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Nigerian Food Journal
Official Journal of Nigerian Institute of Food Science and Techonology www.nifst.org

NIFOJ Vol. 30 No. 2, pages 80 – 88, 2012

Chemical, Functional and Pasting Properties of Defatted Starches from Cowpea and Soybean and Application in Stiff Porridge Preparation

* Chinma, C.E.[1], Abu, J.O.[2], James, S.[1] and Iheanacho, M.[1]

ABSTRACT

The effects of defatting on the chemical, functional and pasting properties of starches from cowpea and soybean and their application in stiff porridge preparation were studied. Conventional cassava starch served as standard. Defatting of cowpea and soybean resulted in higher yield. Defatted starches also had higher amylose contents with low protein, fat and ash contents than full fat starches. In addition, defatted starches from cowpea and soybean had higher water absorption capacity, swelling power, blue value index and low bulk density, higher peak viscosity, trough, final viscosity, setback values than full fat cowpea and soybean starches while cassava starch had higher peak time and pasting temperature than the legume starches. The full fat starches from soybean and cowpea had high breakdown and low setback values than the defatted samples and control. The extensibility values of defatted starches were significantly ($p \leq 0.05$) higher than full fat starches but lower than control. There was no significant ($p \geq 0.05$) difference in texture and appearance of stiff porridges prepared from cowpea, soybean and cassava starches. Similarly, there was no significant ($p \geq 0.05$) difference in mouldability, stickiness and overall acceptability between defatted starches and control but significantly different ($p \leq 0.05$) with the full fat starches. It is therefore concluded that consumption of such stiff porridges could be beneficial to individuals requiring decreased and/or slow starch digestibility such as diabetic patients and long distance athletes since legume starches are known to have low starch digestibility.

Keywords: Legume starch, yield, functional, chemical composition, pasting, stiff porridge.

Introduction

Legumes are not only good sources of protein but also excellent sources of carbohydrates (Jood *et al.* 1985). Starch remains a major source of calories in the human diet and can be found in high concentration in the main storage organs of plants including roots and tubers, stems, seeds and grains. Starch is the most important carbohydrate consumed on a worldwide basis because of its high uninterrupted abundance and low cost.

In Nigeria, especially the southern parts, starch is used mainly in the preparation of stiff porridges which are usually consumed with stews and vegetable soups. Stiff porridges are prepared mostly from cassava starch that is low in protein and high in glycemic index.

Foods with high glycemic index tend to release energy rapidly and raise blood sugar level at a fast rate. Such is undesirable in the diets of individuals with compromised health such as diabetics. As the number of people diagnosed with diabetes continues to increase around the world, nutritional approaches to diabetes prevention is one step researchers ought to take to address this serious situation by formulating a diet to optimize health and counteract the risk factors of metabolic

1 Department of Food Science and Nutrition, Federal University of Technology, Minna, Nigeria.
2 Department of Food Science and Technology, University of Agriculture, Makurdi, Nigeria.
* corresponding author: chinmachiemela@yahoo.com

syndrome in an aging population (Aoe, 2008). Partly for this reason, research into alternative starch sources with slow and or low digestibility in stable food preparations such as stiff porridges have been carried out (Abu *et al.* 2011).

Legume starches promote slow and moderate postprandial glucose and insulin responses, and have low glycemic index values (Jekins *et al.* 1981). Legume starch contains variable amount of lipids which interact with carbohydrates to play a significant role in their functional properties end-product quality, shelf life and texture of starch-based foods (Radhika *et al.* 2008). Therefore, to guarantee consistent and predictable quality in food systems, it may be necessary to defat starch prior to application. To our knowledge, there is scanty information on the effect of defatting on the chemical composition and functionality of cowpea and soybean starches and their performance in stiff porridge preparation.

Therefore, the objective of this study was to determine the effect of defatting on the yield, chemical, functional and pasting profiles of soybean and cowpea starch in comparison with cassava starch and their application in stiff porridge preparation.

Materials and Methods

Source of materials

Cowpea and soybean seeds were purchased from Minna Central Market, Minna while cassava starch was purchased from Amigo Supermarket, Abuja, Nigeria.

Starch isolation

Soybean and cowpea seeds were separately sorted, washed, soaked in distilled water for 6 h and milled into slurries. The slurries were suspended in cold deionized water and sieved to remove fibrous material leaving the starch in solution. The starch layer was suspended in deionized water and centrifuged for 6 to 7 times, until the settled starch gave a firm, dense deposit at the bottom of the flask. The final sediment was suspended in cold deionized water and screened through 150 μm screen to keep the cell wall off the starch slurry. The residue was amassed and dried in a convection oven at 50°C until 6% moisture content was achieved. The dried material was milled and sieved through a 75 μm screen to obtain the starch. Full fat starch samples from soybean and cowpea seeds were defatted using petroleum ether at temperatures ranging from 30 to 60°C using the Soxhlet method for 8 h. Defatted starch samples were air dried for 30 min and milled into fine powder using a blender ((Philips, model HR 1702). Starch samples were separately stored in plastic containers with lids at 4°C in a refrigerator from where samples were drawn for analysis. Starch yield was calculated as a percentage of weight of starch/weight of ground cowpea/soybean seeds.

Chemical analysis

Moisture content, protein, fat, crude fibre and ash contents of starch samples were determined using the AOAC (1995) method. The amylose content of starches were determined using the method of Williams *et al.* (1970) involving the preparation of stock iodine solution and iodine reagent. A 0.1 g of starch was weighed into a 100 ml volumetric flask, then 1 ml of 99.7 – 100% (v/v) ethanol and 9 ml 1N sodium hydroxide were carefully added. The mouth of the flask was covered with parafilm and the contents were properly mixed. The samples were heated for 10 min in a boiling water bath to gelatinize the starch (the timing was started when boiling began). The samples were removed from the water bath and allowed to cool, then made up to the mark with distilled water and shaken thoroughly. Then, 5 ml was pipetted into another 100 ml volumetric flask and 1.0 ml of 1N acetic acid and 2.0 ml of iodine solution were added. The flask was topped up to the mark with distilled water. Absorbance (A) was read using a spectrophotometer at 620 nm wavelength. The blank contained 1 ml of ethanol and 9 ml of sodium hydroxide, boiled and topped up to the mark with distilled water. Finally, 5 ml was pipetted into a 100 ml volumetric flask; 1 ml of 1N acetic acid and 2 ml of iodine solution were added and then topped up to the mark. This was used to standardize the spectrophotometer at 620 nm. The amylose content was calculated as:

$$\text{Amylose content (\%)} = 3.06 \times \text{absorbance} \times 20$$

Functional analysis

Determination of water absorption capacity

Water absorption capacity was determined by the method of Okezie and Bello (1988). One gram of each sample was thoroughly mixed at high speed in a flask shaker with 20 ml distilled water. After standing at room temperature for 30 min, the contents was centrifuged at 500 rpm for 1 h, and the volume of free water or oil was read directly from the graduated tubes. The amount of water/ was multiplied by its density for conversion to grams. Water absorption capacity was expressed as grams of water absorbed (retained) per gram of sample. Water was assumed to have a density of 1.0 g/ml.

Determination of swelling power

Swelling power of starches was determined at 60, 70, 80 and 90°C using a modified version of Sathe and Salunkhe (1981) method. Forty millilitre of 1% starch-soy protein concentrate suspension (w/v) was prepared in a previously tarred, 50 ml centrifuge tube. The tube was placed in a water bath for 30 min at constant temperatures of 60, 70, 80 and 90°C. Each suspension was centrifuged at 2120 g for 15 min, the supernatant decanted and the swollen granules weighed. A 10 ml sample was taken from the supernatant, placed in a crucible and dried in an air convection oven (Imperial V) at 120°C for 4 h to constant weight. Swelling power was calculated using the following formulae:

Swelling power = weight of swollen granules × 100/sample weight × (100-solubility).

Determination of blue value index

A 0.10 g of starch was suspended in 5 ml of distilled water in a centrifuge tube, mixed for 1 h in a water bath and centrifuged at 5000 × g for 30 min. The supernatant was recuperated and its blue value determined by modified iodine method of Birch and Prietly (1973).

Determination of extensibility

The method of Ekwu *et al.* (2005) was adopted for the determination of extensibility of stiff porridges. A 25 g of each starch sample was added in 75 ml of boiling water and the mixture stirred until a gelled solid dough was formed. A 20.47 g of each gelled dough sample was weighed in a top loading metre balance after cooling to room temperature. This was rolled between palms into a cylindrical geometry with initial length of 5 cm. Cooling the rolled stiff porridge was achieved by allowing it to cool at room temperature (27 ± 1°C) for 0, 15, 30 and 45 min respectively. Each of the rolled cooled cylindrical stiff was stretched by holding the ends of the rolled stiff porridge between the right and left fingers. It was then pulled by moving the right and left hand gently in opposite direction until it breaks. The total length of the stretched cylindrical stiff porridge was measured with metre rule and recorded. The extensibility was taken as the difference between the total final length and the initial length of the samples.

Determination of pasting properties

Pasting parameters were determined using a rapid visco analyzer (Newport Scientific Pty Ltd., Warrie-Wood NSW 2102, Australia). A 2.5 g of starch sample was weighed into a previously dried empty canister; then 25 ml of distilled water was dispensed into the canister containing the sample. The suspension was thoroughly mixed and the canister was fitted into the rapid visco analyzer. Each suspension was kept at 50°C for 1 min and then heated up to 95°C at 12.2°C /min and held for 2.5 min at 95°C. It was then cooled to 50°C at 11.8°C /min and kept for 2 min at 50°C. All determinations were done in triplicate.

Preparation of stiff porridge and sensory evaluation

Fifty grams of starch samples were separately reconstituted into paste using approximately 150 ml of boiling water over a low gas flame with continuous stirring for 5 min to obtain stiff porridge samples. Sensory evaluation was done using a twenty-member panel consisting of students and staff of Food Science option, Department of Animal Production, Federal University of Technology, Minna, Nigeria based on their familiarity with stiff porridges. Stiff porridge samples prepared from the various starches were presented to panellists with warm soup in coded white plastic plates. Cassava starch served as standard. The order of presentation of samples to the panel was randomized. Tap water was provided to each panelist to wash their hands in-between evaluations. The samples were evaluated for appearance, colour, stickiness, mould ability, texture and overall acceptability. Each sensory attribute was rated on a 9-point Hedonic scale (1 = disliked extremely while 9 = liked extremely).

Statistical analysis

Data were analyzed by analysis of variance (Steel and Torrie, 1980). The difference between mean values was determined by the least significant difference (LSD) test. Significance was accepted at 5% probability level (Ihekoronye and Ngoddy 1985).

Results and Discussion

Yield and chemical composition of starch samples

The yield and chemical composition of full fat and defatted starches from cowpea and soybean in comparison with cassava starch is presented in Table 1. The starch yield ranged from 35.13 to 49.92% with defatted cowpea having the highest starch yield while full fat soybean had the lowest starch yield. Defatted starch samples had higher starch yield than full fat starch samples. The variation in starch yield could be due to enhanced separation of starch from starch-lipid complexes following fat removal. The starch yields obtained in this study compare fairly with the range (18 to 45 %) reported for other legume starches (Yamez-Farias *et al.,* 1997; Gujska *et al.,* 1994).

Table 1: Yield and chemical composition of full fat and defatted starches from cowpea and soybean in comparison with cassava starch

Starch Sources (%)	Starch yield (%)	Total amylose (%)	Protein (%)	Fat (%)	Moisture (%)	Ash (%)
Defatted soybean	43.45 ± 1.36^{b}	33.52 ± 0.97^{a}	0.71 ± 0.01^{a}	0.28 ± 0.04^{c}	5.08 ± 0.01^{b}	0.36 ± 0.22^{a}
Full fat soybean	35.13 ± 0.84^{d}	29.01 ± 1.05^{c}	0.47 ± 0.00^{a}	3.71 ± 0.38^{a}	6.43 ± 0.01^{a}	0.21 ± 0.34^{a}
Defatted cowpea	49.92 ± 1.53^{a}	32.17 ± 0.05^{b}	$0.64 \pm +0.01^{a}$	0.25 ± 0.01^{c}	5.30 ± 0.02^{b}	0.28 ± 0.01^{a}
Full fat cowpea	41.81 ± 0.69^{c}	26.39 ± 2.01^{e}	0.39 ± 0.01^{a}	2.64 ± 0.03^{b}	5.63 ± 0.07	0.16 ± 0.01^{a}
Cassava starch	ND	28.16 ± 0.92^{d}	0.10 ± 0.00^{a}	0.16 ± 0.59^{c}	4.43 ± 0.01^{c}	0.10 ± 0.01^{a}

Values are mean and standard deviation of three determinations.
Values followed by different superscript letters in a column are significantly ($p < 0.05$) different from each other.
ND= Not Determined

The total amylose content varied significantly ($p \leq 0.05$) from 26.39 to 33.52 % with defatted cowpea starch having the highest amylose value while cassava starch had the lowest value. Amylose content is one of the important factors affecting starch pasting and retrogradation behaviours. It provides surface and textural regularity, elasticity and sticky characteristics to starch based products (De la Gueriviere, 1976). The higher amylose content in defatted legume starches than full fat starch samples may be indicative of possible textural differences when used in stiff porridge preparations. The differences in amylose content between defatted and full fat starch samples may be further indicative of the amylase-lipid complexes alluded to earlier. According to Radhika *et al.* (2008), the presence of lipids reduces amylose leaching and therefore less amylose will be available for network formation and the product will be softer in texture. In general, the amylose content of the legume starches was higher than the cereals, roots and tuber starches. Legume starches have previously been found to have relatively high amylose content (30 to 40 %) (Madhusudhan and Tharanathan, 1995). The amylose contents of our starches from cowpea and soybean are within the expected range.

The moisture, protein, fat and ash contents ranged from 4.43 to 6.43%, 0.10 to 0.71%, 0.16 to 3.71% and 0.10 to 0.36% respectively. The variations in moisture content among starch samples could be attributed to the extent of drying. The lower ash content of defatted samples may be attributed to possible loss of inorganic ions during the defatting process. The purity of starch is judged by the least amount of protein, fat, ash and other non-starch constituents. Therefore, defatting may be desirable as it results in lower residual protein, fat and ash contents leading to improvement in starch purity. This is because impurities such as lipids tend to reduce clarity of starch paste and hinder the swelling of starch granule owing to formation of amylose-lipid complexes (Kasemsuwan *et al.,* 1998). Conversely, proteins and lipids play important role in the retention of amylose in starch noodles during cooking, leading to reduced cooking losses (Kim *et al.,* 1996). For this reason, full fat legume starches may find useful applications in noodle preparations. The residual fat of full fat and defatted starches reported in this study compare fairly with values reported by Adeniran *et al.* (2012). These authors reported fat contents of 3.95% and 4.82% for breadfruit and cassava starch respectively. Also, the non-starch constituents of our starches compare well with starch extracted from some Indian blackgram cultivars (Singh *et al.*, 2004).

Functional properties of starch samples

The functional properties of full fat and defatted starches from cowpea and soybean in comparison with cassava starch samples are shown in Table 2. Water absorption characteristics represent the ability of a product to associate with water under conditions where water is limiting (Singh, 2001). The water absorption capacity ranged from 2.10 to 2.74 g water/g sample with full fat soybean having the lowest value while cassava starch had the highest value. The high water absorption capacity of cassava starch than other samples could be attributed to higher amount of carbohydrate in cassava starch. Also, the high water absorption capacity of defatted starch samples than full fat starches may be attributed to the removal of the non-polar groups that may interfere with starch-water interaction. The water absorption values obtained in this study were comparable to values (2.24 to 2.61g water/g sample) reported for full fat starch from brown and yellow varieties of tigernut starch by Chinma *et al.* (2010).

Table 2: Functional properties of full fat and defatted starches from cowpea and soybean in comparison with cassava starch

Starch sources	Water absorption capacity (g water/g sample)	Bulk density (g/cm³)	Blue value index	Swelling Power (%)			
				70	80	90	100
Defatted soybean	2.44 ± 0.01[a]	0.69 ± 0.03[a]	43.08 ± 1.92[c]	15.60 ± 0.34[b]	19.32 ± 0.24[c]	23.76 ± 0.68[a]	28.10 ± 0.50[b]
Full fat soybean	2.10 ± 0.01[a]	0.87 ± 0.10[a]	40.30 ± 0.54[d]	12.09 ± 0.16[d]	15.89 ± 0.56[d]	17.00 ± 0.06[c]	23.24 ± 0.96[c]
Defatted cowpea	2.52 ± 0.03[a]	0.59 ± 0.01[a]	51.47 ± 0.60[b]	14.25 ± 0.52[c]	20.01 ± 1.04[b]	18.15 ± 1.16b	19.69 ± 1.32[d]
Full fat cowpea	2.13 ± 0.01[a]	0.73 ± 0.50[a]	40.84 ± 1.35[d]	9.73 ± 0.05[e]	12.40 ± 0.08[e]	15.05 ± 0.04[d]	18.17 ± 0.44[e]
Cassava	2.74 ± 0.01[a]	0.64 ± 0.10[a]	67.55 ± 0.09[a]	16.3.16 ± 0.49[a]	21.95 ± 0.50[a]	23.50 ± 0.78[a]	29.36+0.17[a]

Values are mean and standard deviation of three determinations.
Values followed by different superscript letters in a column are significantly ($p < 0.05$) different from each other.

Bulk density ranged from 0.64 to 0.87 g/cm^3. Bulk density of full fat samples were higher than defatted starch samples. There were no significant ($p \geq 0.05$) differences in bulk density among starch samples.

Blue value index represents the degree of starch damage or fragility of starch (Amani *et al.*,1993). Blue value index varied significantly ($p \leq 0.05$) between 40.30 and 67.55%. Low blue value index value in full fat legume starch than other starch samples may be attributed to less damaged starch granules in full fat starches. Damaged starch granules have greater affinity for water, resulting in increased water absorption and swelling power. This could be responsible for low swelling power and water absorption capacity observed in full fat starches from cowpea and soybean as well as high swelling power and water absorption capacities of defatted starches when prepared into stiff porridge. Brennam and Ayernor (1973) reported that higher degree of starch damage is desirable in fufu (stiff porridge). This is in line with the blue value results obtained in this study. Defatted starches from cowpea and soybean had higher blue value index than full fat starch samples and produced better stiff porridges as shown by the sensory results.

Swelling power indicates the water holding capacity of starch, which has generally been used to demonstrate differences between various types of starches (Crosbie, 1991). Swelling power of starch samples varied significantly ($p \leq 0.05$) from 9.73 to 29.36%. Swelling power of starch samples increased with increase in temperature and reached its peak value at 90^{o}C. Swelling power of defatted starches from cowpea and soybean were higher than full fat starch samples. The variation in swelling properties of starch samples could be attributed to reduction in fat content as a result of defatting process. According to Swinkels (1985), swelling power of starch is affected by the presence of lipids. Schoch and Maywald (1998) reported swelling powers in the range of 16 to 20 g/g for yellow pea, navy bean, lentil and garbanzo bean starches.

Pasting properties of starch

The pasting properties of full fat and defatted starches from cowpea and soybean in comparison with cassava starch soybean, cowpea and cassava starches are presented in Table 3. The peak, trough, breakdown, final viscosity, setback, peak time and pasting temperature ranged from 136.26 to 468.25 RVU, 75.83 to 295.50 RVU, 60.43 to 234.45 RVU, 125.99 to 434.90 RVU, 50.16 to 139.40 RVU, 5.63 to 6.01 minutes and 78.35 to 81.10^{o}C respectively. The defatted starches from soybean and cowpea had higher peak viscosity, trough, final viscosity and setback values than cassava and full fat legume starches while cassava starch had higher peak time and pasting temperature than legume (cowpea and soybean) starches. The low final viscosity observed in cassava starch compared to the peak viscosities of legume starches indicates the low tendency of cassava starch to retrograde (Moorthy, 2002). The final viscosity (125.99 RVU) of cassava starch obtained in this study is close to the value (130.07 RVU) reported by Nuwamanya *et al.* (2010) for starch isolated from Bao cassava variety. Also, full fat starches from soybean and cowpea showed high breakdown and low setback values. These results were in agreement with the findings that free fatty acid, one of the most important components of lipid, could increase the peak viscosity and delay the pasting time during the gelatinization cycle (Pomeranz, 1988). The crystal structure of starch granules began to melt at lower temperature without lipid and needed longer time to reach peak viscosity, which was the equilibrium point between swelling, causing an increase in viscosity and rupture, and alignment causing its decrease (Sun *et al.,* 2010). High breakdown is associated with peak viscosity which is related to the degree of swelling of starch while low setback value indicates low rate of starch retrogradation and syneresis (Ragaee and Aal, 2006). This implies that full fat soybean and cowpea starches will exhibit low starch retrogradation and syneresis when used in food systems such as stiff porridge. Low breakdown indicates high paste stability (Ragaee and Aal, 2006). This may imply that these starches have good potential as ingredients in foods exposed to high temperatures and mechanical stirring. Therefore, soybean and cowpea starches may be suitable alternative starch sources in the preparation of low and slow digestible stiff porridges. The peak, final and setback values of defatted starches from cowpea and soybean obtained in this study were comparable to earlier reports of Singh *et al.* (2004) for starch extracted from some Indian blackgram cultivars. They reported peak, final viscosity and setback values in the range of 422 to 514 RVU, 400 to 439 RVU and 102 to 151 RVU respectively.

Table 3: Pasting properties of full fat and defatted starches from cowpea and soybean in comparison with cassava starch

Starch sources	Peak (RVU)	Trough (RVU)	Breakdown (RVU)	Final viscosity (RVU)	Setback (RVU)	Peak time (min)	Pasting temperature (°C)
Defatted soybean	437.65^b ± 1.54	295.50^a ± 1.11	142.15^d ±1.20	434.90^a ± 0.90	139.40^a ± 0.05	5.83^a ± 0.11	78.35^c ± 0.97
Full fat soybean	390.64^c ± 0.98	156.19^c ± 0.74	234.45^a ± 0.95	280.75^c ± 1.13	124.56^c ± 0.16	5.61^a ± 0.23	79.94^c ± 0.45
Defatted cowpea	468.25^a ± 0.71	276.38^b ± 1.40	191.87^c + 1.10	411.51^b ± 0.95	135.13^b ± 0.99	5.79^a ± 0.30	80.65^b ± 1.13
Full fat cowpea	345.54^d ± 0.90	120.57^d ± 0.83	224.97^b + 1.44	244.52^d ± 1.36	123.95^c ± 1.05	5.63^a ± 0.05	79.24^c ± 0.56
Cassava	136.26^e ± 1.04	75.83^e ± 0.55	60.43^e + 0.85	125.99^e ± 0.19	50.16^d ± 0.08	6.01^a ± 0.72	81.10^a ± 0.83

Values are mean and standard deviation of three determinations.
Values followed by different superscript letters in a column are significantly ($p < 0 .05$) different from each other.

Table 4: Extensibility characteristics of stiff porridges prepared from full fat and defatted starches from cowpea and soybean in comparison with cassava starch

starch sources	cooling time (min)			
	0	15	30	45
Defatted soybean	32.03 ± 0.62^b	29.42 ± 0.57^b	24.05 ± 0.05^c	18.43 ± 0.28^c
Full fat soybean	29.11 ± 1.80^d	26.05 ± 0.08^d	23.78 ± 0.01^d	16.10 ± 0.10^d
Defatted cowpea	30.47 ±1.09^c	28.10 ± 1.10^c	25.80 ± 1.04^b	20.32 ± 0.71^b
Full fat cowpea	26.69 ± 0.44	23.33 ± 0.50^e	20.60 ± 1.47^e	15.16 ± 0.08^e
Cassava starch	35.95 ± 0.72^a	30.18 ± 0.31^a	26.92 ± 0.64^a	22.24 ± 0.21^a

Values are mean and standard deviation of three determinations.
Values followed by different superscript letters in a column are significantly ($p < 0.05$) different from each other.

Extensibility characteristics of stiff porridges

Extensibility is the extent to which a material can be distorted or stretched without breaking. It is often expressed as a proportion of the material's original size. Table 4 shows the result of extensibility characteristics of stiff porridges prepared from starch samples. Extensibility values ranged from 15.16 to 35.95%, with cassava starch having higher extensibility value while full fat cowpea starch had the lowest value. Defatted starches from cowpea and soybean had higher extensibility value than full fat samples. The extensibility of the starch samples were influenced by cooling time. Generally, as the cooling time increased, the extensibility of stiff porridges prepared from cowpea, soybean and cassava starch samples decreased. This agrees with the findings of Ngoddy and Onuoha (1994) that stretchability of yam fufu had strong time dependency on measurement. The variations in extensibility of starch samples may be attributed to the degree of crystalline starch present in the sample. According to Rindlav-Westling *et al.* (1998), extensibility depends on starch crystallinity; the higher the crystalline structure of starch, the lower the extensibility.

Sensory properties of stiff porridge

The sensory properties of stiff porridge prepared from starch samples are presented in Table 5. There was no significant difference ($p \geq 0.05$) in texture and appearance of stiff porridges prepared from legume and cassava starches ($p \geq 0.05$). There was no significant difference in mouldability, stickiness and overall acceptability between defatted starches (from cowpea and soybean) and cassava starch but differed significantly ($p \leq 0.05$) between full fat samples.

Table 5: Sensory properties of stiff porridges prepared from full fat and defatted starches from cowpea and soybean in comparison with cassava starch

Starch source	Sensory attributes				
	Texture	Mouldability	Stickiness	Appearance	Overall acceptability
Defatted soybean	6.1^a	7.0^a	6.5^a	7.3^a	8.2^a
Full fat soybean	6.0^a	6.0^b	5.8^b	7.5^a	7.0^b
Defatted cowpea	6.2^a	7.1^a	6.7^a	7.0^a	8.3^a
Full fat cowpea	5.8^a	6.5b	5.6^b	7.2^a	7.5^b
Cassava	6.4^a	7.3^a	6.4^a	7.0^a	8.1^a
LSD	–	0.65	0.54	–	0.48

Values are mean and standard deviation of three determinations.
Values followed by different superscript letters in a column are significantly ($p < 0.05$) different from each other.
– = no LSD value.

Conclusions

Defatting of cowpea and soybean led to higher starch yield as well as lower residual protein, fat and ash contents in starch isolates. Also, higher water absorption, swelling power and blue value index of cowpea and soybean starches were achieved following defatting. Similarly, pasting properties of cowpea and soybean starches as well as the extensibility and sensory properties of stiff porridge products prepared from the starch samples when compared with cassava starch were improved as result of defatting process. These starches may be potentially useful in providing stiff porridges with reduced starch digestibility.

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