UNDER PEER REVIEW

Original Research Article

DETERMINATION OF THE PASTING AND FUNCTIONAL PROPERTIES OF COWPEA (*VIGNA UNGUICULATA*) AND SOYBEAN (*GLYCINE MAX*) BLENDS

ABSTRACT

Aim: This study was carried out to check the pasting and functional properties of cowpea and soybean blends for culinary uses.
Methods: The two legumes (cowpea and soybean) were combined in different percentage of 90% to 10% which serves as sample A and Sample B and C had 80% to 20% and 70% to 30% respectively.
Results: The pasting properties results showed a reduction in trough value which range from 0.50 RVU in sample C to 8.00 RVU in sample A. Also a reduction in final viscosity results was observed which ranged between 9.50 RVU in sample C to 16.00 Rvu in sample A. The reduction followed with increase in the percentage of soybean blend with cowpea. The functional properties results showed a decrease in bulk density with an increase in soybean blend with cowpea (i.e sample A > B>C). The same pattern of results were recorded for water absorption and swelling capacity. Sample A have the highest value in all the functional properties determined except in oil absorption capacity, total soluble solid, and wettability. Increase in percentages of soybean subtitution resulted to increase in oil absorption capacity, total soluble solid and wettability.
Conclusion: In conclusion, the pasting properties of the blend improved significantly over that of soybean alone, thus suggesting the trial of the blends for culinary uses such as the production of *akara,* and *moi-moi.*

Keywords: Pasting, Functional properties, Cowpea, Soybean, Culinary

INTRODUCTION

Pasting characteristic is the transition from a suspension of starch granules to paste when heat is applied, it is accomplished by a large increase in viscosity. It is a phenomenon that follows gelatinisation in the dessolution of starch. This involves granular swelling, exudation of molecular composnent from the granular and eventually total distruption of the granules [1]. Jideani [2] reported functional properties as intrinsic physico-chemical characteristics which affect the behaviour of a food ingredient in food systems during processing manufacturing, storage and preparation. Henshaw et al.[3] expressed functional properties as physico-chemical properties that give information on how food ingredients will behave in a food system. Functional properties are therefore important in determining the quality (nutritional, sensory, physico-chemical and organoleptic properties) of the final product as well as facilitating processing such as improved machinability of cookie dough or slicing of processed meats. Functional properties of food protein are important in food processing and food product formulation [2]. Legumes are generally believed to be the cheapest source of plant protein available in West Africa. Cowpea (vigna ungucuilata) is a primary food legumes with more than 90% of the world crop being produced in west Africa region of the world [4]. Cowpeas (vigna ungucuilata) are probably the most porpular grain legume in West Africa unlike other legumes such as soybean and groundnut, which are oil-protein seeds, cowpeas are starch-protein seeds offering a wide parttern of utilization than any other legume in West Africa [3]. Protein and starch are the major macromolecules that contribute toward the functionality of cowpea flour. The suitability of cowpea flour for use in food products is attributed to its functionality in terms of hydration, foaming, gelation and pasting properties [5, 1]. The paste forms the basis of several popular food items such as moi-moi and akara which are prepared by steaming or deep-fat frying or baking in some special case or instances [6]. Soybean (Glycine Max) is a particularly great source of plant protein in the world. Its protein have high biological value while it cost is relatively low. Ajayi et al. [7] reported that several years of rigorous scientific and clinical research has establised that most of the component of soybean

UNDER PEER REVIEW

have beneficial health effect as characterised by its preventive pontential for the so-called life-style-related diseases. Futhermore, soybean proteins contain all amino acids essential to human nutrition which makes soy products almost equivalent to animal sources in protein quality but with less saturated fat and no cholesterol. Soybean is not only high quality protein, but it is now thought to play preventive and therapeutic roles for several diseases. In recent years, soybean, although high in protein and other nutrient has defiled its use in making food products such as moinmoin and akara. Athough its has been useful in making other food such as soycheese (Tofu), flours and soy milk. Soybean contains about 35% carbohydrates most of which is non-starch polysaccharides [7]. This may explain it poor pasting quality. It will be of great importance if protein present in soybean can be complimented with starch through the best local means i.e if soybean can be blended with cowpea for culinary uses. Blending cowpea with soybean will boost the starch component and increase the utilization of soybean for culinary purposes, hence the need to study the pasting and functional behaviour of different blends of cowpea and soybean.

Materials and Methods

Cowpea and Soybean were purchased at Owode market in Offa, Kwara State, Nigeria. Processing equipment and other materials were provided at the food processing laboratory of the department of food technology, Federal Polytechnic Offa, Kwara State, Nigeria. The pasting properties of samples were dertermined at the department of food science and technology, Federal University of Agriculture, Abeokuta, Nigeria.

Preparation of Samples

The cowpea and soybean samples were sorted to remove damaged onces and other extraneous materials. They were combined in the following ratios (90:10, 80:20 and 70:30) of cowpea and soy bean respectively. Exactly 200g of mixture were weighed for each sample. The samples were label A, B, and C respectively.

Preparation of Paste

Each sample was soaked separately in a litre of cold water for one hour in other to soften the seed coats. Thereafter, the seed coats were removed manually and the seeds rinsed in water until they were clean and free from impurities. The samples were blended separately with 200ml of water using a Kenwood blender until a fine paste was obtained. Each paste was transfer into a clean bowl and labelled accordingly.

Determination of Functional properties of samples

The functional properties of samples were determined based on standard methods in the Association of Official Analytical Chemist [8].

Determination of the Pasting properties of samples

The pasting properties of each sample was determined using a Rapid viscosity Analyser (RVA).

UNDER PEER REVIEW

Results and Discussion

Table 1: Results of functional properties of cowpea and soy bean blends

	Bulk densily g/ml	Water Absorption capacity %	Oil Absorbtion capacity g oil/g	Total Soluble solid %	Wettability WETA (s)	Swell capacity (%)
A	0.851± 0.02[b]	1.72± 0.01[c]	1.46± 0.02[a]	4.501±0.71[a]	5.50± 0.71[a]	3.57± 0.01[c]
B	0.84± 0.01[a]	1.67± 0.01[b]	1.50± 0.01[ab]	5.00± 0.00[a]	11.00± 1.40[b]	3.25± 0.01[b]
C	0.83± 0.01[a]	1.56± 0.02[a]	1.58± 0.01[c]	5.00± 0.00[a]	40.5± 0.70[c]	3.19± 0.01[a]

N=3, values are means (LSD), common superscriptLetter in a column are Significally differentat $p \leq 0.05$

Table 2. Pasting Properties of cowpea and soy bean blends

	Peak Viscosity1 Rvu)	Peak Temp 1 (^oC)	Trough Viscosity 1 (Rvu)	Trough Temp (^oC)	Peak Viscosity 2 (Rvu)	Peak Temp 2 (^oC)	Final Viscosity (Rvu)
A	9.50	78.6	8.00	80.03	17.00	30.05	16.00
B	3.50	80.00	2.50	80.00	10.50	29.79	9.50
C	2.50	80.00	0.50	80.00	10.50	30.13	9.50

Table 1 showed the results of fuctional properties of the samples. The bulk density of all the samples were similar except little difference in value without significant differences at $p < 0.05$. The bulk density is influenced by particle size and density of the flour and is important in determining the packaging requirment and material hardling [9]. Low bulk density is reported to be influenced by loose structure of the starch polymer [10]. The result obtained for water absorption capacity ranged between 1.56-1.72%. Sample A which contained 90% cowpea flour and 10% soy flour gave the highest water absorption capacity followed by sample B and C respectively. This may be due to the percentage soy flour added to each sample. Osundahunse et al. [11] reported that good water absorption capacity is desirable in food system to improve yield and consistency and give body to the food. The low water absorption capacity of the cowpea-soyflour may be due to loose association of amylose and amylopectin in the samples. This result is supported by Lorenz and collin, [12] and Malomo et al. [10]. They both reported that water absorpton capacity will be low if there is loose association between amylose and amylopectin in the native granules of starch and weak associativ e forces maintainng the granules structure.

The Oil absorption capacity of all the samples were also different with significant difference at $P<0.05$. Oil absorption capacity is an important property of cowpea flour that could be used as an extender in various culinary uses. The presence of soy flour in the sample reduced the rate of oil absorption of all the

UNDER PEER REVIEW

samples. This was shwon in the reduction rate of the value obtained. Low oil absorption is highly desirable as far as flour product is concerned. [13].

Total soluble soild of all the samples showned no significant difference at P<0.05. sample A recorded the lowest value with the remain samples (i.e sample A and B) having the same value (5%). The total soluble solid is an indication of the rate at which such sample will dissolve in water. The result obtained were good for cowpea – soybean flour analysed.

Wetability is the time taken for samples to absorb water. The wetability results revealed the effect of soy flour on the samples. The wetability of the samples increased with increase in ratio of soy flour. Sample C (90% cowpea, & 30% soy flour) had the highest value of 40.50%, followed by sample B (11%) and sample A (5.50%). It may be explained that soy flour showed the highest level of water absorption which resulted in the increase of wetability of sample with the highest ratio of soy flour.

The swelling capacity of the three samples followed the same trend of water absorption capacity with sample C having the lowest swelling capacity (3.10%), followed by sample B (3.25%) and highest in sample A (3.57%). The swelling capacity results of the three samples may be due to the ratio of soy flour to cowpea flour in all the samples. The swelling index or swelling capacity is largely cotrolled by the strength and character of the micellar network within the starch granules [14]. The starch granules present in the samples showed a weak strength which resulted in low swelling capacity. This result is in line with the result of Abioye et al. [15], who reported a decreases in swelling capacity of soy – plantain flour.

The resuult of the pasting characteristics are shown in Table 2. The pasting characteristics indicate that the addition of soy flour reduced the peak viscosity of all the samples. Sample A, which contained the smallest amount of soy flour had the highest peak viscosity value of 17.00 RVU followed by sample B and C with the same value (10.50 RVU). The equal value of sample B and C indicates that there is particular ratio of subtitute that will affect the final peak viscosity. This result is in consonant with the result of Abioye et al. [15]. The trough viscosity, which is the minimum viscosity value, measures the ability of paste to withstand breakdown during cooling and it ranged from 0.50 to 8.00 RVU. This also followed the same trend with that of peak viscosity. The final viscosity is the most commonly used parameters to determine a particular starch based sample quality. It gives an idea of the ability of such material to gel after cooking [16]. The final viscosity decreased with increase in soy flour substitution. This is an indication that the ability of the material (i.e food substance) to form a viscous paste or gel after cooking and coolling, as well as the resistance of such paste to share stress during stirring is low.

The value obtained range from 16.00 RVU for sample A, 9.50 RVU for sample B and C. This result is also suported by Abioye et al. [16], who reported a decrease in final viscosity of soy – plantain flour.

CONCLUSION

This study showed that the addition of soybean to cowpea had a significant influence on the pasting and functional properties of the differents samples. When compared with the pasting and functional properties of cowpea the differences observed are not significant enough to discourage the use of the blend samples for culinary purposes such as the production of akara, moi-moi etc. Further more, when compared with the pasting properties of soybean there is a significant improvement. This suggests that the blend can be used for culinary uses.

UNDER PEER REVIEW

REFERENCE

1. Darfour B, Whilson D. D., Ofosu D. O. And Ocloo F. C. K. Physical, Proximate, Functional and Pasting properties of flour produced from gamma radiated cowpea (Vigna Unguiculata, L. Walp). Radiation physics and chemistry 2012; 81: 450 – 457.
2. Jideani V. A. Functional properties of soybean ingredients in food systems http://www.intechopen.com/books/soybean-biochemistry-chemistry-and physiology / functional-properties of soybean-food-ingredients-in-food-systems, 2011; pp 345-367.
3. Henshaw F. O. McWatters K. H., Oguntunde A. O. And Philips R. D. Pasting properties of cowpea flour: effects of soaking and decortication methods. Journal of agriculture and food chemistry 1996; 44: (7) 1996 – 1865.
4. McWatters, K. H. Compositional, physical and sensory characteristics of akara processed from cowpea paste and Nigerian cowpea flour. Cereal chemistry. 1983; 60 (5): 333 – 336.
5. Henshaw F. O. and Sobowale M. K. cowpea flour produced from different bean variaties: functional properties, composition and acceptability of products. Nigerian food journal. 1996; vol. 14 1996.
6. Reber E. F., Eboh, L. Aladeselu A., Brown W. A., and Marshall D. D. Development of high – protein low-cost Nigerian foods. Journal of food Science 1983; 48:217.
7. Ajayi IA, Ajibade O, Oderinde RA. Preliminary Phytochemical Analysis of some Plant Seeds. *Res. J. Chem. Sci.* 2011; 1(3): 58-62.
8. A.O.A.C. Official methods of analysis of A.O.A.C. international (17th ed). Washington, DC: A.O.A.C. 2000; International.
9. Karuna D, Noel G, Dilip K. Production and use of raw potato flour in Mauritanian traditional foods. Food and Nutr bulletin. 1996; 17:2.
10. Malomo Olu, Ogunyele O. A. B, Adekoyeni O. O. Jimoh O., Oluwajoba S. O. and Sobariwa . O. . Rheological and functional properties of soy-pondo yam flour. International journal of food science and nutrition engineering. 2012; 2 (6): 101 – 107.
11. Osundahunsi, O.F., Fagbemi, T.N., Kesselman, E. & Shimoni, E. Comparison of the physicochemical properties and pasting characteristics of flour and starch from red and white sweet potato cultivars. Journal of Agricultural Food Chemistry 2003; 51: 2232-2236.
12. Lorenz, K. and Collins, F. Quinoa (Chenopodium Quinoa) Starch-Physichochemical Properties and Functional characteristics. Starch/Staeke: 1990; Pp. 42,81-86
13. Odediji J. O. and Oyeleke W. A. Proximate, physico-chemical and organoleptic properties of whole and dehulled cowpea seed flour (vigna unguiculata). Pakistan journal of nutrition 10 (12): 2011; 1175 – 1178.
14. Bolade MK. Effect of flour production methods on the yield, physicochemical properties of maize flour and rheological characteristics of a maize-based non fermented food dumpling. Afri. J. of Food Sci. 2009; 3(10): 288-298
15. Abioye V. F., Ade – Omowaye, B. I. O, Babatunde G. O. and Adesigbin M. K. Chemical, physico-chemical and sensory properties of soy-plantain flour. African journal of Food science 2011; vol. 5 (4). Pp 176 – 180
16. Osungbenro, Taiwo, Jimoh D. and Osundeyi E. Functional and pasting properties of composite cassava – sorghum flour meal. Agriculture and biology of North America. 2010; 2151 – 7517.