



Sensory Evaluation of Bean cake (Akara) Vitamin a Cassava Fortified with Cray Fish Powder

Busari, S. O.; Olatunji, I. I.; Wilson-imiere, M. O.; Amoo, T. A.; Agbonhin, S.D.; Olawepo, N. A.

Department of Home and Rural Economics, Oyo state College of Agriculture and Technology, Igboora.

Email address- ajanisusan@gmail.com; 07050275802

Abstract

This study showed the production and nutritional value of bean cake (Akara) produced from vitamin A cassava and cowpea fortified with cray fish. The main objective was to produce nutritive packaged bean cake fortified with cray fish and the specific objectives are to evaluate and analyse proximate bean cake made with vitamin A cassava. The study was undertaken to produce an acceptable bean cake from bean flour, vitamin A cassava flour and cray fish flour blends in a ratio; 100:0, and 20:80. The proximate results of the bean cake produced from both control and other treatments indicated an increasing level of moisture (%), 36.70 and 9.04, ash, 2.80 and 1.73, fat (%), 19.10 and 0.79, protein (%), 12.65 and 4.93, crude fibre (%), 0.95 and 0.27 and carbohydrate (%), 28.65 and 85.20. Data were subjected to Analysis of Variance (ANOVA) and Tukey Test was used to determine the significant difference among the various samples in duplicates. The study recorded a significant ($p < 0.05$) difference between the composite sample and the control. The sensory attribute of the product and nutritional values were assessed. The bean cake was produced with 80% vitamin A cassava and 20% cray fish effectively blended together. The blended product was administered to panellists for assessment. The result shows that 76% of the panellists accepted the product based on the sensory parameters evaluated (taste, odour, colour, texture and overall acceptability) in relation to the nutritional values. This implied that the product was accepted and adopted by the consumers. From this study, the following recommendations were drawn, bean cake should be regarded as food for everyone. Furthermore, vitamin A cassava bean cake fortified with cray fish should be seen as food for enhancing the nutrition and improvement of people towards prevention of diseases and infection.

Keywords: Vitamin A cassava, Cray fish, Sensory, Proximate analysis and Immune

Introduction

Bean cake (Akara) is a fried paste and brownish in colour. The cooking process is always shallow frying, Olapade *et al.*, (2012). This is common breakfast accompanied with food products like corn porridge, cassava flakes and solid pap paste in Nigerian homes. It is delicious, nutritive and easy to make (Meiners, 2006) Bean cake is a good source of protein, B complex vitamins, iron, copper, magnesium, zinc and phosphorus. Bean cake have low glycaemic index that does not raise blood sugar levels sharply. Bean cake consist of considerable quantity of protein but needs to be more fortified in meeting body requirements. Beans used in producing bean cake is utilised and competed by animals and human beings. The greater consumption of beans by mankind lead to its shortage at times also affected by drought, seasonal changes and pest infestations during season production. In this process there are lack of reduced products obtained from the beans. During period of bean supply shortage. It can be

boiled into a porridge or cooked up to make a creamy pudding. Also, for regular supply of bean cake throughout the year another raw product such as vitamin A cassava paste could be used. Vitamin A cassava is a staple tuberous root crop which mainly consist of carbohydrates, little protein and reasonable quantity of vitamins especially fat soluble vitamins. The root crop is good for consumption through direct boiling, pound into paste, turn to porridge and converted to flour in producing varieties of useful products. Vitamin A cassava is very delicious and nutritive. Cray fish is a seafood which is one of the first class protein, commonly found in aquatic environment and sold in the market. Crayfish is delicious and highly (gallegos, 2007). Two types of balanced nutrient composition can be produced from vitamin A cassava blended with cray fish powder producing bean cake. First bean cake consists of hundred (100%) percent bean slurry that stand as control while the second bean cake of vitamin A cassava with cray fish powder



consisted of ratio eighty (80%) percent to twenty (20%) per cent nutrition composition. The two samples of bean cake were oven dried at suitable temperature before effectively packaged for long shelf life of about two weeks' life span duration, before usage. The aim of this research work is to boost the nutritive value of the protein level and minerals in the bean cake produced for suitable balanced nutrition for people consuming it. It is also to have enough raw materials year round in producing bean cake. (Aniedu, 2012).

Statement of the problem

The bean cake produced are usually of high protein nutrient and low basic diet especially essential micro nutrients such as leucine, isoleucine and lysine. Bean cake are reduced in protein especially when bean bran has been removed during production. There is therefore, the need to increase the protein nutritional value by fortifying bean cake with protein product such as crayfish powder. Beans are at times are scarce due to drought, bad roads, diseases and pest infestation, government policy and seasonal changes. In reducing bean supply shortage and increase bean production quantity vitamin A cassava could be used as another option (Crandall, 2017). The vitamin A cassava is succulent and reasonably contain expected nutritive value. The product (vitamin A cassava) will be rich in carbohydrate, vitamins, minerals, proteins and fat make it a balanced meal. The identified problem of bean cake consumed in the country is of low value in some nutrients, such as protein, fat and oil, essential micro nutrient and sometimes less palatable in taste. In reducing wastage of vitamin A cassava seasonal production, the crop could be converted to some useful products for nutritional value. This motivated the researchers in blending the crop with cray fish for producing balanced nutritional bean cake The project attempt to produce balanced nutritive bean cake and strengthen life span of people nutritionally, with a meal processed in hygienic and scientific way.

Materials and methods

Dried white beans, vitamin A cassava and cray fish were procured from Bodija central Market, Ibadan in Oyo State.

Production of White beans

Dried white beans was thoroughly sorted, washed, soaked and husk removed for about thirty minutes. The beans husked removed was grounded into slurry and oven dried at 60°C for 24 hours. The dried powdery were sieved (300-400 μ m). The sifted flour was sealed in polythene bags (100 μ m) until frying commenced.

Vitamin A cassava flour processing

The vitamin A cassava flour was prepared using the method of Adelekan, *et al.*, 2010 with minor modification. The vitamin A cassava tuber was sorted to remove adhering soil particles, peeled and washed. The cleaned vitamin A cassava was milled into slurry using Hammer mill and dried at temperature above 600°C using vacuum drier. Flour obtained was sifted through a 250- μ m aperture sieve. The flour was packed and sealed in polyethylene bags until ready for use.

Cray fish processing

Brown large cray fish desired quantity was bought in the market, sorted, peeled and placed inside clean container. The cleaned dried cray fish was milled into powder using hammer mill. The milled powder was sifted through a 250- μ m aperture sieve to remove shaft. The powder was packed and sealed in polyethylene bags until ready for use.

Sample Formulation

Two different samples of bean cake were produced and coded as A and B. The blends of milled bean flour, vitamin A cassava flour and cray fish flour were prepared in the ratio 100:0, and 80:20. The flours were carefully combined to obtain a uniform mixture. The samples were stored at the temperature $30 \pm 2^\circ\text{C}$ in air tight containers and labelled until needed for bean cake production. The combination of both bean, vitamin A cassava and cray fish flours were prepared in different formulations as presented in Table1.

Production of bean cake

Bean cake were produced from the two formulations using the method of (Adelekan, 2010). Vitamin A cassava and cray fish flour were effectively blended according to designed ratio. It was then combined to form fortified bean cake. The flour was mixed with the hand in a mixing bowl for 5 min until uniform blended slurry was



obtained. Samples used for sensory evaluation was prepared and used immediately after cooling while other samples were packed in air tight polyethylene bags (100 µm) and stored (24 hours) at ambient temperature ($25 \pm 2^\circ\text{C}$) until analysis.

Proximate composition of fortified bean cake

Proximate analysis of samples was determined according to AOAC (2012). The samples were analysed for moisture content, ash, protein, fat, carbohydrate and crude fibre.

Moisture content and total solids: Oven Drying Method

Five grams (5g) of the sample was transferred to the previously dried and weighed dish. The Dish was placed in an oven and thermostatically controlled at 105 degrees for 5 hours. Dish was removed and placed in a desiccator to cool to room temperature and weighed. It was then dried again for 30 minutes, cooled down again and weighed. Drying, cooling and weighing were repeated until a constant weight was reached. (Alternatively, sample could be dried in a thermostatically controlled oven for at least 8 hours where a constant weight would be achieved). The determinations were duplicated and the average found (AOAC 2005).

Calculations

% Moisture (wt/wt) = $\frac{\text{Weight H}_2\text{O in sample}}{\text{Weight of wet sample}} \times 100$

Weight of wet sample

% Moisture (wt/wt) = $\frac{\text{Weight of wet sample} - \text{wt of dry sample}}{\text{Weight of wet sample}} \times 100$

Weight of wet sample

% Total solids (wt/wt) = $\frac{\text{Weight of dried sample}}{\text{Weight of wet sample}} \times 100$

Weight of wet sample

Where Weight = Weight of sample/spread

Ash content

5g sample was weighed into a tarred crucible and pre-dried. Crucibles were placed in cool muffle furnace using tongs, gloves and protective eyewear. The crucibles ignited for 2 hours at about 600 degrees Celsius. Muffle furnace was turned off and opened when temperature dropped to at least 250 degrees preferably lower. The door was carefully opened to avoid losing ash that may be fluffy. Safety tongs was used to transfer crucibles to a desiccator with a porcelain

plate and desiccant. Desiccator was closed and allowed crucibles to cool prior to weighing.

Calculations

%Ash = $\frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$

Weight of sample

%Ash = $\frac{\text{Weight of crucible} + \text{ash} - \text{Weight of empty crucible}}{\text{Weight of crucible} + \text{sample} - \text{Weight of empty crucible}} \times 100$

(Weight of crucible+ sample) – Weight of empty crucible

Where Weight = Weight of sample/spread

Fat content: soxhlet extraction

Previously dried (air oven at 100°C) 250 ml round bottom flask was weighed accurately. 5.0g of dried sample to 22 ×80mm paper thimble or a folded filter paper was weighed. A small cotton or glass wool was placed into the thimble to prevent loss of the sample. 150ml of petroleum spirit B.P $40-60^\circ\text{C}$ was added to the round bottom flask and assembled the apparatus. A condenser was connected to the soxhlet extractor and reflux for 4 - 6 hours on the heating mantle. After extraction, thimble was removed and recovered solvent by distillation. The flask and fat/oil was heated in an oven at about 103°C to evaporate the solvent. The flask and contents were cooled to room temperature in a desiccator. The flask was weighed to determine weight of fat/oil collected.

% Fat (dry basis) = $\frac{\text{fat/oil collected}}{\text{Weight of sample}} \times 100$

Weight of sample

% Fat (dry basis) = $\frac{\text{Weight of flask} + \text{oil} - \text{wt. of flask}}{\text{Weight of sample}} \times 100$

Weight of sample

Crude fibre determination

Two grams (2g) of the sample from crude fat determination was weighed into a 750ml Erlenmeyer flask. Two hundred milliliters (200ml) of 1.25% H_2SO_4 was added and immediately flask was set on hot plate and connected to the condenser. The contents were boiled within 1-minute contact with solution. At the end of 30 minutes, flask was removed and immediately filtered through linen cloth in funnel and washed with large volume of water. Filtrate (containing sample from acid hydrolysis) was washed and returned into the flask with 200ml 1.25% NaOH solutions. Flask was connected to the condenser and boiled for exactly 30 minutes. It was then filtered through Fischer's crucible and washed thoroughly with water and added 15ml 96%



alcohol. Crucible and contents was dried for 2 hour at 105 °C and cooled in desiccator weighed. Crucible was ignited in a furnace for 30 minutes and cooled and reweighed.

% Crude fibre = $\frac{\text{Weight of crude fibre}}{\text{Weight of sample}} \times 100$

Weight of sample

% Crude fibre = $\frac{\text{Weight of crucible + sample (before - after) ashing}}{\text{Weight of sample}} \times 100$

Weight of sample

Where Weight = Weight of sample/spread

Protein Determination

Digestion Method

Two grams (2g) of sample and a half of selenium –based catalyst tablets and a few anti-bumping agents were added to the digestion flask. Twenty- five milliliters (25ml) of concentrated H₂SO₄ was added and the flask was shaken for the sample to become thoroughly wet. Flask was placed on digestion burner and heated slowly until boiling ceased and the resulting solution was clear. The sample was then cooled to room temperature and digested sample solution was transferred into a 100ml volumetric flask and made up to the mark.

Distillation Method

To flush out the apparatus before use, distilled water was boiled in a steam generator of the distillation apparatus with the connections arranged to circulate through the condenser, for at least 10 minutes. The receiving flask was lowered and continued to heat for 30 seconds in order to carry over all liquid in the condenser. 25 ml of 2% boric acid was pipetted into 250ml conical flask and 2 drops of mixed indicator added. The conical flask and its contents was placed under the condenser in such a position that the tip of the condenser is completely immersed in solution. 10ml of the digested sample solution was measured into the decomposition flask of the Kjeldahl unit, fixed it and excess of 40% NaOH (about 15-20ml) was added. The ammonia produced was distilled into the collection flask with the condenser tip immersed in the receiving flask till a volume of about 150ml– 200ml is collected. Before distilling another sample and on completion of all distillations, the apparatus was flushed as in step 1 above. Steam was allowed to pass only until 5ml of the distillate is obtained.

Titration Method

The Distillate with 0.1N HCL solution was titrated. The acid was added until the solution became colourless. Additional acid added made the two solutions become pink. The nitrogen content was determined in duplicate, and a blank determination was run using the same amount of all reagents as used for the sample. The blank was meant to correct for traces of nitrogen in the reagents and included digestion as well as distillation methods.

Calculation:

% Total nitrogen = $100 \times \frac{(V_a - V_b) \times N_A \times 0.01401}{W \times 10}$

W× 10

Where:

V_a- volume in ml of standard acid used in titration

V_b- volume in ml of standard acid used in blank

N_A- normality of acid

W- Weight of sample taken

Carbohydrate content

The calculation of available carbohydrate (nitrogen-free extract-NFE) was made after completing the analysis for ash, crude fibre, ether extract and crude protein. The calculation was made by adding the percentage values on dry matter basis of these analysed contents and subtracting them from 100%.

Calculation:

Carbohydrate (%) = % crude fibre + % NFE

OR

Carbohydrate (%) = $100 - (\% \text{ moisture} + \% \text{ fat} + \% \text{ protein} + \% \text{ ash})$

×. Calculation for dry basis = $\frac{(100 - \% \text{ moisture}) \times \text{wet basis}}{100}$

100

Sensory Analysis

The sensory evaluation was carried out on two different samples: Sample A, and B. Twenty- Five (25) consumers were randomly selected for the sensory. Consumers' were asked to evaluate the two coded samples on a 5-point hedonic scale with 1= like extremely, 2= like very much 3= like moderate, 4=like slightly, 5= dislike in an experiment for sensory evaluation on the parameters (colour, texture, aroma, taste and overall acceptability).

Statistical Analysis

Data collected were subjected to Analysis of Variance (ANOVA) and Tukey Test was used to



determine the significant difference among the various samples in duplicates. Data were analyzed using the software, Statistical Package for Social Sciences (SPSS) version 22.00 (SPSS inc., Chicago), IL, USA at the 0.05 level of significance.

Results and discussion

Proximate compositions of the various bean cake samples were undertaken. From the results, it was realized that, the moisture content of B sample (80:20) vitamin A cassava was 9.04 ± 1.56 . The control sample (100:0) gave the highest moisture content of 36.70 ± 0.00 as compared to blended B sample (80% vitamin A cassava flour and 20% cray fish powder) with the least moisture content of 9.04 ± 1.56 . It was detected that the moisture content of the vitamin A cassava was reduced of the composite flour was added. This could be attributed to the nature of vitamin A cassava and i this could enhance the shelf life of the bean cake. Statistical analysis of the samples showed significant ($p < 0.05$) among the samples. The results were similar to that produced by Adelekan, *et al.*, (2010) from whole corn flour and fat soya bean flour (ranged from 7.24-9.85%).

The ash content ranged from 1.73 ± 0.11 to 2.80 ± 0.00 with sample A (100% Bean flour) given the highest ash content while the least was the B sample (1.73 ± 0.11). From the results, there was a significant ($p < 0.05$) difference between the composite vitamin A cassava flour samples and the control. The ash contents of B samples was lower than that recorded by Akinrele, *et al.*, (2001); that reported ash contents of 2.20 to 2.57%.

It was observed that the fat content ranged from 0.79 ± 0.04 to 19.10 ± 0.14 with the control sample A given the highest fat content of 19.10 ± 0.14 while the least was the B sample (0.79 ± 0.04). The fat content for the two sample formulations were significantly different ($p < 0.05$) from each other. This result is similar to that of Afolayan, *et al.*, (2010) who reported 47.7% in soy bean as a substitute to bean flour in bean cake preparation.

The crude protein content of the various bean cake samples ranged from 4.93 ± 0.56 to 12.65 ± 0.07 with sample A (bean flour) having the highest protein content and the least was the B sample (80% vitamin A cassava flour, 20% cray fish powder). The crude protein content of the

two formulations was significantly different ($p > 0.05$) from each other. It was observed that the protein content increased as the proportion of the composite flour also increased as reported in the work of Bahmalia, *et al.*, (2011) and Akinrele, *et al.*, (2001). Akinrele, *et al.*, (2001) reported a lesser protein content (4.93 ± 0.56) for their bean cake produced from soybean flour. The bean cake produced from bean flour was substituted up to 30% with soybean flour.

The carbohydrate content ranged from 28.65 ± 0.21 to 85.20 ± 2.85 with the B sample (80% vitamin A cassava flour, 20% cray fish powder) given the highest carbohydrate content followed by the control (sample A) (100% bean flour). The study reported a significant ($p < 0.05$) differences in the carbohydrate of all samples. The high carbohydrate content of the control sample suggested a high energy content of the bean cake and high-energy foods tend to gave a protective effect in the optimal utilization of other nutrients (Akinrele, *et al.*, 2011).

Colour generally refers to the appearance of the product. It is one the sensory attributes consumers explore in purchasing new products due to its aesthetic appeal. The panelists rated the colour of the various bean cake from 5.10 to 6.23. They were thus rated as like slightly to like very much. From the hedonic scale, product A (100% bean flour), was rated like extremely while the rest were rated like very much.

The results of sample A (100% bean flour) was significantly ($p > 0.05$) different from the remaining product. These findings were similar to work of (Bahmalia, *et al.*, 2011) who concluded that colour is vital quality trait of bean cake. Colour is produced through a process of visual perception in the eyes resulting from the stimulation of the retina by light (wavelengths between 380 and 760 nm). Colour is the foremost and most important sensory attribute that influences consumer preference and acceptance for any product especially in food products (Akinrele, *et al.*, 2011).

The texture of the bean cake samples was rated as 'like slightly' to 'like very much'. Panelists rated the texture of the various bean cake products from 3.20 to 4.10, with product A (100% bean flour) given the highest mean score and product B (80% vitamin A cassava flour and 20% cray fish powder) recorded the least mean



score of 3.20. All bean cake samples recorded a significant ($p < 0.05$) different from one another.

Aroma influences the consumers' acceptance of the fried products. The composite bean cake sample B (80% vitamin A cassava flour and 20% cray fish powder) recorded the highest mean score of 4.30 that is "liked extremely", followed by sample A with a score of 4.01, had the lowest mean score rating according to the respondents with the score of approximately 4.01. It was observed from the result that there was a significant ($p > 0.05$) difference between the composite samples and the control as 80% vitamin A cassava flour and 20% cray fish powder flour was incorporated.

The taste of the different bean cake samples ranged from 3.10 ± 0.70 to 5.20 ± 0.60 . The products were thus rated as like slightly to like very much. Product B (80% vitamin A cassava flour and 20% cray fish powder) was liked very much by the panel when compared to the other sample. There was significant ($p < 0.05$) differences in taste among the various samples. This could be as a result of variation among the ingredients used in the preparation of the bean cake. Taste is chemical sense stimulated by the taste receptors upon interaction with taste stimuli on the tongue. In general, humans can distinguish between five to six basic tastes – sweet, sour, bitter, umami, fatty, and salty. The quality of the porridge (Aroma, colour, texture, taste and overall acceptability) had influence the overall acceptability of the porridge. There was a significant ($p < 0.05$) difference between the fortified sample and the control sample. Sample B (80% vitamin A cassava flour and 20% cray fish powder) had the highest mean score (5.40) followed by sample A (100% bean flour). With a mean score of (5.10) that is "liked very much. Sample B (80% vitamin A cassava flour and 20% cray fish powder) was accepted by the panel.

Table 2: Proximate analysis of Bean cake

Samples	Moisture %	Ash%	Fat%	Protein%	Carbohydrate%
A	36.70 ± 0.00	2.80 ± 0.00	19.10 ± 0.14	12.65 ± 0.07	28.65 ± 0.21
B	9.04 ± 1.56	1.73 ± 0.11	0.79 ± 0.04	0.27 ± 0.02	85.20 ± 2.85

Product A (100% bean flour), Product B (80% vitamin A cassava flour and 20% cray fish powder)

Conclusion

The study showed that vitamin A cassava flour fortified with cray fish powder can be used to produce an acceptable bean cake without effects on the nutritional and sensory attributes of the products. Furthermore, vitamin A cassava flour can be used to replace bean flour up to 80% level. Bean cake made with B (80% vitamin A cassava flour and 20% cray fish powder) substitutions was accepted by the respondents. The nutritional value of bean cake can be improved when fortified with cray fish. The use of vitamin A cassava in fortified bean cake made it more attractive in colour, taste and nutritional value. In conclusion, cray fish powder is good in fortified bean cake and can be used to fortify other bean cake. The addition of cray fish improved the nutritional quality of the bean cake.

Recommendation

This work revealed that bean cake fortified with cray fish had high nutritive value with greater economic benefit; therefore;

1. Bean cake should be considered as food for everyone with essential nutrient provision to the body
2. Bean cake fortified with cray fish is delicious and essential in the curing of diseases (Malaria and Cancer inflammation).

Table 1: Ingredients Formulation

INGREDIENTS	A	B
Bean flour (g)	100	0
Vitamin A cassava flour + cray fish powder (g)	80	20

Product A (100% bean flour), Product B (80% vitamin A cassava flour and 20% cray fish powder)



Table 3: The sensory analysis of vitamin A cassava bean cake fortified with cray fish powder

Samples	Colour	Texture	Aroma	Taste	Level of acceptability
A	6.23±0.80	4.10±0.93	4.01±0.10	3.10±0.70	4.20±0.70
B	5.32±0.70	3.20±0.80	4.30±0.80	5.20±0.60	5.10±0.70
LSD	0.23	0.342	0.021	1.481	0.061

Product A (100% bean flour), Product B (80% vitamin A cassava flour and 20% cray fish powder)

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