Methods

Materials Collection

This research was carried out at the Food processing Laboratory, Imo State University Owerri, Nigeria and Central Laboratory of National Root Crops Research Institute (NRCRI) Umudike Abia Nigeria. Good

quality bullet pear fruits and other bread ingredients used for this study such as wheat flour (Dangote brand), baking fat (margarine), granulated sugar (Dangote brand), baker's yeast, table salt (NaCl) were purchased at popular "Eke-Ukwu" market Owerri, Imo Nigeria. All the equipment used were obtained from the Food Processing Laboratory of the University whereas the chemicals (analytical grades) were procured at NRCRI, Umudike.

Sample Preparation

The bullet pear fruits were sorted and thoroughly washed to remove the bad fruits and dirt. The fruits were soaked in warm water (60 – 70°C) for 45 min to soften the pulps. The softened pulps were scrapped out with the aid of a kitchen knife. The extracted pulps were conditioned prior to oil extraction by oven-drying for 30 min at 70 – 80°C. This was carried out to reduce the moisture content and enhance oil extraction.

The method of AOCS [11] was adopted for the oil extraction. N-hexane was the solvent used for the oil extraction. The softened bullet pear pulps were thoroughly mixed with the solvent (n-hexane) in bowl covered tightly and left for 2 h. The muslin cloth was used to squeeze out the oil solution from the pulp. More extraction of oil was carried out by breaking the pulp cakes and mixing with fresh hexane. The oil was separated from n-hexane by exposing the mixture (oil and n-hexane) under the sun, for the hexane to evaporate. Further evaporation of the remaining hexane and moisture was done by heating the oil in an oven temperature at 60°C for an hour to expel the trapped hexane. Finally, the extracted oil was filtered with the aid of muslin cloth and then used as ingredient in bread samples at different levels of substitutions.

Five bread samples containing 0, 25, 50, 75 and 100% bullet pear oil replacing bakery fat were prepared by mixing with other bread ingredients (recipe) as shown in Table 1. Mixing of the ingredients was carried out using the straight dough method [12]. This method was modified with the inclusion of bullet pear oil at five different levels of substitution (0 – 100%). The baking fat was thoroughly mixed with bullet pear oil and other ingredients. The dough was kneaded with a wooden kneader until it formed a smooth elastic and non-sticky material and was placed in a bowel and allowed to rest for 2 h. It was then divided into portions and scaled to 250g, molded to its final shape with hand and put in a greased pan. The dough were allowed to proof for 30 – 45 min after which they were loaded into pre-heated oven and baked at a temperature of 210°C for 45 min until a golden-brown color appeared at the crust. The hot bread samples were off-loaded from the oven and allowed to cool for 15 min before they were de-panned. They were allowed to cool further at the room temperature before the sensory, physical and chemical analyses were conducted on these samples.

Proximate Analysis of the Bread Samples

Proximate analysis was done on the bread samples using standard method of the AOAC [13] to determine the moisture, ash, crude protein, fat, crude fibre contents. Moisture content was determined by heating 2.0 g of the bread sample to constant weight in a crucible placed in a laboratory oven (Gallenkamp IH-100) maintained at 105°C for 5 h. Ash was determined by furnace incineration gravimetric method; this was done by incineration of 2.0 g sample in muffle furnace maintained at 550°C for 5 h. Crude protein (Total Nitrogen x 6.25) was determined by Kjeldahl method using 2.0 g of the sample. Crude fat was obtained by exhaustively extracting 5.0 g of the sample in soxhlet apparatus using n-hexane as the extractor. The trichloroacetic acid method was used for the crude fibre determination. The method involves deflating the food material. This is followed by hydrolyzing the protein and carbohydrate in the food using a mixture of acids. The total carbohydrate was calculated by difference, while the energy values of the samples were estimated by calculation using Atwater's conversion factor (4 x % Protein + 9 x % Fat + 4 x % Carbohydrate) expressed in kcal/100g as reported by Onyeike *et al.* [14]. All the analyses were carried out in triplicate.

Physical Analysis of the Bread Samples

The length and width of the bread at the base were measured with a ruler. The height of the bread slices taken at different points (edges and centre) were also measured using a ruler. The average height was obtained by calculating the mean as the bread height. The loaf volume was calculated by multiplying the length, width and mean height of the bread samples in cm^{3}. Before the length, width and height of the bread was measured, it was placed on an electronic weighing balance (Soehnle Professional 9230) to obtain the loaf weight. The loaf weight was equally used to calculate the specific loaf volume. Thus, the specific loaf volume = Loaf Volume/ Loaf weight (cm$^{3/}$g) (1).

Sensory Evaluation

Five bread samples (With varying levers of bakery fat substitutions with bullet pear fruit oil) were evaluated for appearance (color), flavor, texture, mouth feel and overall acceptability. A Panel of thirty untrained panelists comprising of males and females' staff and students who are familiar and consumers bread were randomly selected. The samples were coded and randomly presented to the panelists in the same type of saucers. Bottled water was provided to rinse the mouth between evaluations. A 9-point Hedonic scale was used for the

evaluation where 1 represented "dislike extremely" and 9 "like extremely" [15]. The flavor, texture, mouth feel, and overall acceptability were evaluated under amber light while appearance was under bright illumination.

Statistical Analysis
All the data obtained from analytical determinations were subjected to analysis of variance and reported using descriptive statistics as mean ± standard deviation of the three determinations. Sample means were separated using Duncan's Multiple Range Test (p<0.05). Analyses were done using statistical software package (SPSS, version 17.0).

II.   Results and Discussion.

Proximate Compositions
        Proximate composition data showed that there were significant differences (P<0.05) in percentage moisture and carbohydrate as well as energy contents of the bread samples (Table 2). There were however no variations in the percentage ash, crude fat, crude fibre and protein contents of the bread samples. This showed that the samples had similar percentage ash, crude fat, crude fibre and protein contents.
        Moisture contents is one of the outstanding and widely used parameters for measuring food quality was found to reduce as the levels of substitution of bakery fat with bullet pear fruit (BPF) oil increased. The control sample (B - 100/0), the sample that was baked with 100% bakery fat had the highest percentage moisture content of 32.48%, while sample B – 0/100 (Bread sample made with 100 % bullet pear fruit oil) had the least moisture content of 31.83%. These reductions in the percentage moisture contents of the bread samples as the level of substitution of bakery fat with BPF oil increased could be attributed to moisture in the bakery fat. The bakery fat label used showed that it contained moisture, though the quantity of the moisture was not specified. Also, ABF oil contained little or no moisture as the moisture was evaporated along with the solvent (n-hexane) used in the extraction of the oil. Recently, Onuegbu *et al*. [8] reported the moisture content of the wheat bread to be 36.13% which is nearer to the moisture content of the bread samples under study which ranged from 31.83 – 34.48%. The differences in percentage moisture content of the bread could also attributed to the degrees of exposure to heat which led to moisture evaporation during baking.
        On the other hand, the percentage fat contents of the bread samples followed a reverse trend. A steady increase was observed in the percentage fat contents of the bread samples as the levels of substitution of bakery fat with BPF oil increased. As bakery fat contained some percentage of water, BPF oil which contained little or no water is used to replace it, the more the quantity of fat added to the bread samples. The percentage carbohydrate contents of the bread samples under study ranged from 49.02 – 49.14%. The variations in the percentage carbohydrate content were due to the variation in the proximate compositions as carbohydrate was calculated by difference [16]. Similarly, the energy contents of the bread samples increased from 299.61 Kcal/100g (sample B – 100/0) to 305.71Kcal/100g (sample B – 0/100). The increment could be as a result of increased in fat contents since fat has almost twice energy content than protein and carbohydrate [17].

Physical Parameters
        The results of the physical parameters measurement carried out on the bread samples showed that there were no significant differences (P>0.05) on the widths and length of the bread loaves (Table 3). The reason could be because the pans used for the bread baking were equal in widths and lengths. Significant differences (P<0.05) were however observed in the loaves weight, volumes and heights as well as specific volumes. The loaf heights, volumes, specific volumes and weights decreased as the levels of substitution of bakery fat with BPF oil increased.
        The loaf height and volume were respectively 6.55cm and 1730.38cm^3 for the bread sample, B – 100/0 (the bread made with 100 % bakery fat) and 5.95cm and 1573.86cm^3 for sample B – 0/100 (the bread sample made with 100% BPF oil). The reduction in the height and volume as level of substitution of bakery fat with BPF oil increased could be due to the effect of BPF oil on the gluten content of the dough. Belderock [18] reported that fat affects the development of gluten in breads by coating and lubricating the individual strands of protein and also helping to hold the structure together. The type of fat used for this purpose no doubt could affect the way the flour proteins are lubricated and the way the dough are held together.
        Similarly, loaves weight and specific loaf volumes were observed to reduce as the level of substitution of bakery fat with BPF oil increased. Loaf weight reduced from 328.33 – 319.40g while specific loaf volume from 5.27 – 4.93cm^3/g. This is normal since moisture decreased as the levels of substitution of bakery fat with BPF oil increased (Table 2). Sample B – 100/0 was most dense than other samples. Similar result was obtained when high moisture mango mesocarp was added to wheat flour in bread making by Radifu *et al*. [19] to obtain heavier loaves. There was no significant difference (P>0.05) between the bread samples B – 100/0 and B – 75/25 in terms of specific loaf volume but they differed significantly (P<0.05) from other samples. Also, samples B – 25/75 and B – 0/100 are the same in terms of their specific loaf volume.

Sensory Evaluation

The results of the sensory evaluation carried out on the bread samples made with 100% bakery fat and those made with 25, 50, 75 and 100% levels of bakery fat substitution with bullet pear fruit (BPF) oil were not significantly different (P>0.05) in flavor, mouth feel and overall acceptability among themselves (Table 4). The bread samples had nice flavors which were not significantly different (P>0.05) from the control sample. Sample B – 50/50 (bread made with 50% bakery fat and 50% BPF oil) and B – 0/100 (bread made with 100% BPF oil) were rated highest in terms of flavor by the Panelists with mean scores of 6.60 and 6.30 respectively. It was observed that the bread flavors was enhanced or improved by the flavor of the BPF oil. Omeire and Onyenagorom [20] reported a similar result where the peculiar flavor of walnut was said to affect the flavor of African walnut-wheat flour composite flour bread. However, the result showed significant variations (P<0.05) among the samples in appearance (color) and texture. Sample B – 50/50 was rated highest in appearance. Its crust (the outer later) was observed to be brown in color while the crumb (the inner part) was light brown in color. This was attributed to the golden color of the BPF oil which was combined with the bakery fat to give the loaves a nice color. Onuegbu *et al.* [8] reported a similar result where the blue-green color of the African pear (*Dacryodes edulis*) fruit pulp/oil used as a replacement for bakery fat was said to affect the appearance of the bread. Sample B – 50/50 however showed no significant difference (P>0.05) in appearance when compared with samples B – 100/0 and B – 75/25, that is bread samples baked with 0% and 25% levels of bakery fat substitution with BPF oil.

In terms of texture, sample B – 100/0 (control) was rated highest and was significantly different (P<0.05) from those samples, B – 75/25, B – 50/50, B – 25/75 and B – 0/100. This shows that the texture of the sample B – 100/0 was most preferred by almost all the Panelists with the mean score 7.30±1.22. The reason for this could be due to the fact that the dough rose enough and give better texture. However, there were no significant differences (P>0.05) among the appearance of these bread samples: B – 75/25, B – 50/50, B – 25/75 and B – 0/100. Generally, the bread samples were all good and accepted by the Panelists.

III. Conclusion

From the results presented in this research work, it has been shown that a good quality and acceptable bread could be produced by replacing bakery fat with bullet pear fruit (BPF) oil up to 50% level in bread recipe. It is therefore recommended that up to 50% BPF oil level should be used as replacement for bakery fat in bread making industries. This will helps in conserving the scarce foreign exchange and at the same time provides opportunity for the industrial utilization of bullet pear fruit.

References

[1]. K. Dewettinck, F.V. Bockstaele, B. Kuhne, W. Van, T. Courtens, and X. Gellynck, Nutritional value of bread: influence of processing, food interaction and consumer perception, *Journal of Cereal Science, 48,* 2008, 243- 257.

[2]. J.U. Anyika, and A.C. Uwaegbute, Frequency of consumption and nutrient content of some snacks eaten by adolescent female students in Abia state, Nigeria, *Nigerian Journal of Nutritional Sciences 26 (2),* 2005, 10 – 15.

[3]. E.N.T. Akobundu, C.N. Ubbaonu, and C.E. Ndupuh, Studies on the baking potential of non-wheat composite flour, *Journal of Food Science and Technology 25 (4),* 1988, 211 -214.

[4]. J.C. Okaka, *Handling, storage and processing of plant foods.* (O.C.J. Academic Publishers, Independent Layout Enugu Nigeria, 2005). 89 – 101.

[5]. A. Onabolu, A. Abbass, and M. Bokanga, *New Food Products from Cassava.* (International Institute of Tropical Agriculture (IITA) Ibadan, Nigeria, 2003). 40.

[6.] FAO. *Food and Agricultural Organization.* Cassava Industrial Revolution in Nigeria. FAO Corporate Reposition, 2006.

[7]. C.M.F. Mbofung, T. Silou, and I. Mouragadja, Chemical characterization of sajou (*Dacryodes edulis*) and evaluation of its potential as ingredient in nutritious biscuits, *Tree and Livelihoods 12,* 2002, 105 – 117.

[8]. N.C. Onuegu, E.U. Onyeka, and D. Agbayi, Evaluation of African black pear pulp and oil as ingredients in bread production, *Nigerian Food Journal 25 (2),* 2007, 171 – 175.

[9]. V.I.E. Ajiwe, C.A. Okeke, J.O. Ogwuagu, U. Ojukwu, and V.I. Onwukuru, Characterization and application of oils extracted from *Canarium schweinfurthii, Vitex doniana* and *Xylopia acthiopia* fruits/seed, *Bioresource Technology 68,* 1997, 249 – 252.

[10]. H.M. Burkill, *Useful plant of West tropical Africa.* Vol. 2, Families E – 1 *Royal Botanical Gardens, Kew,* 2004, 5 - 9.

[11]. AOCS, *American Oil Chemist Society,* Official Methods and Recommended Practice of the American Oil Chemist Society, 5th Edition, Washington DC, USA, 1993.

[12]. G.S. Chauhan, R.R. Zilman, and N.A.M. Askin, Dough mixing and bread making of quinoa-wheat flour blends, International Journal of Food Science and Technology 27: 701- 705, 1992.

[13]. AOAC, *Official method of analysis,* 18th edition, Association of official analytical chemists. International Gaithersburg, Md. USA, 2005.

[14]. E.N. Onyeike, E.O. Ayalogu and C.O. Ibegbulem, Evaluation of the nutritional value of some crude oil pollution of fresh water fishes. *Global Journal of Pure and Applied Sciences 6 (2)*, 2000, 227 – 233.

[15]. M.O. Iwe, *Analysis handbook of sensory method*. (Re-joint Communications Services Limited Enugu Nigeria, 2002), 68–75.

[16]. L.A. Bryant, J.J.R. Monlecalvo, K.S. Morey, and B. Lay, Processing, functional and nutritional properties of okro seed products, *Journal of Food Science 53(3)*, 1988, 810 – 816.

[17]. S. Roday, *Food Science and Nutrition*. (Oxford University Press, India, 2007), 86.

[18]. B. Belderock, Development in bread making processing. Plant Food for Human Nutrition 55 (1): 1 – 8, 2000.

[19]. G.I.O. Badifu, C.E. Chima, Y.I. Ajayi, and A.F. Ogbori, Influence of mango mesocarp flour supplementation to micronutrient, physical and organoleptic qualities of wheat based bread. *Nigerian Food Journal 23*, 2005, 59 – 68.

[20]. G.C. Omeire, and O.I. Onyenagorom, Proximate composition and the use of African walnut (*Tetracarpidium conoforum*) as a composite flour in bread making, Nigerian Institute of Food Science and Technology (NIFST) Proceeding, 12 – 14th October, 2004.

Table 1: Recipe of the Bread Samples

Bread Ingredients	Bread samples				
	B – 100/0	B – 50/25	B – 50/50	B – 25/75	B – 0/100
Baking Fat (g)	7.50	5.63	3.75	1.88	0.00
Bullet Pear Oil (g)	0.00	1.88	3.75	5.63	7.50
Flour (g)	250.00	250.00	250.00	250.00	250.00
Bakers' yeast (g)	3.00	3.00	3.00	3.00	3.00
Common salt (g)	3.50	3.50	3.50	3.50	3.50
Granulated sugar (g)	25.00	25.00	25.00	25.00	25.00
Water (ml)	155.00	155.00	155.00	155.00	155.00

Sample Codes:

B – 100/0 = Bread made with 100 % bakery fat (Control sample).

B – 75/25 = Bread made with 75% bakery fat and 25% bullet pear fruit oil.

B – 50/50 = Bread made with 50% bakery fat and 50% bullet pear fruit oil.

B – 25/75 = Bread made with 25% bakery fat and 75% bullet pear fruit oil.

B – 0/100 = Bread made with 100% bullet pear fruit oil.

Table 2: Proximate Composition of the Bread Samples.

Bread Samples	Moisture (%)	Crude Fat (%)	Ash (%)	Crude Fibre (%)	Crude Protein (%)	Total Carbohydrate (%)	Energy Value (Kcal/100g)
B – 100/0	34.48±0.02[a]	8.14±0.02[a]	2.61±0.02[a]	0.19±0.00[a]	7.57±0.01[a]	49.02±0.02[b]	299.61±0.21[c]
B – 75/25	32.38±0.01[a]	8.20±0.02[a]	2.53±0.01[a]	0.18±0.02[a]	7.57±0.03[a]	49.14±0.02[a]	300.63±0.15[c]
B – 50/50	32.21±0.03[b]	8.41±0.02[a]	2.50±0.01[a]	0.21±0.01[a]	7.58±0.01[a]	49.09±0.05[ab]	302.37±0.12[bc]
B – 25/75	32.07±0.03[c]	8.43±0.01[a]	2.51±0.00[a]	0.24±0.01[a]	7.58±0.00[a]	49.11±0.07[ab]	303.17±0.31[b]
B – 0/100	31.83±0.03[d]	8.60±0.01[a]	2.48±0.02[a]	0.27±0.01[a]	7.58±0.02[a]	49.04±0.01[ab]	305.71±0.12[a]

Values are means of three loaves ± standard deviation. Values with different superscript along the same column are significantly different (P<0.05) using Duncan Multiple Range Test.

Sample Codes:

B – 100/0 = Bread made with 100 % bakery fat (Control sample).

B – 75/25 = Bread made with 75% bakery fat and 25% bullet pear fruit oil.

B – 50/50 = Bread made with 50% bakery fat and 50% bullet pear fruit oil.

B – 25/75 = Bread made with 25% bakery fat and 75% bullet pear fruit oil.

B – 0/100 = Bread made with 100% bullet pear fruit oil.

Table 3: Physical Parameter Measurements of the Bread Samples

Physical Parameters	Bread Samples				
	B – 100/0	B – 75/25	B – 50/50	B – 25/75	B – 0/100
Loaf length (cm)	20.40±0.02[a]	20.43±0.01[a]	20.40±0.01[a]	20.44±0.00[a]	20.41±0.02[a]
Loaf width (cm)	12.95±0.05[a]	12.95±0.00[a]	12.97±0.03[a]	12.95±0.01[a]	12.96±0.02[a]
Loaf height (cm)	6.55±0.04[a]	6.34±0.04[b]	6.13±0.03[b]	6.00±0.01[c]	5.95±0.05[c]
Loaf volume (cm³)	1730.38±0.03[a]	1677.36±0.05[b]	1621.92±0.03[c]	1588.19±0.06[d]	1573.86±0.04[e]
Loaf weight (g)	328.33±0.02[a]	326.95±0.05[b]	323.00±0.00[c]	322.07±0.05[d]	319.40±0.01[e]
Specific loaf volume (cm³/g)	5.27±0.05[a]	5.02±0.03[b]	5.02±0.05[b]	4.93±0.01[c]	4.93±0.05[c]

Values are means of three loaves ± standard deviation. Values with different superscript along the same row are significantly different (P<0.05) using Duncan Multiple Range Test.

Sample Codes:

B – 100/0 = Bread made with 100 % bakery fat (Control sample).

B – 75/25 = Bread made with 75% bakery fat and 25% bullet pear fruit oil.

B – 50/50 = Bread made with 50% bakery fat and 50% bullet pear fruit oil.

B – 25/75 = Bread made with 25% bakery fat and 75% bullet pear fruit oil.

B – 0/100 = Bread made with 100% bullet pear fruit oil.

Table 4: Sensory Evaluation of the Bread Samples.

Sensory Parameters	B – 100/0	B – 75/25	Bread Samples B – 50/50	B – 25/75	B – 0/100
Appearance (Color)	6.95 ± 1.36^{ab}	6.30 ± 1.13^{ab}	7.00 ± 1.17^{a}	5.65 ± 2.06^{bc}	5.25 ± 1.92^{c}
Flavor	5.90 ± 1.56^{a}	5.91 ± 1.53^{a}	6.60 ± 1.57^{a}	5.90 ± 1.21^{a}	6.30 ± 1.42^{a}
Texture	7.30 ± 1.22^{a}	6.10 ± 1.16^{b}	5.75 ± 1.76^{b}	5.40 ± 1.39^{b}	5.50 ± 1.24^{b}
Mouth feel	7.22 ± 1.34^{a}	7.22 ± 1.2^{a}	7.16 ± 1.11^{a}	7.15 ± 1.87^{a}	7.33 ± 1.49^{a}
Overall Acceptability	6.84 ± 1.37^{a}	6.70 ± 1.24^{a}	7.00 ± 1.23^{a}	7.11 ± 1.54^{a}	7.11 ± 1.16^{a}

Values are means of three loaves ± standard deviation. Values with different superscript along the same row are significantly different ($P<0.05$)   using Duncan Multiple Range Test.

Sample Codes:

B – 100/0 = Bread made with 100 % bakery fat (Control sample).

B – 75/25 = Bread made with 75% bakery fat and 25% bullet pear fruit oil.

B – 50/50 = Bread made with 50% bakery fat and 50% bullet pear fruit oil.

B – 25/75 = Bread made with 25% bakery fat and 75% bullet pear fruit oil.
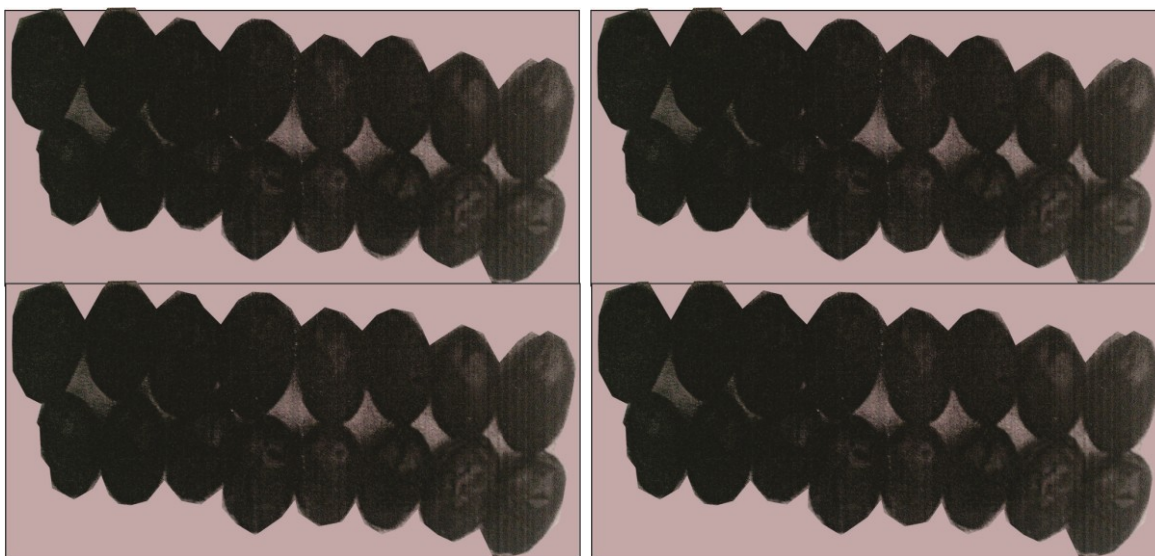
B – 0/100 = Bread made with 100% bullet pear fruit oil.

Fig. 1: Sample of Bullet Pear (*Canarium schweinfurthii*) Fruits.

| Sample B – 100/0 | Sample B – 75/25 | Sample B – 50/50 |

Sample B – 25/75	Sample B - 0/100

Sample Codes.
B – 100/0 = Bread made with 100 % bakery fat (Control sample).
B – 75/25 = Bread made with 75% bakery fat and 25% bullet pear fruit oil.
B – 50/50 = Bread made with 50% bakery fat and 50% bullet pear fruit oil.
B – 25/75 = Bread made with 25% bakery fat and 75% bullet pear fruit oil.
B – 0/100 = Bread made with 100% bullet pear fruit oil.

Fig. 2: The Picture showing the five bread samples.