JHER Vol. 30, No. 1, September 2023, pp. 151 - 159

Proximate and Organoleptic Analysis of Cassava-based Snack (*Combo bits*) and *Chin-chin*

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Abstract

This study investigated the proximate and organoleptic properties of *combo bits* and *chin-chin*. Specifically, it determined: proximate composition of *combo bits* and *chin-chin,* organoleptic properties of *combo bits* and *chin-chin*. Samples of *combo bits* and *chin-chin* were prepared using standard methods. One part of each product was subjected to proximate analysis while the other part was subjected to sensory evaluation. Proximate analysis of *combo bits* and *chin-chin* were carried out using standard methods. Twenty panelists were involved in sensory evaluation of both products. A 9-point hedonic scale was used to collect data on the sensory properties of *combo bits* and *chin-chin*. Data for sensory evaluation were analyzed using percentages (%). Findings indicate variations in the proximate analysis values (%) of *combo bits* and *chin-chin*. Also, *combo bits* was ranked higher when compared to *chin-chin* based on the 9-point hedonic scale rating for overall acceptability. Furthermore, none of the snacks was rated as being disliked (0%). There were however, variations in their ratings for "being liked", ranging from, for instance, "liked moderately" in colour for *combo bits* (38.6%), "liked slightly" in colour for *combo bits* (20.5%), "liked very much" in colour for *combo bits* (30.1%); for *chin-chin,* "liked moderately" in colour for *chin-chin* (38.6%), "liked slightly" in colour for *chin-chin* (20.5%), "liked very much" in colour for *chin-chin* (19.3%). Based on findings two recommendations were made.

Keywords: Acceptability, *Chin-chin, Combo bits*, Sensory Shelf life, Organoleptic, Proximate

Introduction

A snack is a portion of food often smaller than a regular meal, generally eaten between meals (Oluwalana, 2014). Snacks are ready-to-eat food, raw or cooked, hot or chilled, but ready for immediate consumption at the point of sale without further treatment (Tsang, 2002).Snacks have been found to differ from meals in terms of size, nutritional content and hunger and thirst sensations before and after the event (Bellisle*et al*., 2003). Snacks can be made out of varied food items including wheat flour, cassava, among others. *Combo bits* is a cassava (manihot) based snack.

Cassava (*Manihot esculentaCrantz*) has its origin in Latin America where it has been grown by the indigenous Indian population for at least 4000 years (Akinpelu*et al*., 2011). Cassava is the most widely eaten staple food in Nigeria. Roots are primarily white in color and contain no pro vitamin A (Ilona*et al*., 2017) and its roots are rich in energy, containing mainly starch and soluble carbohydrates, good source of vitamins and minerals such as Vitamin C, thiamine, riboflavin and niacin

(Dresden, 2018; Philip *et al*., 2004). Cassava flour can be combined with cowpea paste to produce combo bits (akara chips), a snack commonly consumed in some parts of Nigeria, like Oyo and Lagos states.

Cowpea (*Vignaunguiculata*) is a highly nutritious legume providing much needed protein, fiber and B-vitamins to the diet and other nutrients such as calcium, magnesium, iron, potassium and zinc (Uzogara and Ofuya, 1992). Most of the world's cowpea production, up to 80 percent is produced in West Africa (FAO, 2000), where cowpeas are eaten on a daily basis in foods like soups (*gbegiri*), *moin – moin* (steamed cowpea paste) and *akara* (fried cowpea paste).It is also used in the preparation of *combo bits*.

Combo bits (akara chips) is a savoury snack which is a deep fried product from cassava flour and cowpea paste. It has an indigenous homemade taste, contains no sugar, but has Vitamin A and high protein content. *Combo bits* can be taken with most breakfast cereal like custard or pap and can also go well with some foods such as *garri*, bread and puddings and it's not only for household consumption, it can be produced and sold commercially. *Combo bits* can be classified as a vended food as explained by (FAO, 1998). The choice of a particular street food thus depends on taste, economic power and availability at the time of consumption (Sobukola*et al*., 2008).

Chin-chin is a traditional Nigerian snack prepared using wheat flour, butter, milk and eggs from which a stiff paste is made. It is deep-fried until golden brown and crispy. It has been known to be a popular crunchy and delightful snack across Nigeria and in most of Western African countries, amongst several age brackets (Adebayo *et al*., 2017). *Chin-chin* is sweet to taste, slightly hard and can be compared to a harder version of a doughnut and sometimes prepared by baking instead of frying (Adegunwa*et al*., 2014). It comes in handy at home, in the office, at parties, in reception halls, aircrafts and at schools among others.

According to (Udochuwu*et al*., 2023), proximate analysis is the method which determines the values of the macro-nutrients in food samples and are usually declared as nutritional facts (Sousa *et al*., 2014) shown mostly on the labels of the final products. Ash, moisture, protein, fat and carbohydrates are the five-standard proximate. However, frequent incidence of contamination is usually associated with food due to their nature and method of preparation, they are usually probe to contamination from water, air, storage/distribution facilities, environment and human activities (food handlers and vendors) according to James et al., (2005). It has been reported based on earlier studies on the assessment of microbial contamination that there's been a poor knowledge on the practice of food handling. Also, like many other processed foods, snacks are subjected to physical, chemical and microbiological spoilage by organisms such as *Escherichia coli, Salmonella, Clostridium, Staphylococci, Listeria, Bacillus* s. and moulds of several genera like Rhizopus, Aspergillus and Penicillium (Smith *et al*., 2004; Annan-Prah*et al*., 2011).

Organoleptic analysis is the way of analyzing by using the human senses as the main tool for measuring the acceptability of the product consisting of texture, colour, shape, aroma and taste of the product. Organoleptic analysis is

very important in food products such that if it doesn't taste good, the nutritional value can't be analyzed because nobody consumes (Muflihatin and Purnasari, 2019). Organoleptic properties are differentiated based on the purpose of organoleptic assessment that is differentiation test (discriminative test), acceptance test (affective test) and description test (descriptive test) as stated by Lawless and Heymann, (2010); Gengler, (2009).

Heldman (2004) stated that the acceptance of a food as well as a snack is dependent on whether it responds to consumer needs and also on the degree of satisfaction that it is able to provide. *Combo bits* which is made from cassava flour fortified with Vitamin A and cowpea blend has however not gained a high level of acceptance from the public compared to other snacks (such as chin-chin, plantain chips, potato chips, buns, etc), as only a few percentage of people know about the snack and what it is made from and has only started gaining acceptance. Based on the literature review, it is not found any previous similar work conducted in this field. Therefore, it was considered important to undertake this study which will be developed furthermore in the future. The study is aimed at investigating the proximate and organoleptic analysis of *combo bits* and *chin-chin*, comparing the acceptability level with each other.

Objective of the study

This study investigated the proximate and organoleptic properties of *combo bits* and *chin-chin*. Specifically, the study determined:

1. proximate composition of *combo bits* and *chin-chin*
2. organoleptic properties of *combo bits* and *chin-chin*.

Materials and Methods

Design of study: It was an experimental study.

Materials: The materials used for the production of samples include cassava flour fortified with Vitamin A which was purchased from International Institute for Tropical Agriculture (IITA), Moniya, Ibadan, Oyo state. Cowpea (*Vignaunguiculata*) and other ingredients were purchased from Bodija market, Ibadan, Oyo state.

Preparation of *combo bits:*

Recipe

5 cups of cowpea
20 cups of Vitamin A cassava flour
5 big bulbs of onion
3 Tsp of salt
6 pieces of seasoning cubes
Oil for frying

Procedure for preparation*:* The *combo bits* (*akara chips*) samples were prepared using the method described by Aniedu and Omodamiro (2012) and Sanni*et al*., (2006) with slight modifications. The preparation of the sample was done in the ratio 4: 1 (vitamin A fortified cassava flour to cowpea). Procedure for *combo bits'* (*akara chips*) preparation was as follows:

- Cowpea was sorted, dehulled and soaked for some minutes to get for milling.
- Cowpea was then ground together with scotch bonnet (*atarodo*) and onions.
- The Vitamin A cassava flour was sieved and added to the cowpea paste. Condiments – seasoning cubes and salt were added. Appropriate mixture was obtained.
- Mixture was extruded into the hot oil and deep-fried until golden brown. It

was then removed, drained, cooled, afterwards properly packaged in a polythene bag.

Proximate Analysis: Analytically, four of the constituents **(**Fat, protein, moisture and ash) were obtained via chemical reactions and experiments i.e determined by the method of Association of Official Analytical Chemists (2010) while the constituent, carbohydrate was obtained based on the determination of the four others (Udochukwu *et al*., 2023) as explained below:

***Moisture Content Determination*:** Moisture content determination was carried out using the air oven method. Petri Dishes were washed and dried in an oven. Then were allowed to cool in the desiccators after taking note of the weight. A known weight of samples were then transferred into the crucibles and dried at a temperature between 103-105^{o}C. The dry samples were cooled in a desiccator and the weight noted. They were later returned to the oven and the process continued until constant weights were obtained.

***Ash content Determination*:** A known weight of finely ground sample was weighed into clean, dried previously weighed crucible with lid (W_1). The sample was ignited over a low flame to char the organic matter with lid removed. The crucible was then placed in muffle furnace at 600^{o}C for 6h until it ashed completely. It was then transferred directly to desiccators, cooled and weighed immediately (W_2).

***Crude Fat Determination*:** The soxhlets extraction method (AOAC, 2010) was used. This method could only give the approximate fat content in a sample because all the substances soluble in chosen solvent (Petroleum ether, 40^{o} C – 60^{o} C boiling range) were extracted from the sample. The fat extracted from a given quantity of sample was then calculated.

***Protein Determination*:** The crude protein content was determined using micro Kjeldahl method as described in AOAC (2010).

***Crude fibre determination*:** Two hundred (200ml) freshly prepared 1.25% H_2SO_4 were added to a known weight of the residue obtained from fat extraction and this was brought to quick boil.

Carbohydrate: The carbohydrate content was calculated by difference.

% CHO = 100-(Sum of the percentages of moisture, ash, fat, protein and crude fibre).

***Sensory Evaluation*:**

Panel of judges: A panel of 20 judges was purposively selected to assess the products – *combo bits* and *chin-chin*. The panel included undergraduate students (5), postgraduates (5), academic staffs (5) and non-academic staffs (5). Only persons who were willing to participate were selected. They were appropriately trained for the necessary exercise.

***Data collection Instrument*:** A 9-point hedonic scale was used for the study. The sacle ranged from 1 to 9 representing "Dislike extremely" to "Like extremely". The instrument was appropriately validated.

***Data collection method*:** Sensory attributes tested were appearance, colour, taste, flavor, aroma, texture and overall acceptability. Panelists were served the *combo bits* and *chin-chin* samples in coded plates. Panelists rinsed their months with water after testing each sample.

Data analysis: Data were analyzed using percentages.

Result of the study

Table 1: Proximate analysis of *Combo bits* and *Chin-chin*

Parameters	*Combo Bits* Values (%)	*Chin-chin* Values (%)
Moisture content	10.0	9.4
Protein	21.3	12.6
Ether extract (Fat)	9.6	7.4
Ash	4.1	3.4
Crude fibre	1.5	1.2
Carbohydrate	53.5	66.0

Table 1 shows the result of the proximate analysis carried out on *combo bits* and *chin-chin*. The proximate analysis showed that *combo bits* was moderately high in moisture content (9.9% to 10.2%), moderately high in protein (21.3% to 21.6%), low in fat (9.5% to 9.8%), low in ash (4.0% to 4.3%), low in crude fibre (1.5% to 1.7%) and high in carbohydrate (52.8% to 53.5%); each nutrients having variations in their values. *Chin-chin* was shown to be moderately high in moisture content (9.4 to 9.7%), low in protein (12.2% to 12.6%), low in fat (7.45% to 7.7%), low in ash (3.1% to 3.4%), low in crude fibre (1.1% to 1.4%) and high in carbohydrate than *combo bits* (66.0% to 66.2%).

Tables 2: Sensory Properties of *Combo Bits* and *Chin-chin*

Variables	C(F%)		T(F%)		F(F%)		A(F%)		T(F%)		OV(F%)	
	t1	t2	t1	t2	t1	t2	t1	t2	t1	t2	t1	t2
DEX	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
DVM	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
DM	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
DS	0(0%)	0(0%)	0(0%)	2%	0(0%)	0(0%)	1.2%	2%	0(0%)	0(0%)	0(0%)	0(0%)
NLD	10.8%	9%	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	9.6%	28.9%	19.3%	0(0%)	0(0%)
LS	20.5%	20.5%	28.9%	38.6%	39.8%	40%	28.9%	19.3%	10.8%	41%	10.8%	50.6%
LM	38.6%	38.6%	31.3%	19.3%	19.3%	20.5%	28.9%	30.1%	39.8%	20.5%	28.9%	20.5%
LVM	30.1%	19.3%	39.8%	10.8%	40.9%	9.6%	21.7%	28.9%	20.5%	9.6%	50.7%	19.3%
LEX	0(0%)	1.2%	0(0%)	19.3%	0(0%)	19.3%	9.6%	9.6%	0(0%)	9.6%	9.6%	9.6%
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100

C = Colour ; T = Taste ; F – Flavour ; A – Aroma ; T – Texture ; Ov – Overall acceptability; t_1 = Combo bits ; t_2 = chin-chin ; F = Frequency ; % = Percentage, DEX – dislike extremely; DVM – dislike very much; DM – dislike moderately; DS – dislike slightly; NLD – neither like nor dislike; LS – like slightly; LM – like moderately; LVM – like very much; LEX – like extremely

Table 2 shows the result of the overall acceptability of *combo bits* with comparison to *chin-chin* using the 9-point hedonic scale rating. Variations were observed in the percentages of the rating of the variables. The Table shows that none of the snacks was rated as being disliked (score = 0.0%). There were variations in their ratings for "being liked" as shown in the Table above.

Discussion

Results depicted in Table 1 show the proximate composition of *combo bits* and *chin-chin*. The experiment revealed that the dominant components of both products in no particular order are carbohydrate (53.1% - *combo bits*; 66% - *chin-chin*), protein (21.5% - *combo bits;* 12.4% - *chinchin*), moisture content (10% - *combo bits*; 9.5% - *chin-chin*) and fat (9.6% - *combo bits*; 7.5% - *chin-chin*). However, ash and crude fibre contents were relatively low; ash (4.1% - *combo bits*; 3.3% - *chin-chin*), crude fibre (1.6% - *combo bits*; 1.2% - *chin-chin*).

According to the analysis, the carbohydrate content in *chin-chin*was higher compared to *combo bits*. According to Bakari*et al*., (2017), a sample having a high level of carbohydrate can regulate nerve tissue.

The protein content in *combo bits* was higher in comparison with *chin-chin*. Proteins can serve as enzymatic catalyst, growth control and cell differentiation (Bakari*et al*., 2017). It could also be used as dietary supplement for people who need a lot of protein (Anuforo*et al*., 2017).

The moisture content of *combo bits* according to the analysis was higher than the moisture content of *chin-chin*. This moisture content displays more information about the storage or shelf life and the viability of micro-organisms. Generally, high moisture content enhances the growth of microorganisms and hence microbial spoilage of food. However, low moisture content of food increases their storage time (Anuforo*et al*., 2017).

The ether extract content of *combo bits* was higher in comparison with *chin-chin*. Ether extract (fat) contributes to energy and essential fatty acid provision (Abdel-Razek, 2017); however, excess of it can contribute to increasing problem of overweight and obesity (FAO, 2010). The ash content of *combo bits* was higher when compared with that of *chin-chin*. Ash content signifies the level of mineral present in the samples.

The crude fibre content reported for *combo bits* was higher in comparison with *chin-chin*. However, both samples had relatively low crude fibre content. Fibre improves food bulk, appetite satisfaction, and the movement of food through the digestive system, and also prevents constipation (Edem*et al*., 2009; Erhirhie*et al*., 2013).

Findings on organoleptic attributes of *combo bits* and *chin-chin* in Table 2 reveal sensory attributes of colour, taste, flavour, aroma and texture and the overall acceptability of both products. The assessment was done using the 9 hedonic scale. In terms of colour, the result show that both products had a high level of rating on the 7th rank of the hedonic scale in which they were liked moderately at 38.6%. Colour is the first organoleptic attribute seen by consumers when consuming a product and its characteristics plays an important role in making a choice of food to be consumed (Dias *et al*., 2012). It can be concluded that when someone is interested in the colour of the sampes of study, it's most likely that the person will have high expectations of their taste (Spence, 2015).

The average respondent's assessment of the taste of the samples ranked high from 6 – 8 on the hedonic scale for like slightly: 28.9% - *combo bits*, 38.6% - *chin-chin*; like moderately: 31.3% - *combo bits*, 19.3% - *chin-chin* and like very much: 39.8% - *combo bits*, 10.8% - *chin-chin* respectively. Juliana (2018) stated that people tend to accept and eat food that contain their preferred taste concentration.

Flavour is an organoleptic parameter used in denoting the sensations of odour, taste and mouth feel. Flavouring substances are aromatic compounds brought about the combination of taste and odour and perceived by the mouth and nose (Mian*et al*., 2017). The respondents ranked flavour highest at scale 6 and 8 on the hedonic scale for like slightly: 38.9% - *combo bits*, 40% - *chin-chin* and like very much: 40.9% - *combo bits*, 9.6% - *chin-chin* respectively. It can be concluded according to the report that *combo bits* was rated higher than *chin-chin* in term of its flavour.

As reported in the study, aroma of the two samples was rated highest from scale 6 to 8 on the 9 hedonic scale for like slightly: 28.9% - *combo bits*, 19.3% - *chin-chin*; like moderately: 28.9% - *combo bits*, 30.1% - *chin-chin* and like very much:

21.7% - *combo bits*, 28.9% - *chin-chin* respectively. Aroma can be referred to as volatile compounds perceived by the odour receptors of olfactory tissues of the nasal cavity and a pleasant smell makes food delicious (Mian*et al*., 2017).

The texture for *combo bits* and *chin-chin* on the 9 hedonic scale was rated highest at scales 5 to 8 for neither like nor dislike: 28.9% - *combo bits*, 19.3% - *chin-chin*; like slightly: 10.8%% - *combo bits*, 41% - *chin-chin*; like moderately: 39.8% - *combo bits*, 20.5% - *chin-chin* and like very much: 20.5% - *combo bits*, 9.6% - *chin-chin* respectively. Texture of a food is conceptualized through various ways such as thickness, creaminess, crunchiness, firmness and smoothness as stated by and is a strong indicator of food quality and affects food acceptability (Juliana, 2018).

Overall acceptability comprises of all the organoleptic properties – colour, taste, flavour, aroma and texture of the two samples studied. As reported, *combo bits* was ranked higher when compared to *chin-chin* based on the 9 hedonic scale rating. The organoleptic attributes are key factors in determining food acceptability, since consumers seek food with certain organoleptic properties. In addition, organoleptic properties food has distinct and influential effects on food acceptability (Juliana, 2018), influencing their decision to either like or dislike a product (Kostyra*et al*., 2016). Therefore, it can be concluded that *combo bits* were highly accepted by the panelists in comparison with *chin-chin* according to the study

Conclusion

The findings of the study show that the dominant components of *combo bits* and *chin-chin* which were in high content included carbohydrate, protein, moisture and fat. On the other hand, ash and crude fibre contents were relatively low. The results indicated variations in the proximate analysis values of *combo bits* and *chin-chin*. It was observed that *combo bits* had higher contents of protein, moisture content, fat, ash, and crude fibre in comparison with *chin-chin*. On the other hand, *chin-chin* contained a higher proportion of carbohydrate when compared to *combo bits*.

Recommendations

Based on the findings of the study, it was recommended that research be carried out on:

1. the shelf life of *combo bits* and *chin-chin.*
2. mineral and vitamin composition of *combo bits* and *chin-chin*.

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European Journal of Food, Science and Teachnology 10(2); pp 24 – 34 ISSN 2056 – 5798 (print)