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Full Length Research Paper

Incorporation of peanut as a substitute for egg in a master mix of a pastry product: composition and acceptability studies

Evelyn N. Bede

Department of Food Science and Technology, Federal University of Technology, Owerri, Nigeria.
Email: abedec@yahoo.com.

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The composition and acceptability of a pastry product 'chin chin' prepared by substituting egg with peanut in the master mix has been studied. Six different samples of the pastry product were produced. One sample was produced with neither egg nor peanut incorporated. Another sample had only egg incorporated while four samples had ground raw peanut incorporated in them at 5, 10, 15 and 20% w/w relative to the flour content. Sensory studies showed that all the 'chin chin' samples incorporated with peanut showed higher acceptability than the samples produced with egg. They also showed higher protein content which varied from 20.52 to 26.25% as against the protein content of the sample prepared with egg which was 18.51%. The sample containing 10% w/w peanut was the most preferred of all the samples. The use of 10% w/w peanut in the production of 'chin chin' as a substitute for egg will reduce the cost of the protein source in the pastry product by about 85%.

Key words: Pastry, chin-chin, incorporation, peanut.

INTRODUCTION

'Chin chin' a pastry product is usually eaten as snacks by all classes of individuals in Nigeria. After a thorough mixing of the master mix which usually contains egg as protein source, it is cut into desired shapes and sizes which is either baked or fried in oil. However, due to the relative high cost of eggs in the country (Nigeria), most 'chin chin' produced commercially do not contain egg or any other alternative source of dietary protein, thus leaving the consumers with a very poor product on the bid to maximize profit by the producers. The need therefore arises to obtain a cheap and acceptable substitute for egg in the production of 'chin chin'. However, the consumption of peanut and peanut products have been indicated as an alternative source of dietary protein, especially in countries where diary and poultry products are expensive or are in limited supply (Adair et al., 2001; Jiang et al., 2003; Mate et al., 1996; Swanson and Munsayac, 1999; Hinds et al., 1997). A study to evaluate the diet quality of free-living men, women and children given to peanut consumption (Griel et al., 2004) demonstrated improved diet quality of peanut users, indicated by the higher intake of the micronutrients, vitamin A, vitamin E, folate, calcium, magnesium, zinc, iron and dietary fibre, and by the lower intake of saturated fat and cholesterol. Peanut consumption was not associated with higher body mass index(BMI), however it serves as a complementary food to reduce postprandial glycemia (Johnston and Buller, 2005; Coelho et al., 2006). In addition, it has been suggested that frequent intake of peanut and its products may reduce colorectal cancer risk in women (Yeh et al., 2006), improve indices of cardiovascular disease risk (Alper and Mattes, 2003) and maintain metabolic order and energy balance in adults (Alper and Mattes, 2002). Consequently acceptability studies of products rich in peanuts have been car-

Table 1. Formula for master mix of 'chin chin'.

Ingredient	% w/w flour basis
Wheat flour	100
Water	160 ml / 500 g flour
Sugar	20
Salt	0.1
Shortening	10
Nutmeg	2
Baking powder	0.6
Eggs	2 eggs/ 500 g flour

Table 2. Basic chemical composition of 'chin chin' samples.

Samples	A	B	C	D	E	F
Content Variation	With egg	Without egg/peanut	with 5% peanut	with 10% peanut	with 15% peanut	with 20% peanut
Moisture Content (%)	1.82	7.07	4.07	4.00	3.66	2.26
Protein Content (%)	18.51	13.51	20.52	21.62	25.20	26.25
Fat Content (%)	17.00	14.60	19.45	20.75	21.05	25.90

ried out by some authors (Adair et al., 2001 Swanson and Munsayac, 1999).These studies showed increase in acceptability of products incorporated with peanuts and other fruits or nuts. With the above dietary and medical advantages of consumption of peanut and its products, peanut becomes a ready and cheap alternative to egg in the master mix of 'chin chin' production. In this study therefore, investigation of the variation in the basic composition of 'chin chin' and its acceptability among consumer with increasing percentage of peanut incorporation was carried out. The composition and acceptability of this 'peanut chin chin' compared with that of the 'chin chin' produced with egg and without egg were also investigated.

MATERIALS AND METHODS

Wheat flour produced by the Nigeria Flour Mills PLC was used for this work. The 'red skin spp.' of peanut (*Arachis hypogea*) commonly known as 'gwongworo' in the south eastern part of Nigeria was used. Other materials including sugar, salt, butter, nutmeg, baking powder and eggs were all sourced from a local market in Owerri, Nigeria.

The purchased peanut was sorted to remove immature nuts, damaged nuts, stones and other dirt. The sorted peanuts were ground using an attrition mill. The formulation for the master mix of 'chin chin' used for this work is given in Table 1. The formulation used the weight of the wheat flour as basis.

500 g of wheat flour were weighed each into six different cleaned plastic bowls. 0.5 g of salt, 100 g of granulated sugar, 10 g of nutmeg, 3 g of baking powder and 50 g of butter were added into each of the six bowls containing the wheat flour. The mixtures were thoroughly mixed using finger tips to obtain a uniform mixture. 2 eggs were added to only one of the bowls of flour mixtures and followed by addition of 160 ml of water to form dough. The dough was flattened to a thickness of about 10 mm using a rolling pin and was cut into strips of length 30 mm and width 10 mm. These strips were fried in deep hot vegetable oil at 155^{o}C for 20 min to produce the product sample A. In the second bowl of flour mixture, 160 ml of water was added with neither egg nor peanut addition. The product produced from this mixture gave the sample B, which represents the 'chin chin' produced commercially in Nigeria. Different quantities of raw ground peanut were incorporated into the remaining four bowls containing flour mixtures with no eggs added. 160 ml of water were added into each of the bowls. After a thorough mixture of the dough, the same sizes of 'chin chin' mentioned above were produced by deep frying in hot vegetable oil at 155^{o}C for 20 min. These sets of 'chin chin' produced were labeled samples C, D, E, and F. The variation in the content of the 'chin chin' mixtures is as given below;

Sample A - with egg added
Sample B - without egg or peanut added
Sample C - with 5% (25 g) of peanut added
Sample D - with 10% (50 g) of peanut added
Sample E - with 15% (75 g) of peanut added
Sample F - with 20% (100 g) of peanut added.

The samples were allowed to cool to ambient temperatures and determination of the basic chemical composition of the samples was carried out immediately after cooling. The chemical composition determined include, moisture, fat and protein contents. The procedure followed was as outlined in literature (AOAC, 1990).

The samples were subjected to sensory evaluation to determine consumer preferences among the different samples, for colour, taste, crispiness, flavour, mouth-feel, aftertaste perception and overall acceptability. A panel of twenty five undergraduate students very familiar with the snacks 'chin chin' was used in the sensory evaluation exercise. The samples were presented in coded identical transparent polythene bags and the samples were tested individually. The order of presentation of the six samples was- completely randomized. The panelists rinsed their mouth thoroughly with water after testing each sample and waited for a minute before proceeding to test the next sample. The sensory evaluation was based on a seven point hedonic scale as point (7) represented 'liked extremely' down to point (1) representing 'disliked extremely'.

The samples were packaged in transparent polythene bags of the same size similar to the packaging of 'chin chin' sold in the market and stored. The packaged samples were kept on the shelf for eight weeks. Free fatty acid (FFA) measurements were taken on weekly basis for all the samples. The procedure was also as previously given (AOAC, 1990).

RESULTS

The results of this work are- presented below. Table 2 shows the basic chemical compositions of the 'chin chin' samples. In **T**able 3, the results of the sensory scores of the samples are presented. The quality attributes considered were colour, taste, crispness, flavour, mouth feel, after taste perception and overall acceptability. Table 4 gives the comparison of mean percentage FFA values of the samples over the weeks of storage, while Figure 1 illustrates the trend of the percentage FFA values for the samples over the weeks of storage.

DISCUSSION

Table 2 showed that Sample A had the lowest percentage moisture of 1.82% while sample B had the highest

Table 3. Sensory scores for the 'chin chin' samples.

Samples	A	B	C	D	E	F
Content Variation	with egg	without egg/peanut	with 5% peanut	with 10% peanut	with 15% peanut	with 20% peanut
Colour	5.58^{c}	5.88^{ab}	5.92^{ab}	6.19^{a}	5.88^{ab}	5.81^{bc}
Taste	5.12b^{ed}	4.18^{def}	5.31^{bcd}	6.04^{a}	5.58^{abc}	5.50^{abc}
Crispness	4.27^{f}	5.31^{f}	5.69^{ab}	5.96^{a}	5.59^{abc}	5.19^{bcde}
Flavour	4.77^{cde}	4.69^{def}	4.85^{d}	5.65^{a}	5.54^{abc}	5.31^{abc}
Mouth feel	4.73^{cde}	4.88^{bcde}	5.04^{bcd}	5.92^{a}	5.35^{abc}	5.46^{ab}
After taste Perception	4.62^{cdef}	4.67^{cde}	5.12^{abcd}	5.65^{a}	5.38^{ab}	5.15^{abc}
Overall Acceptability	4.63^{cd}	4.39^{d}	5.22^{b}	6.33^{a}	5.48^{b}	5.12^{bc}

Values within a row for each attribute with different superscript are significantly different ($P < 0.05$).

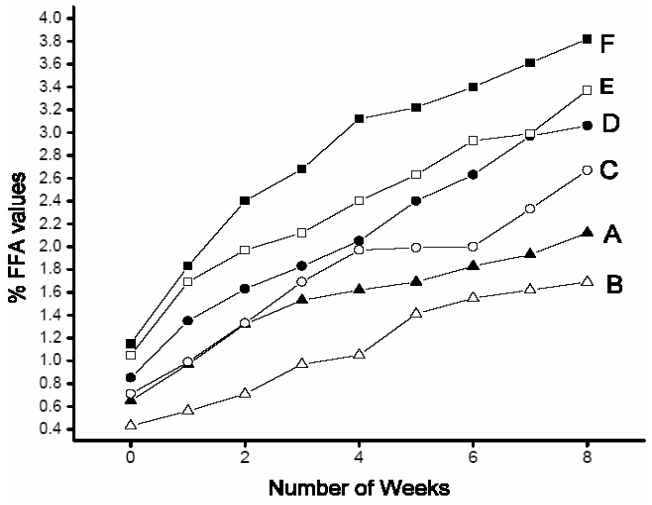

Figure 1. Variation in percentage FFA values with storage time for the 'chin chin' samples.

value of 7.07%. The moisture content for the samples C to F decreased with increase in peanut incorporation. The variations in moisture content of the samples could be as a result of the nature and quantity of protein contained in them. Sample A which contained animal protein in form of egg bound up much moisture during its protein denaturation unlike the other samples (C to F) that contain plant protein in form of peanut. The sample B with no other protein save that contained in the wheat was left with the highest moisture content.

The table also showed that with the addition of only 5% w/w peanut (Sample C), the percentage of protein in the 'chin chin' product was higher than that in sample A (produced with egg). As the percentage of peanut increased, the percentage protein content also increased. However, incorporation of peanut up to 5% w/w showed a higher percentage of fat compared with sample A with egg incorporated. This increased fat content in samples C to F could be due to the high percentage of oil of about 40 - 56.2% in peanut (Ihekoronye and Ngoddy, 1988).

In Table 3, the sensory evaluation showed that the samples with peanut incorporated were more acceptable than the chin-chin samples made without peanut (samples A and B). Sample D (sample with 10% w/w groundnut) was the most preferred in all the organoleptic quailties. This suggests that 10% w/w incorporation of peanut in 'chin-chin' will be the best mixing ratio of incorporation of peanut. At this 10% w/w incorporation of peanut, there was 16.8% increase in protein over the 'chin-chin' produced with egg. When the cost of 2 eggs were compared with the cost of 50 g of peanut in Nigeria, a reduction cost for the protein source of about 85% was obtained (taking average retail cost of 2 eggs to be N40.00 as compared to the retail cost of 50 g of peanut which was calculated to be N6.00), hence suggesting that incorporation of groundnut as a substitute for egg in 'chin chin' will make the product more acceptable and cheap. In addition, consumption of peanut and its products showed a lower intake of saturated fat and cholesterol (Griel et al., 2004) hence making it more preferred to egg which has a high cholesterol content (Pesti and Bakali, 1998; Froning et al., 1998).

The trend for all samples in Figure 1 was- similar as the percentage FFA values increased with weeks of storage. The FFA values for Sample B showed least deviation, followed by sample A. The increase of FFA values with weeks of storage varied greatly with higher percentage of peanut incorporation. It could be observed that the difference in FFA values for sample A and sample C were very small until after the second week. This observation was also confirmed in the table for the statistical comparison of FFA values for the samples (Table 4). The percentage FFA values for samples A and C were not significantly different ($p < 0.05$) till after the second week of storage. At the end of the second week of storage, the percentage FFA values for sample D had doubled. Considering the trend of the percentage FFA values of the samples, it could be inferred that organoleptic qualities of the 'chin chin' samples incorporated with groundnut (Sample C - F) will deteriorate faster than the others (samples A and B). However, most 'chin chin' products

Table 4. Comparison of mean percentage FFA values for samples over the storage period.

Samples	A	B	C	D	E	F
Content Variation	with egg	without egg/peanut	with 5% peanut	with 10% peanut	with 15% peanut	with 20% peanut
Week 0	0.65[a]	0.43[b]	0.71[a]	0.85[c]	1.05[d]	1.15[e]
Week 1	0.97[a]	0.56[b]	0.99[a]	1.35[c]	1.69[d]	1.83[e]
Week 2	1.32[a]	0.71[b]	1.33[a]	1.63[c]	1.97[d]	2.40[e]
Week 3	1.53[a]	0.97[b]	1.69[c]	1.83[d]	2.12[e]	2.68[f]
Week 4	1.62[a]	1.05[b]	1.97[c]	2.05[d]	2.40[e]	3.12[f]
Week 5	1.69[a]	1.41[b]	1.99[c]	2.40[d]	2.63[e]	3.22[f]
Week 6	1.83[a]	1.55[b]	2.00[c]	2.63[d]	2.93[e]	3.40[f]
Week 7	1.93[a]	1.62[b]	2.33[c]	2.97[d]	2.99[d]	3.61[e]
Week 8	2.12[a]	1.69[b]	2.67[c]	3.06[d]	3.37[e]	3.82[f]

Values within a row for each attribute with different superscript are significantly different ($P < 0.05$).

sold in stores rarely exceed 2 weeks on the shelf. The comparison of percentage FFA values over the storage period (Table 4) showed that the FFA values for the samples were significantly different from one another ($p < 0.05$) throughout the storage period except for sam-ples A and C with FFA values not significantly different in weeks 0 – 2. Also FFA values for samples D and E were not significantly different in week 7.

Conclusion

'Chin chin' produced with the incorporation of plant protein as an alternative to egg has shown acceptable quality characteristics. This substitution of peanut for egg will not only increase the protein content of the chin-chin but will highly reduce the cost of producing a protein rich 'chin chin' by about 85%. The most acceptable mixture was the chin-chin with 10% w/w peanut incorporation. As a result of the improved organoleptic quality of chin-chin due to the incorporation of peanut, the problem of producing poor quality pastries in developing countries such as Nigeria due to high cost of animal protein could be abated.

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