

The Acceptability of Snack (Chin Chin) Produced From Composite Blends of Wheat, Acha, and Soy Flour Using Date As Sweetener.

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ABSTRACT

INTRODUCTION: Snack foods, which are typically considered convenience foods, have long been a staple of household diets and have made significant contributions to the economies of all countries (Lasekan and Akintola, 2002). Both industrialised and developing nations are experiencing high population growth and urbanisation, which is driving up demand for snacks (Ugwuanyi et al., 2020). For many consumers, snacks play a significant role in their daily intake of calories and nutrients (Awoyale et al., 2011). The acceptability of ChinChin snacks made from composite mixes of wheat, acha, and soy flour, sweetened with dates, was examined.

MATERIALS AND METHOD: The ingredients for chin chin (margarine, eggs, nutmeg, baking powder, vanilla, milk, salt, sugar, and vegetable oil) and the raw materials for this study (wheat, Acha, soybeans, and date palms) were bought from Sayedero markets in Ilaro, Ogun State, Nigeria. The production methods were adapted from previous studies conducted by Ndife et al. (2014), Okoye et al. (2008), Falola (2011), and Folohunso (2018). 100% wheat made up Sample A, 100% acha made up Sample B, 80% acha, 10% soybean, and 10% date made up Sample C, 70% acha, 20% soybean, and 10% date made up Sample D, and 60% acha, 30% soybean, and 10% date made up Sample E. The samples of chin-chin snacks were analysed for proximate composition using the usual techniques outlined by the AOAC. The analysis's findings were displayed as mean $\pm$ standard deviation. The Statistical Package for Social Sciences (SPSS version 20.0) was used to perform an Analysis of Variance (ANOVA) on the acquired results. Duncan's Multiple Range Test (DMRT) was used to separate the means. $P < 0.05$ indicated a significant difference.

RESULTS AND DISCUSSION: Table 1: Proximate composition of the snack (Chinchin)

SAMPLES	MOISTURE CONTENTS (%)	CRUDE FAT (%)	TOTAL ASH (%)	CRUDE FIBRE (%)	CRUDE PROTEIN (%)	TOTAL CARBS (%)
A	11.74 $\pm$ 0.04 ^d	24.61 $\pm$ 0.01 ^c	1.43 $\pm$ 0.03 ^a	1.24 $\pm$ 0.02 ^a	24.83 $\pm$ 0.02 ^e	59.12 $\pm$ 0.09 ^e
B	3.67 $\pm$ 0.03 ^e	23.96 $\pm$ 0.02 ^b	1.45 $\pm$ 0.02 ^a	1.26 $\pm$ 0.14 ^a	11.96 $\pm$ 0.02 ^a	37.00 $\pm$ 0.01 ^a
C	3.22 $\pm$ 0.03 ^a	19.91 $\pm$ 0.02 ^a	2.69 $\pm$ 0.04 ^b	0.24 $\pm$ 0.03 ^b	15.22 $\pm$ 0.02 ^b	43.33 $\pm$ 0.09 ^b
D	6.09 $\pm$ 0.02 ^b	28.84 $\pm$ 0.03 ^d	2.70 $\pm$ 0.03 ^b	0.86 $\pm$ 0.04 ^b	18.44 $\pm$ 0.03 ^c	45.30 $\pm$ 0.06 ^c
E	9.07 $\pm$ 0.02 ^c	29.03 $\pm$ 0.04 ^e	2.86 $\pm$ 0.03 ^c	0.94 $\pm$ 0.03 ^c	24.83 $\pm$ 0.02 ^e	47.83 $\pm$ 0.11 ^d

Samples with different superscripts within the same column were significantly different ($p < 0.05$).

Result reveals that samples A and C had the greatest and lowest moisture contents, respectively, ranging from 3.22% to 11.74%. Sample C had the lowest fat level, which varied from 19.91% to 29.03%. Sample B had the highest fibre content, which ranged from 0.24% to 1.26%. The largest levels of protein were found in Samples A and E, which ranged from 11.9% to 24.83%. Sample C is more shelf-stable and appropriate for diabetics due to its decreased moisture, lipid, and carbohydrate content, according to the proximate analysis.

CONCLUSION: This study suggests that date palm fruit and Acha flour can replace refined sugar and wheat flour in snacks, promoting nutritious and sustainable food products and supporting public health.

KEYWORDS: Convenience Food, Nutritional Health, Natural Sweetener, Sustainable Bite

INTRODUCTION

Household food security is one of the characteristics that predisposes a person to malnutrition and is essential for adequate nutrition, according to Atoloye et al. (2015). Generally regarded as convenience foods, snack foods have long been a mainstay of household diets and have significantly boosted the economy of every nation (Lasekan and Akintola, 2002). Snack demand is rising as a result of rapid urbanisation and population expansion in both developed and developing countries (Ugwuanyi et al., 2020). Snacks contribute significantly to the daily calorie and nutritional consumption of many consumers (Awoyale et al., 2011).

Cereal snacks, which usually have low nutritional density, are the most popular. According to Ugwuanyi et al. (2020), snack foods are accessible, inexpensive, and simple to eat in places including stores, schools, and the streets. In West African nations, particularly Nigeria, chin-chin is a typical fried delicacy. It is a hard, sweet, baked, or fried food that is frequently liked for its crunchy texture and sweet flavour. Dough produced with wheat flour and additional additives is used to make it (Akubor, 2004; Mepba et al., 2007). However, the main component of the standard composition, wheat flour, might not offer a balanced nutritional profile.

Legumes are the edible seeds of leguminous plants in the Leguminosae family. Since they are known to have twice as much protein as cereals, they are frequently added to cereal-based snacks to boost their protein content (Enwere, 1998; Fasogbon et al., 2017).

Legumes have been successfully included into baked goods to provide protein-enriched products with improved amino acid balance (Mohammed et al., 2012). Soybeans (*Glycine max*) are a rich source of protein, fat, carbohydrates, vitamins, minerals, and water. It is regarded as the meat of the poor in underdeveloped countries where animal products are costly. According to Enwere (1998) and Fasoyiro et al. (2006), it is the most effective alternative to address the problem of protein energy insufficiency.

The gramineae family includes the cereal grain Acha (*Digitaria exilis*), also referred to as hungry rice or fonio (Ayo JA, and Nkama 2003). Porridge, steamed foods (burabusco and couccous), thick (tuwo) and thin (kuku) dishes, and alcoholic beverages are the main traditional cuisines made from the grain (Badifu GIO and Aka S 2001). Acha has a significant amount of pentosan, which may contribute to its high water absorption capacity. It is possible to exploit acha's exceptional water-absorbing qualities in baked foods. Its distinct nutritional properties, low glycaemic index, and comparatively low sugar content guarantee reduced blood fluctuation, which could aid in the recovery of diabetics (Ayo et al., 2018).

Agu et al. (2015) state that acha is a good source of macronutrients and is high in the amino acids cysteine and methionine, which are lacking in other cereal grains. Furthermore, lysine, an essential amino acid, is typically absent from grain flours. The majority of the snacks are low in protein and made of cereal. Thus, adding sources of protein from leguminous plants to cereal proteins can boost their nutritious value (Agu et al., 2015).

Sweeteners are chemicals that increase food products' shelf life and flavour (Andrew, 2018). Sugar substitutes are food additives that taste sweet like sugar but have significantly less food energy, giving them low- or no-calorie sweeteners. They are frequently referred to as sweeteners. Natural sweeteners, such as maple syrup, honey, dates, steric acid, molasses, and xylitol, are made naturally without the use of sophisticated machinery or unnatural chemicals, claim Neascu and Madar (2014).

The date palm tree (*Phoenix dactylifera*), which grows in many tropical parts of the world, produces the edible fruits known as dates. The date is also known in Hausa as "Dabidun."

Dates are not only delicious and chewy, but they also have several benefits. They are also rich in a few essential elements. Dates include several vitamins, minerals, and antioxidants that may help delay the onset of certain chronic diseases, in addition to fibre, which may help regulate blood sugar and reduce constipation (Elliott, 2018). In

addition to their delicious flavour, dates are a nutritional powerhouse that can significantly increase your energy levels. In addition to being used in various different cuisines, they can be stuffed, sliced, and caramelised. They are a great way to combine wellness and flavour (Vineetha, 2014). Ripe dates are around 80% sugar, with the rest being protein, fibre, and trace minerals like copper, fluorine, zinc, boron, and cobalt (Al-Shahib and Marshall, 2003). Calcium, iron, phosphorus, sulphur, potassium, copper, manganese, magnesium, fibre, and vitamins B1, B2, B3, B5, A, and C are all abundant in dates (Mazlan, 2018). Date palm fruit flour could replace refined sugar in snack recipes because date palm fruit is naturally sweet and nutrient-dense.

Composite flour is seen as beneficial in developing nations (Singh et al., 2008) because it promotes the use of locally grown crops as flour and lessens dependency on imported wheat flour. As a result, a number of developing nations have promoted the use of locally accessible flour alternatives in place of wheat flour. The sensory attributes, anti-nutrients, and proximate composition of chin chin made from composite blends of wheat, acha (*Digitaria exilis*), and soy flour sweetened with dates (*Phoenix dactylifera*) will be investigated in this study.

MATERIALS AND METHODS

Materials' source

The raw materials for this study (wheat, Acha, soybeans, and date palms) and the ingredients for chin chin (margarine, eggs, nutmeg, baking powder, vanilla, milk, salt, sugar, and vegetable oil) were purchased from Sayedero markets in Ilaro, Ogun State, Nigeria.

RAW MATERIAL PREPARATION

Preparation of wheat flour

The methods of Joel Ndife et al. (2014) was used. The grains of whole wheat were first cleaned, sorted, and washed with water. After that, they were dried for 15 minutes at 60°C in an oven. The whole wheat grains were stored in an airtight container for later use after being finely ground in a disc attrition mill and sieved through a 2 mm sieve.

Preparation of Acha Flour

Falola (2011) outlined the process of turning Acha grain into flour. They picked dirt, husks, and other foreign items by hand after destoning the acha grain. After being further cleansed with water, the acha grains were dried in a hammer mill after being cooled and dried for four hours at 80°C. To create flour, the ground acha flour was sieved and run over a 0.2 mm mesh screen. It was then stored in an airtight container for subsequent use.

Preparation of Soybean flour:

The soybean seeds were cleaned and sorted using the Okoye et al. (2008) method in order to get rid of bugs, insects, and other impurities. To eliminate the anti-nutrients present in soybeans, it was dehulled and dried in an air oven set at 60 degrees Celsius after soaking for six hours (Kappa Catering Equipment, Italy). After being roasted for 10 minutes at 120°C, the flour was ground and allowed to go through a 500 µm mesh screen to create fine flour. It was then put in a sealed container and kept at 40°C until it was required.

Processing of date fruit powder:

A method outlined by Folorunsho (2018) was used to turn date palm fruit into flour. To get rid of dirt and extraneous material, the dates were sorted and cleaned. The dates were then manually deseeded (de-pitted), cleaned,

weighed, and sliced with a knife into little pieces. After being dried for 12 hours at 60 degrees Celsius in a hot air oven, the pulp containing the pericarp was ground into flour with a blender and sieved through a 0.35 mm mesh screen. The date palm flour was kept at room temperature after being firmly sealed in an airtight container.

COMPOSITE FORMULATION

Table 1: Ratio Formulation of the Composite Flour (%)

Flour	Wheat	Acha	Soybean	Date
A	100	0	0	0
B	0	100	0	0
C	0	80	10	10
D	0	70	20	10
E	0	60	30	10

Table 2: Ratio Formulation for Chinchin Production

sample	Wheat	Acha	Soybean	sugar	Date	Egg	B.powder	Butter	Milk	Salt	Flavor	Water
A	100	0	0	10	0	50g	1/4 Tsp	10g	20ml	Pinch	1/4 Tsp	4 ^{1/2} Tbs
B	0	100	0	10	0	50g	1/4 Tsp	10g	20ml	Pinch	1/4 Tsp	4 ^{1/2} Tbs
C	0	80	10	0	10	50g	1/4 Tsp	10g	20ml	Pinch	1/4 Tsp	4 ^{1/2} Tbs
D	0	70	20	0	10	50g	1/4 Tsp	10g	20ml	Pinch	1/4 Tsp	4 ^{1/2} Tbs
E	0	60	30	0	10	50g	1/4 Tsp	10g	20ml	Pinch	1/4 Tsp	4 ^{1/2} Tbs

Preparation of Chin-chin

The components, which included grated nutmeg and salt, were put in a bowl after 100g of each composite flour had been weighed and sieved. After that, eggs, margarine, baking powder, and powdered milk were manually combined to create a batter. To make a fairly hard dough, the mixture was combined with flour and water and then thoroughly kneaded. The dough was rolled tightly to a thickness of 1 cm on a board that had been cut into uniform cubes. After that, it was deep-fried for six minutes, or until golden brown, in hot vegetable oil at 180°C. The chin was removed from the oil and drained on paper towels to remove any excess, then allowed to cool before being studied in an airtight container.

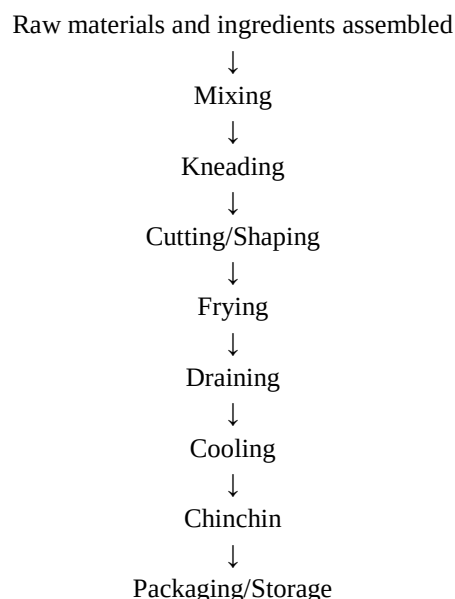


Figure 1: Flow Chart for the Production of Chinchin by Ndife et al., (2020)

Proximate

analysis

The chin-chin samples' proximate analysis (moisture, ash, protein, fat, and crude fibre) was determined using the Association of Official Analytical Chemists (2006) protocol. Carbohydrates were calculated as the difference of moisture, protein, fat, ash, and crude fibre from 100%. According to Adegunwa et al. (2017), the Atwater factor method was used to determine the energy content (E). E is equal to $4 \times \text{Fat} + 4 \times \text{Carbohydrate} + 9 \times \text{Protein}$.

Statistical Analysis

The results of the analysis were presented as mean $\pm$ standard deviations. The obtained results were subjected to an Analysis of Variance (ANOVA) using the Statistical Package for Social Sciences (SPSS version 20.0). The means were separated using Duncan's Multiple Range Test (DMRT). A significant difference was shown by a $P < 0.05$.

RESULTS AND DISCUSSION

Proximate Composition of Snack

Table 3: Proximate composition of the snack (Chinchin)

SAMPLES	MOISTURE CONTENTS (%)	CRUDE FAT (%)	TOTAL ASH (%)	CRUDE FIBRE (%)	CRUDE PROTEIN (%)	TOTAL CARBS (%)
A	11.74 $\pm$ 0.04 ^d	24.61 $\pm$ 0.01 ^c	1.43 $\pm$ 0.03 ^a	1.24 $\pm$ 0.02 ^a	24.83 $\pm$ 0.02 ^e	59.12 $\pm$ 0.09 ^e
B	3.67 $\pm$ 0.03 ^e	23.96 $\pm$ 0.02 ^b	1.45 $\pm$ 0.02 ^a	1.26 $\pm$ 0.14 ^a	11.96 $\pm$ 0.02 ^a	37.00 $\pm$ 0.01 ^a
C	3.22 $\pm$ 0.03 ^a	19.91 $\pm$ 0.02 ^a	2.69 $\pm$ 0.04 ^b	0.24 $\pm$ 0.03 ^b	15.22 $\pm$ 0.02 ^b	43.33 $\pm$ 0.09 ^b
D	6.09 $\pm$ 0.02 ^b	28.84 $\pm$ 0.03 ^d	2.70 $\pm$ 0.03 ^b	0.86 $\pm$ 0.04 ^b	18.44 $\pm$ 0.03 ^c	45.30 $\pm$ 0.06 ^c
E	9.07 $\pm$ 0.02 ^c	29.03 $\pm$ 0.04 ^e	2.86 $\pm$ 0.03 ^c	0.94 $\pm$ 0.03 ^c	24.83 $\pm$ 0.02 ^e	47.83 $\pm$ 0.11 ^d

Samples with different superscripts within the same column were significantly different ($p < 0.05$).

Table 3 above displays the chin-chin snacks' approximate composition. The snack's moisture content ranges from 3.22% to 11.74%. The two control samples, A and B, had different levels of moisture. Sample A, which included 100% wheat flour, had a higher moisture content. This figure was substantially ($p < 0.05$) higher than the other products that contained soybeans and acha. The snack's moisture content exceeded the 3.18–3.54% moisture content of chin-chin made using wheat and *Cissus populnea* stem composite flours, according to Wahab et al. (2018). Since the snack was constructed completely of wheat, sample A's high moisture content can be explained.

Deedam, China, and Wachukwu (2020) found that sample C had a low moisture content, ranging from 3.14% to 4.85%, when making chin-chin with a blend of wheat and African walnut flour. Less than 10% moisture content is unlikely to have any negative consequences on the finished product. Because products with reduced moisture content store better, the chin-chin sample blend's moisture content was below this range, suggesting that the items will be more shelf stable.

Nonetheless, this study's fat percentage varies between 19.91% and 29.03%. The fat contents of samples C and E were the lowest and highest, respectively. When chin-chin is produced from maize, soybean, and orange-fleshed sweet potatoes, the fat concentrations range from 12.60 to 16.70 percent, which is higher than what Ndife et al. (2020) observed. The fat level of the items may have increased as a result of the 30% soybean added to the formulation. The flour samples' higher oil content reduces their shelf life by increasing their susceptibility to rancidity and an off taste.

The sample's ash content varied between 1.43% and 2.83%. Ash content was highest in Sample E (2.86%). The amount of ash found in this analysis is consistent with the 1.90 to 2.60 percent that Ndife et al. (2020) reported. A substance's mineral composition can be roughly inferred from its amount of ash. According to this study, the chin-chin samples would provide the body with a significant amount of mineral components.

On the other hand, the chin's fibre content varied between 0.24 and 1.26%. When compared to other acha samples, the second control sample, B, which was made wholly of acha, had the highest fibre content. This study's fibre concentration is lower than that of Ojo et al. (2022), who found that chin chin prepared from cocoyam-soybean flour had a fibre level ranging from 1.75 to 3.02 percent. A substantial difference ($p < 0.05$) was observed in the chin-chin's fibre content. More fiber-rich foods effectively lower blood cholesterol, prevent constipation, and lower the risk of developing a number of cancers (Ndife et al., 2020). The FAO/WHO states that dietary fibre should not make up more than 5% of food. The fibre content reported in this paper is within acceptable bounds. Making a compelling benefit claim, whether it be a nutritional, structure-function, or health claim, requires determining the amount of fibre in meals with accuracy.

Chin-chin protein concentration varied from 11.9 to 24.83% in samples A (100 percent wheat) and E (0% wheat, 60% acha, 30% soybean, and 10% date). The protein level of the blends was comparable to that of the control sample A, which was composed entirely of wheat flour, after the soybean was added to acha flour. The findings show that the chin-chin's protein composition differs significantly ($p < 0.05$). Since chin-chin is produced using high-protein flours such as wheat, acha, soy, and date flour blends, all of the samples had a high protein content. This study's protein content is higher than that of Ndife et al. (2020), who produced and evaluated the comparative quality of chin-chin snacks made from blends of maize, soybean, and orange-fleshed sweet potato flour. Their findings varied from 10.25 to 19.38%. Enough protein is present in each sample to satisfy daily needs as well as tissue maintenance and repair.

However, the chin-chin's carbohydrate content varied from 37% to 59.12%; sample B, which was made entirely of acha, had the lowest carbohydrate concentration.

Comparing bread manufactured with a partial substitution of plantain and soy flour for wheat flour, Udomkun et al.

(2022) found that the carbohydrate contents ranged from 50.2% to 63.4%. It is also lower than the range of 63.98 to 73.97% that Ayo et al. (2024) reported for couscous made with acha, cowpeas, and carrots. According to research, acha has special nutritional advantages that may aid diabetes patients in their recovery, including a low glycaemic index, comparatively low sugar content, and reduced blood fluctuation. This is corroborated by the control sample B's 37% low carbohydrate content, which was made up completely of acha. The addition of soy beans resulted in a significant ($p < 0.05$) increase in the carbohydrate contents of samples C through E, suggesting that all of the samples are suitable for use as energy sources.

CONCLUSION: According to this study, acha flour and date palm fruit flour can be used in snacks in place of refined sugar and wheat flour, encouraging sustainable and wholesome food items and enhancing public health.

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