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Proximate, Physicochemical and Organoleptic Properties of Whole and Dehulled Cowpea Seed Flour (*Vigna unguiculata*)

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Abstract: Study was conducted to analyze the production, proximate, physicochemical and organoleptic properties of whole and dehulled cowpea (*Vigna unguiculata*) seeds. Flour samples were produced from whole and dehulled cowpea seeds which was purchased from 'Obada' market Iree, Osun State, Nigeria. The flour samples were subjected to proximate, physicochemical and organoleptic analyses. The results of proximate analysis showed that dehulled cowpea was higher in crude protein (23.12%) and carbohydrate content (62.86%) than whole cowpea flour, which was recorded as 22.85% and 61.67% respectively. The fat, ash, crude fibre and moisture content were 1.6%, 1.03%, 0.48%, 10.89% for dehulled cowpea flour and 1.83%, 1.12%, 0.65%, 11.88% for whole cowpea flour respectively. The results obtained for physicochemical analysis showed that the pH, TSS and TS of whole cowpea flour were 6.84%, 16.47% and 88.12% while dehulled cowpea were recorded as 6.80%, 12.85%, 89.11% respectively. The results of organoleptic analysis revealed that beans ball produced from dehulled cowpea flour was more acceptable than that from whole cowpea flour.

Key words: Proximate, physicochemical, organoleptic, dehulled, cowpea

INTRODUCTION

Cowpea (*Vigna unguiculata*) is an example of grain legume, which has found utilization in various ways in traditional and modern food processing in the world. The seed of cowpea can be cooked in the dried form, sprouted, or ground into flour, an intermediate product. Being in the class of legume, they are often referred to as "poor man's meat" owning to their use as primary protein sources. They represent one of the dietary staples in many parts of the world. Cowpea is of considerable importance in Nigeria and in many African countries as a nutritious leguminous crop providing an alternative source to animal protein (Dovlo *et al*., 1976). The consumption of beans is however, curtailed because of the long cooking time needed to achieve the desired palatability and digestibility (Sefa-Dedeh *et al*., 1978; Tuan and Phillips, 1991).

In Nigeria, cowpea is consumed in the form of bean pudding, bean cake, baked beans, fried beans, bean soup amongst others. The main advantage of cowpea over many other crops apart from being the most practical source of storable and transportable protein is due to the fact that it is a cheap source of protein. However, it is susceptible to many diseases and pests attack right from its growth stage up to storage (Singh *et al*., 1997) and final consumption. There is therefore the quest for means of preservation which include flour production.

For most food uses, the seed coats of legumes including cowpea are removed to reduce the anti-physiological factors and fibre content and this result in better appearance, texture, cooking quality, palatability and digestibility of the products (Akinjayeju and Enude, 2002). Dehulling can be accomplished manually or mechanically depending on the type of legume and/or quantity involved (Ehiwe and Reichert, 1987). The inclusion of seed coat (hull) in the preparation of flour from legume, especially Bambara groundnut, that could produce acceptable moinmoin substitute has been a limiting factor most especially with respect to texture and flavour. The conventional methods used always result into a product with a very hard texture and strong beany flavour (Alobo, 1999).

Cowpea testa however has been shown to be rich in mineral elements such as Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Manganese (Mn), Iron (Fe) etc (Akpapunam and Daribe, 1994). Thus, the inclusion of cowpea testa in cowpea products will serve as a form of food enrichment or fortification. Cowpea flour production involves cowpea grain cleaning, sorting and grading, soaking in water to remove the hull, draining, drying, milling into flour and packaging.

The objectives of the research work include the production of flour samples from whole and dehulled cowpea seed, proximate, physicochemical and organoleptic analysis of the flour samples so produced.

MATERIALS AND METHODS

The major materials used for this work is cowpea which was purchased from 'Obada' market, Iree, in Osun State of Nigeria. Other materials include Attrition mill, vortex mixer, magnetic stirrer, water bath, balance, pH meter, oven, crucibles, desiccator, muffle furnace, soxhlet apparatus and kjedahl apparatus. All chemicals used were of food grade.

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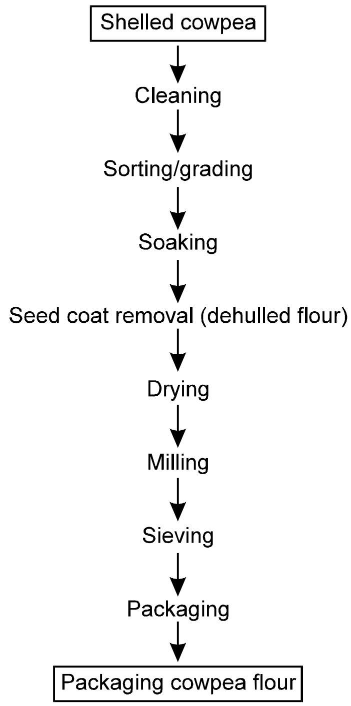

Fig. 1: Flow chart for flour production from cowpea seed

Production of flour from cowpea seed: Matured cowpea seeds purchased from 'Obada' market, Iree in Osun State of Nigeria were carefully cleaned, sorted to remove defective ones from the lots graded according to sizes and colours. Cleaning was equally done to remove adhering soil and extraneous matter from the seed. The cleaned seeds were soaked in potable water to soften the coat for easy removal and production of flour from dehulled seed.

This step was however excluded for production of flour from whole cowpea seed. This was thereafter followed by drying to reduce the moisture content. The dried cowpea seeds were milled into flour and sieved to obtain uniform particle size. The flour was packaged inside airtight container for further analytical use.

Production of bean ball (Akara): Measured quantity of cowpea flour was mixed with measured volume of water. This was allowed to form batter or slurry. The batter was whipped severally to incorporate air using wire whisk or wooden spoon. Other ingredient like pepper, onion, salts, spices were then added. This was then scooped to make ball into already heated oil. The scooped balls (fritters) are turned frequently until deep fried and golden brown colour is obtained.

Proximate analysis: The moisture content, fat, crude protein, crude fibre and ash contents were determined by the AOAC (1995) method. The total carbohydrate was determined by difference.

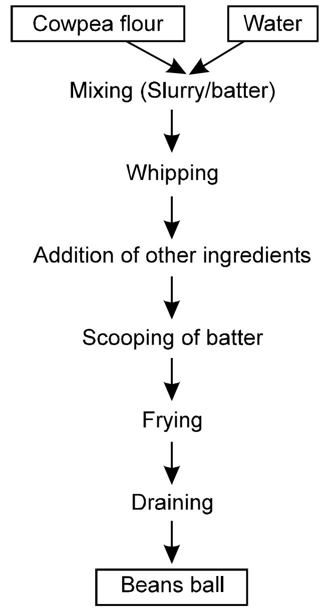

Fig. 2: Flow chart of the production of beans ball

Physicochemical analysis

pH determination: 10 g of each sample was homogenized in 50 ml distilled water. The resulting suspensions were decanted and pH was determined using a standardized pH meter. Standard buffer of pH 4.0 and 7.0 were used in the standardization.

Total solid determination: Two gram of the samples were weighed into a previously weighed crucible. The crucible plus sample was weighed and then transferred into the oven set at 100°C to dry to a constant to the desiccator, cooled for 10 min and weighed Percentage Total solid was calculated thus:

$$TS\ (\%) = \frac{W_3 - W_0}{W_1 - W_0} \times \frac{100}{1}$$

Where:

W_0 = Weight of empty crucible

W_1 = Weight of crucible plus sample

W_3 = Weight of crucible plus oven dried sample

Total Soluble Solids (TSS) determination: 10 g of each sample was homogenized in 50 ml distilled water 2 drops from the sample was placed on a cleaned refractometer. The lid of the refractometer was replace and placed in direction of light source. The TSS value was read on the graduated refractometer. This was recorded in degree Brix (°B).

Organoleptic analysis: Organoleptic analysis was carried out using simple paired comparison method. Nine panelists were asked to evaluate the products for taste, colour, texture, aroma and overall acceptability using nine point hedonic scale.

Table 1: Chemical composition of dehulled and whole cowpea flour

Sample	CP (%)	Fat (%)	Ash (%)	CF (%)	Moisture (%)	Carbohydrate (%)	pH	TS (%)	TSS °Brix
Whole cowpea flour	22.85	1.83	1.12	0.65	11.88	61.67	6.84	88.12	16.47
Dehulled cowpea flour	23.12	1.62	1.03	0.48	10.89	62.86	6.80	89.11	12.85

TS = Total Solid, TSS = Total Soluble Solid, CP = Crude Protein, CF = Crude fiber

RESULTS AND DISCUSSION

Results of proximate and physicochemical analyses of whole and dehulled cowpea flour: The results of proximate and physicochemical analyses of whole and dehulled cowpea flour is as presented in Table 1. The proximate analysis results revealed that the two samples had values that are very close for crude protein. The cowpea flour had 22.85%. The two values are almost in line with the value recorded for unprocessed cowpea (24.8%) (Ihekoronye and Ngoddy, 1985). Proteins are useful in the body for growth, tissue maintenance and repair. Previously, it was thought that proteins of animal origin were indispensable and that diet lacked sufficient nutrition if it did not contain abundant animal proteins. But it has been proven that, thanks to the phenomenon of supplementation, a sufficient quantity of proteins can be obtained by combining vegetable proteins, as if they were of animal origin (George and Pamplona-Roger, 2003).

The fat content of whole cowpea flour (1.83%) is higher compared to that of the dehulled cowpea flour (1.60%). The difference in the fat content may be due to the percentage of fat which may be present in the seed coat. Fat is needed for support of certain metabolic activities within the body of living organisms and equally a source of energy. The ash and crude fibre contents of whole cowpea flour and dehulled cowpea flour are 1.12%, 0.65% and 1.03%, 0.48% respectively. This indicates that the whole cowpea flour had higher values. This ash content is a function of mineral content. Product with higher ash content is expected to have relatively higher mineral content, suggesting that whole cowpea flour contains more minerals than the dehulled counterpart. The high value recorded for fibre in whole cowpea flour is in line with submission of George and Pamplona-Roger (2003). They reported that fibre is found only in plant foods, especially in whole grains fruit and garden products. Vegetables fibre is a special kind of carbohydrate which is not absorbed/does not go from the intestines to the blood, so that the as an authentic broom in the intestines, absorbing toxins and carrying out harmful substances such as biliary acids, the precursors of cholesterol. Vegetable fibre swells with water, increasing its volume several times. This gives consistency to the feces and facilitates its transit through the colon until it is expelled through the rectum. When the diet contains little fibre because of the lack of whole grains and vegetables, the feces are hard, dry and concentrated, thus obliging the intestine to make enormous effort to eliminate them. This causes or worsens several problems, such as intestinal diverticulum, hemorrhoids and even cancer of the colon (George and Pamplona-Roger, 2003).

The moisture content of whole cowpea flour (11.88%) is higher compared to dehulled cowpea flour (10.89%). However, the two sample are still in the range of dried product of 15% (Ihekoronye and Ngoddy, 1985). The higher value recorded for whole cowpea flour might be due to the effect of seed coat present in it. Moisture content and water activity affect the progress of chemical and microbiological spoilage reactions in foods. Moisture content is determined for long term storage. The result for moisture is in line with the finding of Ihekoronye and Ngoddy (1985) that cowpea contain 11.5% moisture content and maximum moisture content for a safe storage is 15%.

Carbohydrate content of dehulled cowpea flour is a little bit higher than whole cowpea flour. The duhulled cowpea flour recorded 62.86% while whole cowpea flour recorded 61.67%. This might be due to lower values of other proximate constituents in dehulled cowpea flour compared to whole cowpea flour. Carbohydrate was calculated by difference. Carbohydrate is a source of energy and it supports other metabolic activities within the body.

Physicochemical analysis results revealed that the pH of the whole cowpea flour (6.84) is higher than that of the dehulled flour (6.80) but very close. This means that there is higher hydrogen ion concentration in the dehulled cowpea flour. However, the two samples are operating within slight acidic region. This converts preservative activity on the products. The total solid in dehulled cowpea flour is 89.11% which is higher compared to whole cowpea flour (88.12%). The total soluble solid present in whole cowpea flour is 16.47 °brix compared to dehulled cowpea flour which is 12.85 °brix. Total soluble solid is therefore higher in the whole cowpea flour which might be due to the inclusion of seed coat in this flour sample.

Results of organoleptic analysis of bean-ball produced from whole and dehulled cowpea flour: The results of organoleptic analysis of bean-ball produced from whole and dehulled cowpea flour is as presented in Table 2. The results revealed that there is significant difference between the beans-ball produced from flour from whole and dehulled cowpea in terms of taste, colour, texture, aroma and overall acceptability. From the Table 2, it could be seen that the values obtained for $d/s\sqrt{n}$ were greater that t-value (2.262) indicating that there is

Table 2: Sensory evaluation of beans ball from whole and dehulled cowpea flour

Sensory parameter	d/s√n	t-value
Taste	3.396	2.262
Colour	3.387	2.262
Texture	3.396	2.262
Aroma	3.233	2.262
Overall acceptability	4.531	2.262

significant difference between the two products. Panelists preferred beans-ball from dehulled cowpea which could be due to the fact that they are use to it and the other sample is relatively new. However, the product from whole cowpea flour had appreciable proximate constituents hence; there is the need to orientate people to the nutritional significance of beans ball produced from whole cowpea.

Conclusion: Production of flour from whole and dehulled cowpea reduces preparation time, cooking time, labour requirement, low digestibility and abdominal upsets as well as post-harvest grain losses caused by insects and pests which are constraints to the wide utilization of the produce. Cowpea flour is less susceptible to post-harvest pest damage and can be used in many different dishes thus enhancing food security.

Cowpea flour produced from whole cowpea displayed significant potentials in term of nutritional values. However, bean all produced from this sample was not as acceptable as the one from dehulled counterpart regardless of the nutritional advantage hence, there is the need to herald the nutritional significance of products from whole cowpea flour knowing fully well that in the cooking of cowpea, the seed coat is not removed and the seed coat has been reported to contain appreciable quantity of mineral elements and source of dietary fibre.

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