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Effect of Mixing Ratios on Proximate Composition and Consumer Acceptability of "Gurundi" Snack Prepared from Tigernut (*Cyperus esculentus*)

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ABSTRACT: Gurundi a crunchy ready to eat snack was prepared from tigernuts, using different formulations of mixing ratios tigernut: cassava starch ANN (50:50), BUK (90:10), FUN (80:20), YEM (70:30). Proximate composition evaluation of the resultant snacks showed Protein, Fat, Crude fibre, Carbohydrate, Total ash and moisture content decreased with an increase in cassava starch ratio in all the snacks. Consumer acceptability of the different formulation ratios of snacks produced was also determined with respect to the following parameters: taste, colour, crunchiness, mouthfeel and general acceptability by trained panelists. At ($P \leq 0.05$), There was no significant difference in taste and mouthfeel at for all samples. ANN was the most preferred sample for all parameters except crunchiness. BUK was least preferred in terms of colour. FUN and YEM were most preferred for crunchiness. BUK with the highest proportion of tigernuts was least preferred in terms of crunchiness. Though ANN had the most general acceptability, FUN would provide more calorific energy nutritionally since it has a higher carbohydrate content. ©JASEM

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Gurundi' a crunchy ready to eat snack food was prepared from Tigernut, which belong to the family *cyperaceae* and produce rhizomes from the base and tubers that appear spherical. It is known by several names such as'Chuffa, chew-fa and Zulu nuts' (Adejuyitan *et al.,* 2009). In Nigeria, the utilization of tigernut is highly limited despite the fact that it is cultivated in the northern part of the country (Ukwuru *et al.,* 2011). Known modes of consumption of tigernuts apart from the raw state include but are not limited to roasted dried, baked form or processed into a refereshing beverage (Cantalejo, 1997; Abaejoh *et al.,* 2006). 'Gurundi' is prepared locally in Nigeria from nuts. Coconut is the most predominant nut used. Convenience foods whilst serving as a snack food, can be helpful in reducing postharvest food losses particularly in areas with less developed storage technology (Adegoke and Adebayo, 1994) hence enhancing food and nutrition security They are ready to eat foods usually consumed in between meals. Snacks are normally eaten in between meals and are usually smaller than regular meals. Snacks are known to contribute significantly to the daily nutrient and calorie intake (Badau, 2013; Bhattacharyya *et al.,* 1997). Snacks are typically produced from common ingredients available in a locality and designed with the expectation of being portable and providing quick satisfaction.(Badau, 1997) Tigernut (*Cyperus esculentus*) is reputed to be very rich in mineral content, sodium, potassium, magnesium, zinc and traces of copper (Omode *et al.,* 1995). It is also an excellent source of useful minerals such as iron and calcium which are essential for body growth and development (Oladele and Aina, 2007;Omode *et al.,*1995). Tigernut are underutilized crops which are valued for their highly nutritious starch content, dietary fibre, carbohydrate, mono, di and polysaccharide (Umerie and Enebeli, 1997). Despite the varied advantages and potential of this crop, it is largely consumed in raw form as snack in few places; hence more studies are needed to further demonstrate its potential to aid its acceptability in food formulation in Nigeria (Ade-Omowaye *et al.,* 2009). This study was conducted to determine the effect of mixing ratios on the proximate composition and consumer acceptability of gurundi made from tigernut using different mixing ratios (Tigernut: Cassava starch). Proximate analysis of samples was determined. Sensory evaluation parameters (taste, colour, crunchiness, mouth-feel and general acceptability) were assessed to determine the quality

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attributes of samples with a view to determine its acceptability.

MATERIALS AND METHODS

Materials: Wholesome tigernuts, cassava starch, salt, spices and granulated sugar were purchased from Yaba market in Lagos Nigeria. The traditional method of preparing 'gurundi' was prepared as follows

Chemical Analysis: Standard methods described by AOAC (2000) were used to determine the proximate composition such as crude protein, moisture content, fat ash and total carbohydrate. The moisture content was determined by drying the Gurundi in a hot air oven at100-105^{0}C for 4hrs or until a constant weight was determined. Kjeldahl method was used to determine Protein. Fat was determined using Soxhlet Extraction Method using petroleum ether at 40-60^{0}C.

Sensory Evaluation: Sensory evaluation was done using multiple comparism tests as described by Larmond 1977. A panel of ten panelists of trained students of the Department of Food Technology, Yaba College Technology were selected and trained to assess acceptability of snacks of different blending ratios of tiger nuts: cassava starch. A 9-points hedonic scale method (9: Like extremely and 1 Dislike extremely) was used to evaluate the following parameters (taste, colour, crunchiness, mouth feel and general acceptability).

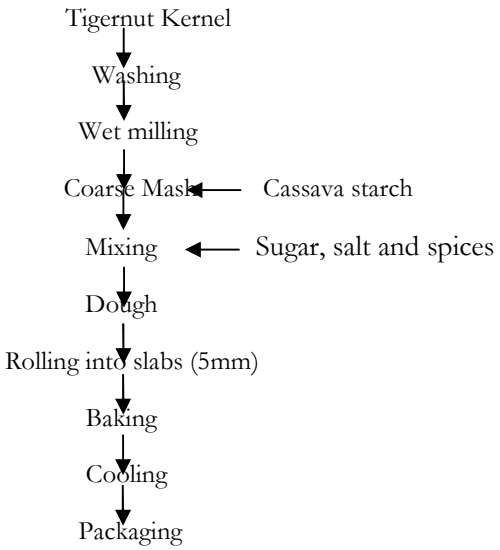

Fig:1: Process flow chart for production of Tigernut Gurundi'.

RESULTS AND DISCUSSION

Proximate composition: The effect of mixing ratios on the proximate composition of "Gurundi" Snack prepared from tigernut (*Cyperus esculentus*) is summarized in Table 1. The protein content of the Gurundi snack decreased with an increase tigernut in the mixing ratio which varied from 6.6% to 8.2% for BUK (90:10). The fat content also followed the same trend as it varied from 7.14% for ANN (50:50) to 7.12% for BUK (90:10). Total carbohydrate content varied between 60.17% to 69.70% and reduced with an increase in the mixing ratios. This could be a desirable attribute for weight watchers and diabetic patients who require less carbohydrate and high protein intake. Decreased carbohydrate content and increased protein content also contributes to the highest energy content (386.8Kcal/g) of the 'gurundi' snack. The synergetic effect of low carbohydrate, high protein and high energy contents of the snack is an additional advantage. The moisture content of the snack varied between 5.2 to 6.5%. Total ash varied from 2.7% to 3.6%. Crude fibre varied between 6.25% to 7.12%. The proximate analysis showed that all the samples were within the normal moisture contents of dried food / snack foods to ensure shelf stability if properly packaged. Snacks are a good vehicle to promote nutrition and food security and reduce malnutrition. Egounlety (2002) opined that 'Early childhood malnutrition is detrimental to the mental and physical development of the child and has a negative impact on the growth and productivity of a nation if careful attention is not paid to it. Snacks play a strong role in the diets of children and can go a long way in preventing early childhood malnutrition. The low moisture of snacks which ranged between 5.20% and 6.5% in the four formulations is a good indicator of their potential to have longer shelf life. This is in line with the findings of Vincent, 2002. It is believed that materials such as snack food and starch containing more than 12% moisture have less storage stability than those with lower moisture content. For this reason, a moisture content of 10% or less is generally specified for flours and other related products. The crunchy snack products were allowed to equilibrate for periods of more than one week at 60% relative humidity and at room temperature (25 to 27^{0}C). The ash content, which is an indication of the presence of mineral elements ranged from 2.7% to 3.6%. Ash content was found to be higher in gurundi fortified snacks. Fortification thus increased the ash content, protein, fibre and crude fat content of the snack. These values are similar to the values reported from the production of legumes fortified weaning food (Egounlety, 2002) but lower than that reported by Kanu *et al.,* 2009 from production and evaluation of breakfast cereal-based porridge mixed

with sesame and pigeon peas for adults. Fat content ranged from 7.14% to 12.22%. A similar increase for soy–maize snacks (Lasekan & Akintola, 2002). The gross energy value for the gurundi snack ranged between 331.4 to 421.58KJ/100g (Table 3). Gurundi snack fortified with 10% cassava starch had the highest energy value of 421.58KJ/100g while the gurundi snack with 50% cassava starch had the lowest energy content of 331.34kJ/100g. The energy content of the snacks was found to decrease with an increase in cassava starch blend ratios. Energy was observed to be high for all the four formulations. Significantly higher ($p \leq 0.05$) as shown in Table 3. Energy content is a parameter used to determine the quality of food especially for formulations designed for adult with high energy requirements. According to the Indian Council for medical research, the required optimal protein-calorie requirement for preschool children in India is 7.1% (Mahgoub, 1999). Protein-energy ratio gives the protein content of a food or diet expressed as the proportion of the total energy provided by protein (17KJ i.e. 4kcal/100 g). The average requirement for percent protein is about 7% of total energy intake. Average Western diets provide about 14% for children and half of it for adults (Bender, 2005).

Table1: Proximate composition of 'Gurundi' in (%) at different mixing ratios.

Blend ratio	Protein (%)	Fat(%)	Crude fibre(%)	Carbohydrate(%)	Ash(%)	Moisture content (%)
ANN (50:50)	6.60	7.14	6.25	60.17	2.7	5.20
BUK (90:10)	8.20	2.22	7.12	69.70	3.6	6.50
FUN (80:20)	7.62	11.22	7.00	61.52	3.2	6.41
YEM (70:30)	7.50	9.35	6.72	62.73	3.0	6.12

Consumer Acceptability: Sensory analysis is defined as a scientific application used to evoke, measure, analyze, and interpret responses to food attributes or characteristics as they are perceived through a person's sense of sight, smell, hearing, touch, and taste in forming a food perception (Stone and Sidel, 1993). Taste is the primary factor that determines the acceptability of any product, which has the highest impact as far as market success of the product, is concerned. The effects of mixing ratios on the consumer acceptability of "Gurundi" snack prepared From Tigernuts (Cyperus esculentus) are summarized in Table 2 below. Consumer testing is one of the most important activities in product development. The primary purpose of consumer tests is to assess the personal response by current and potential customers of a product, product ideas, or specific product characteristics. Consumer evaluation concerns itself with testing certain products using people who are or will become the ultimate users of the product. Consumer testing is necessary throughout the various stages of a product cycle. These stages include the development of the product itself, product maintenance, product improvement and optimization, and assessment of market potential (Resurreccion, 1998). In this study, the consumer test was conducted to detect differences between products. The entire sample ANN, BUK and FUN were well rated in terms of their sensory attributes. Significant differences however were observed among sample attributes at 5% level of significance ($P \leq 0.5$). Sample ANN with blend ratio 50:50 (Tigernut: cassava starch) had the overall best general acceptability followed by samples FUN, YEM and BUK which was least accepted. There were no significant differences in taste and mouth-feel ($P \leq 0.5$), for all samples. ANN was the most preferred sample for all parameters except crunchiness. BUK was least preferred in terms of colour. The colour was found to be preferred by panelists as the quantity of Tigernuts decreased in the blend ratios and starch content increased in samples. FUN and YEM were most preferred for crunchiness. BUK with the highest proportion of tigernut was least preferred in terms of crunchiness. This is probably attributable to an increase in the Fibre content of the snack from Tigernuts. Though ANN had the best general acceptability, FUN would provide more calorific energy nutritionally since it has a higher carbohydrate content. General acceptability was found to increase with an increase in cassava starch in the blend ratio and a decrease in tigernut on (W/W) basis. There were no significant differences in blend ratios for samples FUN and YEM respectively for all parameters except for general acceptability where FUN was better preferred.

Table 2: Sensory evaluation of 'Gurundi' in (%) at different mixing ratios.

Blend Ratios	Taste	Colour	Crunchiness	Mouth Feel	General Acceptability
ANN (50:50)	8.9[a]	8.6[a]	8.0[ab]	8.2[a]	8.5[a]
BUK (90:10)	7.8[a]	6.5[b]	7.1[b]	7.3[a]	6.3[b]
FUN (80:20)	8.1[a]	8.1[ab]	8.3[a]	7.6[a]	7.2[ab]
YEM (70:30)	7.7[a]	7.6[ab]	8.3[a]	8.1[a]	6.8[b]

Mean of sensory scores with same superscript letters in a column are not significantly different at ($P \leq 0.05$)

Table 3: Gross energy values of 'Gurundi' in (%) at different mixing ratios

	Gross Energy (KJ/100g)			
Blend Ratios	ANN (50:50)	BUK (90:10)	FUN (80:20)	YEM (70:30)
	331.34	421.58	377.54	365.07

Conclusion: Gurundi snack made from tigernut at different mixing ratios had no significant differences in term of taste and mouth-feel. There were however significant differences in terms of crunchiness, colour and general acceptability. This product has increased the variety of products tigernut can be made into. It is noteworthy that the relatively low moisture content for all the ratios of snacks which was below 7% ensured good keeping quality and low susceptibility to mould growth for the snacks, if properly packaged and stored. Since snacking is a major part of our culture and food habits, 'Gurundi' snack from tigernut is a significant addition to snack variety available. This snack needs to be given adequate publicity, because of it health benefits which include its rich fibre and mineral content from the health and nutritional standpoint. Gurundi snack has good potentials of being used as a means of fortification with good energy value to make up for deficient nutrients among target consumer populations.

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