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Functional And Pasting Properties of Cocoyam-Wheat-Groundnut Flour Blends

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Abstract*— The study investigated the effect of the addition of wheat flour with cocoyam and defatted groundnut flour blends for composite flour production. Composite flour was produced from blends of wheat-cocoyam-groundnut flour formulated in the ratio wheat flour: cocoyam flour: groundnut flour: (100:0:0, 90:5:5, 80:10:10, 70:15:15, 60:20:20, 50:25:25, 40:30:30 and 30:35:35). The proximate composition, functional and pasting properties of the composite flour blends was then determined. The protein content of the flour blend ranged from 12.33-29.39% with sample H ((30% wheat flour, 35% cocoyam flour, and 35% groundnut flour) having the highest value. The carbohydrate content of the flour blends decreased with the addition of cocoyam and groundnut flour blends. The water holding capacity of the flour blend ranged from 145.25-186.90%. The oil absorption capacity, swelling power, and bulk density of the flour samples increased with the addition of cocoyam and groundnut flour. However, the pasting viscosity decreased with the increased addition of cocoyam and groundnut flour blends. It was concluded that a composite blend of flour from wheat, cocoyam, and groundnut with satisfactory functional and nutritional values can be produced.

Keywords: *Wheat, Cocoyam and Groundnut*

I. INTRODUCTION

Composite flour is referred to as a combination of several non-wheat flours obtained from roots, tubers, cereals, and legumes with or without the addition of wheat flour formulated to satisfy specific functional characteristics and nutrient composition (Julianti et al., 2015). The purpose of composite flour production is to create a product that is better in terms of improved properties or performances, or in some cases improved economies than the individual components (Okpala and Okoli, 2011). Composite flour technology has been of great advantage for developing countries especially Nigeria as it reduces the use and importation of wheat flour while encouraging the use of indigenous underutilized agricultural products (Arise et al., 2017). Cocoyam is an important root food crop commonly cultivated among low-income earners in Nigeria (Amanyunose et al., 2021). Cocoyam is one of the underutilized tropical crops in Nigeria and its cultivation remains at subsistence level despite its rich nutritional profile (Okunade and Arinola, 2021). Efforts are currently underway to improve its post-harvest processing and extend the utilization of the crop by developing suitable processing technology and securing consumer acceptance (Ikpeme et al., 2009). Defatted groundnut flour (DGF) produced from groundnut cake has been reported to enhance the nutritive value of wheat and other flour (Purohit and Rajyalakshme, 2011). Groundnut is relatively cheap and contains a high amount of protein. The mixture of groundnut, cocoyam, and wheat flours in composite flour production for bread, pastry, and pasta will extend the utilization of cocoyam flour and groundnut while reducing the over-dependence on

II. MATERIALS AND METHODS

Cocoyams (*Xanthosoma* sp) and groundnuts used for this work were obtained from Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife, Nigeria (OAU). The cocoyam corms and groundnut seeds were identified at the herbarium of the Botany Department, Obafemi Awolowo

University, Ile-Ife. All chemicals used were of analytical grade.

Cocoyam Flour Production

Cocoyam flour was produced using the method described by Amanyunose *et al*., (2021). The cocoyam tubers were washed to remove soil particles and other debris and then peeled. The peeled tubers were washed again, sliced into smaller pieces of 2.0 mm thickness using a stainless steel kitchen knife, and blanched at 80 °C for four minutes. The blanched tubers were dried at 65 °C. It was then milled to obtain flour and sieved through a 100 µm mesh sieve. The flour was stored in air-tight containers until required.

Groundnut Flour Production

Groundnut flour was produced according to the modified method described by Mgbemere (2011). Shelled groundnuts were roasted in the oven at 170 °C for 15 – 20 mins, allowed to cool and the skin was removed. The roasted kernels were then milled and defatted using a hydraulic press. The defatted cake obtained was disintegrated, sieved to obtain fine flour, and packaged in a cellophane bag until required.

Formulation of Flour Blends

Composite blends of cocoyam flour, groundnut flour, and wheat flour were formulated in the following ratio: wheat flour: cocoyam flour: groundnut flour (100:0:0, 90:5:5, 80:10:10, 70:15:15, 60:20:20, 50:25:25, 40:30:30 and 30:35:35) to obtain 8 samples. The flour blends were thoroughly mixed using a Kenwood blender until a homogenous blend was obtained. This was then packaged in polythene bags until required.

Proximate Analysis

The proximate composition of the samples was determined using AOAC (2006) methods.

Determination of Functional Properties of the Flour Blends

Water and oil absorption capacity was determined according to the method of Onwuka, (2005). Bulk density was determined using a method described by Murphy *et al*., (2003) while the swelling index was estimated by the method of Leach *et al*., (1995).

Pasting Properties

The pasting profile of the flour blend samples was determined using a Rapid Visco-Analyzer (RVA) (Newport Scientific Pty Ltd) with the aid of a thermocline for Windows version 1.1 software (1998).

Statistical Analysis

Data obtained were subjected to statistical analysis using SPSS/16 software to compare the differences between treatment means.

III. RESULT AND DISCUSSION

Proximate Composition of Wheat-Cocoyam-Groundnut Flour Blends

The proximate composition of the composite flour blends of wheat cocoyam and groundnut flour are presented in Table 1. The moisture content of the formulated flour blends ranged between 7.40 and 9.35%. The values were observed to be significantly different ($p<0.05$) except for samples C and E. Sample A (100% wheat flour) had the highest moisture content (9.35%). The values obtained for moisture content were below the usual maximum recommended moisture content of 10% for flour samples (Makinde and Ladipo, 2012). This suggests that the composite flour blends will be shelf-stable. The protein content of the composite flour blends ranged between 12.33 and 29.39%. The values were observed to be significantly different ($p<0.05$). The addition of the cocoyam and defatted groundnut flour significantly increased the protein content of the samples. A percentage increase of 21.57 to 138.36% was observed for the flour blend. Sample A had the lowest protein content of 12.33% which was higher than the 10.7% reported by Bala *et al*. (2015) for wheat flour but lower than the 15.1% reported by Ade-Omowaye *et al*. (2008) for wheat flour. These differences in the protein content of the wheat flour could be linked to the varietal differences and different refining processes of wheat flour production. The protein content reported for the wheat-cocoyam-groundnut composite flour (14.99 to 29.39%) was higher than 9.4 to 15.1% reported by Ade-Omowaye *et al*. (2008) for wheat-tiger nut composite flours. The increase observed in the protein content of the composite flour may be largely attributed to the differential protein composition of the base materials (wheat, cocoyam, and defatted groundnut). The ash content of the composite flour blends ranged between 1.39 and 2.99%. The values were significantly different ($p<0.05$). There was an increase of 12.95 to 115% for the composite flour of wheat, cocoyam, and defatted groundnut. The ash content for this study was found to be higher than the range 0.45 to 1.60%) reported by Ade-Omowaye *et al*. (2008) for tiger nut wheat composite flour samples. The addition of cocoyam and defatted groundnut flour to wheat flour caused a significant increase in the ash content of the flour blend which indicates an increase in the mineral content of the flour blend.

Functional Properties of Wheat-Cocoyam-Groundnut Flour Blends

The functional properties (swelling, water absorption capacity, oil absorption capacity, and bulk density) of the composite flour blends of wheat cocoyam and groundnut flours are presented in Table 2.

Swelling Power of Wheat-Cocoyam-Groundnut Flour Blends

The values ranged between 96.35 and 115.77%. and are significantly different (p<0.05). The swelling capacity increased with the incorporation of the cocoyam and defatted groundnut flour. This can be attributed mainly to the high carbohydrate content of cocoyam flour compared with defatted groundnut flour.

Table 1 Proximate Composition (%) of Wheat-Cocoyam-Groundnut Flour Blends

Sample	Moisture	Ash	Fat	Protein	Fibre	Carbohydrate
A	9.35 ± 0.02^{a}	1.39 ± 0.01^{g}	1.29 ± 0.01^{e}	12.33 ± 0.04^{h}	0.71 ± 0.01^{h}	74.90 ± 0.03^{a}
B	8.98 ± 0.01^{b}	1.57 ± 0.01^{f}	1.36 ± 0.01^{d}	14.99 ± 0.03^{g}	0.91 ± 0.04^{g}	72.19 ± 0.01^{b}
C	8.31 ± 0.04^{c}	1.72 ± 0.05^{e}	1.37 ± 0.01^{d}	15.97 ± 0.02^{f}	1.11 ± 0.03^{f}	71.53 ± 0.06^{c}
D	8.10 ± 0.01^{d}	1.92 ± 0.05^{d}	1.45 ± 0.03^{c}	20.09 ± 0.04^{d}	1.51 ± 0.02^{e}	66.94 ± 0.05^{d}
E	8.30 ± 0.02^{c}	2.31 ± 0.03^{c}	1.50 ± 0.04^{c}	22.51 ± 0.03^{d}	1.76 ± 0.03^{d}	63.63 ± 0.15^{e}
F	7.31 ± 0.02^{g}	2.34 ± 0.04^{c}	1.60 ± 0.03^{b}	23.70 ± 0.03^{c}	1.84 ± 0.04^{c}	63.23 ± 0.15^{f}
G	7.81 ± 0.01^{e}	2.80 ± 0.03^{b}	1.70 ± 0.02^{a}	27.13 ± 0.03^{b}	2.15 ± 0.01^{b}	58.42 ± 0.11^{g}
H	7.40 ± 0.03^{f}	2.99 ± 0.07^{a}	1.74 ± 0.02^{a}	29.39 ± 0.05^{a}	2.40 ± 0.04^{a}	56.09 ± 0.21^{h}

Values are means of duplicate determinations ± standard deviation.
Mean values along the same column with different superscripts are significantly different (p<0.05)

A = 100% Wheat flour
B = 90% Wheat flour, 5% cocoyam flour and 5% groundnut flour
C = 80% Wheat flour, 10% cocoyam flour and 10% groundnut flour
D = 70% Wheat flour, 15% cocoyam flour and 15% groundnut flour
E = 60% Wheat flour, 20% cocoyam flour and 20% groundnut flour
F = 50% Wheat flour, 25% cocoyam flour and 25% groundnut flour
G = 40% Wheat flour, 30% cocoyam flour and 30% groundnut flour
H = 30% Wheat flour, 35% cocoyam flour and 35% groundnut flour

The same trend was described by Chandra *et al*. (2015) who produced composite flour from wheat, rice, potato, and green gram flour. Chandra and Samsher (2013) reported that such an increase could be due to differences in particle sizes, types of variety, and types of processing methods or unit operations on the flours. Swelling capacity is regarded as a quality criterion in some food formulations such as bakery products. It reflects the extent of the associative (non-covalent bonding) forces within the molecules of starch and protein compounds in the flour samples. It suggests the crystalline packing of the starch granules of the particulate food material (Billiadaris, 1982). The degree of swelling depends on the type and species of starch in the flour samples (Osungbaro, 1990).

Water Absorption Capacity of Wheat-Cocoyam-Groundnut Flour Blends

The water absorption capacity values ranged between 145.25 and 186.90%. The values are significantly different (p<0.05). The water absorption capacity reported for 100% wheat flour compared well with 145.97% reported by Islam *et al*. (2012) for refined wheat flour. The water absorption capacity of the composite flours increased with the addition of cocoyam and defatted groundnut flours. This increase agrees with that of Omeire *et al.* (2015) for wheat–cassava–groundnut composite flour. Similarly, Adebowale *et al.* (2012) reported that with increasing incorporation of sorghum into wheat flour from 0 to 20%, water absorption capacity increased from 86.8 to 92.5%. This also agrees with the trend reported for soya bean-maize flour (Mishra *et al.*, 2012) and soya-plantain flour (Abioye *et al.* 2011). Onabanjo and Ighere (2014) also reported increasing water absorption capacity values for wheat-sweet potato composite flour. The water absorption capacity is one of the important parameters that is considered when incorporating food powders in aqueous food formulations (Iwe and Onadipe, 2001) especially those involving dough handling. An increase in water absorption in the blends can be of benefit in bakery products such as bread, cakes, and biscuits that require hydration to improve dough handling characteristics (Kinn-Kabari *et al.*, 2015).

Oil Absorption Capacity of Wheat-Cocoyam-Groundnut Flour Blends

The oil absorption capacity values ranged between 161.49 and 181.70%. The values are significantly different (p<0.05) from one another. The oil absorption capacity of the composite flours increased with the addition of cocoyam and defatted groundnut flour. This suggests that cocoyam and defatted groundnut flours have more hydrophobic interaction sites than wheat flour. Variations in the presence of non-polar side chains, which might bind the hydrocarbon side chains of oil among the flours, could explain the difference in the oil absorption capacity of the flours (Adebowale and Lawal, 2004). This report is similar to that of Kiin-Kabari *et al.* (2015) who observed that the incorporation of Bambara groundnut protein concentrate into wheat-plantain composite flour increased the oil absorption capacity. The same observation was reported by Beruk (2015) for chickpeas enriched with Quality Protein Maize flour mix.

Bulk Density of Wheat-Cocoyam-Groundnut Flour Blends

The bulk density values ranged between 0.68 and 0.78%. The values are significantly different (p<0.05). The addition of cocoyam and groundnut flour increased the bulk density of the flour blends. This suggests that the flour blends were denser than the 100% wheat flour per volume at any unit mass. Bulk density is important in the estimation of the packaging and material handling (Plaami, 1997). It has been shown that high bulk density is desirable for greater ease of dispersibility and reduction of paste thickness (Amadinkwa, 2012). The high bulk density of the sample may be attributed to its higher fat content when compared with other samples. Bulk density is an indication of the porosity of a product which influences package design and could be used to determine the type of packaging material required (Omeire *et al.*, 2015).

Table 2 Functional Properties of Wheat-Cocoyam-Groundnut Flour Blends

Sample	Swelling (%)	Water absorption capacity (%)	Oil absorption capacity (%)	Bulk density (g/ml)
A	95.48 ± 0.15[g]	145.25 ± 0.35[g]	161.49 ± 0.69[f]	0.68 ± 0.01[e]
B	96.35 ± 0.49[f]	147.74 ± 0.02[f]	157.51 ± 0.03[g]	0.67 ± 0.00[e]
C	97.41 ± 0.02[e]	148.04 ± 0.04[f]	161.19 ± 0.00[f]	0.69 ± 0.00[d]
D	101.30 ± 0.05[d]	160.49 ± 0.08[e]	165.03 ± 0.03[e]	0.71 ± 0.01[c]
E	101.13 ± 0.03[d]	161.89 ± 0.04[d]	166.83 ± 0.06[d]	0.71 ± 0.00[c]
F	110.06 ± 0.06[c]	177.30 ± 0.03[c]	179.13 ± 0.04[c]	0.77 ± 0.01[b]
G	114.56 ± 0.02[b]	182.74 ± 0.21[b]	180.77 ± 0.02[b]	0.78 ± 0.00[a]
H	115.77 ± 0.02[a]	186.90 ± 0.04[a]	181.70 ± 0.03[a]	0.78 ± 0.00[a]

Values are means of duplicate determinations ± standard deviation.
Mean values along the same column with different superscripts are significantly different ($p<0.05$)
A = 100% Wheat flour
B = 90% Wheat flour, 5% cocoyam flour and 5% groundnut flour

C = 80% Wheat flour, 10% cocoyam flour and 10% groundnut flour
D = 70% Wheat flour, 15% cocoyam flour and 15% groundnut flour
E = 60% Wheat flour, 20% cocoyam flour and 20% groundnut flour
F = 50% Wheat flour, 25% cocoyam flour and 25% groundnut flour
G = 40% Wheat flour, 30% cocoyam flour and 30% groundnut flour
H = 30% Wheat flour, 35% cocoyam flour and 35% groundnut flour

Pasting Properties of Wheat-Cocoyam-Groundnut Flour Blends

Pasting properties are one of the important properties that influence functional and sensorial quality in foods since they generally affect digestibility, texture, and the end use of

Through the Viscosity of Wheat-Cocoyam-Groundnut Flour Blends

Trough viscosity values for the wheat-cocoyam-groundnut flour blends ranged between 30.92 and 81.75 RVU. The 100% wheat flour. had the highest trough viscosity (81.75 RVU) while the samples containing 30% wheat flour, 35% cocoyam flour, and 35% groundnut flour had the lowest trough viscosity (30.92 RVU). Trough viscosity which is the measure of the ability of the paste to withstand breakdown during cooling, was observed to decrease significantly with an increase in substitution with cocoyam and defatted groundnut flours. A similar decrease was also observed by Osungbaro et al. (2010) for cassava-sorghum composite flours. Increased millet substitution in wheat flour by Adegunwa et al. (2014) also resulted in a decrease in trough viscosity. The same trend was also observed by Kiin-Kabari et al. (2015) who reported decreasing values of trough viscosities as the incorporation of plantain flour and bambara groundnut protein concentrate into wheat flour decreased starch-based food products (Onweluzo and Nnamuchi, 2009).

The properties of pasting include the peak, trough, breakdown, final and setback viscosities, peak time, and pasting temperature. The pasting properties of the flour blends are presented in Table 3.

Peak Viscosity of Wheat-Cocoyam-Groundnut Flour Blends

The peak viscosity of the flour blends ranged between 43.46 and 146.42 Rapid Visco Units (RVU) with the 100% wheat flour (Sample A) having the highest peak viscosity. There was a significant decrease ($p < 0.05$) in the values of the peak viscosity as the proportion of the cocoyam and defatted groundnut flour increased. High peak viscosity indicates high pure starch content in a sample and this could be responsible for the 100% wheat flour having the highest peak viscosity. Sample H had the lowest peak viscosity of 43.46 RVU among the samples. This reduction reflects the degree of resistance to the mixing operation of the swollen mass gel particles of the samples. The reduction in the peak viscosities may be attributed to the presence and interaction of nutritional components like proteins in the defatted groundnut and cocoyam flours. These observations were also reported by Oluwamukomi *et al*. (2005) for soy-fortified maize *ogi* flour blends and Osungbaro *et al*. (2010) for composite cassava starch with fermented sorghum flour. The peak viscosity is described as the maximum viscosity developed during or soon after the heating portion of the rapid visco analyzer. It is also an index of the ability of starch-based food to swell freely before its physical breakdown under deformation caused as a result of the continuous mixing of the Rapid Visco Analyzer (Sanni *et al*., 2006; Adebowale *et al*., 2008).

Final Viscosity of Wheat-Cocoyam-Groundnut Flour Blends

The final viscosity of wheat-based flour samples ranged between 87.67 and 183.54 RVU. The final viscosity of the composite flour samples was significantly ($p < 0.05$) lower than that of the 100% wheat flour indicating that the mixture of wheat flour with cocoyam and defatted groundnut flours reduced the final viscosity of the flour blends.
A similar decrease in final viscosity was reported by Adegunwa *et al*. (2014) for wheat flour fortified with millet flour and by Falola *et al*. (2014) for modified cocoyam-wheat composite flours. This is an indication that the addition disrupted the viscosities of the samples. Final viscosity also called cold paste viscosity, indicates the extent of starch retrogradation that occurs during the cooling process and indicates the re-association of starch granules especially amylose during cooling time after gelatinization and the formation of gel network (Ortega-Ojeda *et al*., 2004). It gives an idea of the ability of a material to gel or form dough during processing (Osungbaro *et al*., 2010).

Table 3 Pasting Properties of Wheat-Cocoyam-Groundnut Flour Blends

Sample	Peak viscosity (RVU)	Trough (RVU)	Breakdown (RVU)	Final viscosity (RVU)	Setback (RVU)	Peak time (mins)	Pasting Temperature (ºC)
A	146.42 ± 4.12^{a}	81.75 ± 2.59^{a}	64.67 ± 1.53^{a}	183.54 ± 4.42^{a}	101.79 ± 1.82^{a}	5.53 ± 0.00^{b}	83.12 ± 0.02^{b}
B	115.29 ± 3.01^{b}	64.96 ± 4.54^{b}	50.33 ± 1.53^{b}	141.75 ± 7.07^{b}	76.79 ± 2.53^{b}	5.53 ± 0.00^{b}	83.65 ± 0.57^{ab}
C	104.83 ± 2.12^{c}	61.17 ± 0.82^{b}	43.67 ± 1.30^{c}	135.58 ± 0.59^{bc}	74.42 ± 1.41^{b}	5.77 ± 0.05^{a}	84.38 ± 0.60^{ab}
D	94.54 ± 2.77^{d}	54.46 ± 1.47^{c}	40.08 ± 1.30^{c}	128.83 ± 1.89^{c}	74.38 ± 0.41^{b}	5.67 ± 0.00^{ab}	84.78 ± 0.04^{a}
E	74.33 ± 2.47^{e}	44.13 ± 0.41^{d}	30.21 ± 2.89^{d}	113.00 ± 0.35^{d}	68.88 ± 0.77^{b}	5.57 ± 0.14^{b}	83.58 ± 0.11^{ab}
F	72.96 ± 1.00^{e}	42.79 ± 0.06^{de}	30.17 ± 1.06^{d}	117.29 ± 1.24^{d}	74.50 ± 1.18^{b}	5.37 ± 0.05^{c}	83.93 ± 1.10^{ab}
G	66.04 ± 0.88^{f}	38.38 ± 2.42^{e}	27.67 ± 1.53^{d}	93.67 ± 9.07^{e}	55.29 ± 11.49^{c}	5.33 ± 0.00^{c}	84.29 ± 0.08^{ab}
H	43.46 ± 1.59^{g}	30.92 ± 1.30^{f}	12.54 ± 0.29^{e}	87.67 ± 1.89^{e}	56.75 ± 0.59^{c}	5.27 ± 0.09^{c}	84.33 ± 0.60^{ab}

Values are means of duplicate determinations ± standard deviation. Mean values along the same column with different superscripts are significantly different ($p<0.05$) A = 100% Wheat flour. B = 90% Wheat flour, 5% cocoyam flour and 5% groundnut flour. C = 80% Wheat flour, 10% cocoyam flour and 10% groundnut flour. D = 70% Wheat flour, 15% cocoyam flour and 15% groundnut flour. E = 60% Wheat flour, 20% cocoyam flour and 20% groundnut flour. F = 50% Wheat flour, 25% cocoyam flour and 25% groundnut flour. G = 40% Wheat flour, 30% cocoyam flour and 30% groundnut flour. H = 30% Wheat flour, 35% cocoyam flour and 35% groundnut flour.

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Setback Viscosity of Wheat-Cocoyam-Groundnut Flour Blends

The setback viscosity values ranged between 56.75 - 101.79 RVU. The 100% wheat flour had the highest setback viscosity while the samples containing 30% wheat flour, 35% cocoyam flour, and 35% groundnut flour had the lowest setback viscosity. This signifies that substitution caused a reduction in the setback values of the flour blends. From the results obtained, it was evident that the ability of starch molecules to re-associate decreased with an increase in the inclusion of cocoyam and defatted groundnut flours. Osungbaro *et al*. (2010) also reported a similar decrease for cassava-sorghum composite flours. A similar trend was also observed by Abioye *et al*. (2011) during the incorporation of plantain flour with soy flour. It was observed that, as the level of incorporation increased from 0 - 40%, the setback value reduced from 156.33 to 35.33 RVU. Higher setback, as seen in the control sample is attributed to an increase in the formation of not only thermally reversible hydrogen bonds but also thermally irreversible hydrophobic and or covalent bonds (Singh *et al*., 2003; Lim and Narsimhan, 2006; Shindano, 2007). These intermolecular bonds contribute to a higher final paste viscosity upon subsequent cooling (Lim and Narsimhan, 2006).

Pasting Temperature and Peak Time of Wheat-Cocoyam-Groundnut Flour Blends

The pasting temperature of wheat-cocoyam-groundnut flour blends ranged between 83.12 and 84.78 ºC. Pasting temperature gives an indication of the gelatinization temperature during processing. It is the temperature at which the first detectable increase in viscosity is measured and is an index characterized by the initial change due to the swelling in starch. The pasting temperature is also the temperature at which the viscosity starts to rise (Liang and King, 2003). The attainment of pasting temperature is essential in ensuring swelling, gelatinization, and subsequently gel formation during processing (Eke-Ejiofor and Owuro, 2012). The pasting temperature indicates the minimum temperature required to cook a given sample and also indicates energy costs. Pasting temperature has been reported to relate to water binding capacity. A higher pasting temperature implies higher water binding capacity, higher gelatinization, and lower swelling properties of starch due to a high degree of association between starch granules (Oluwamukolami *et al.,* 2005). There were no significant differences ($p<0.05$) in the pasting temperature of the wheat-cocoyam-groundnut flour blends. The result indicated that there was no definite trend for the behavior of the flour blends as regards pasting temperatures. This could be linked to varying thermal-interactive effects of the nutritional composition of the flour blends (Iwe *et al*., 1998). The peak time of the wheat-cocoyam-groundnut flour blends ranged between 5.27 and 5.77 min. There were significant differences ($p<0.05$) in the peak time of the wheat-cocoyam-groundnut flour blends The result indicated that there was no definite trend for the behavior of the flour blends as regards the peak time. The peak time may have been affected by the pasting temperatures of the flour blends. The increased pasting temperature could influence processing times because high-temperature treatment causes a reduction in processing time (Jena and Das, 2014). The peak time is a measure of the cooking time required by the product to form a paste (Adebowale *et al*., 2005).

IV. CONCLUSION

The result obtained from this study shows that acceptable composite flour with improved nutritional levels and functional properties can be produced from cocoyam and defatted groundnut flour. This will reduce the overdependence on wheat flour and reduce the importation

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