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EVALUATION OF HIGH-QUALITY CASSAVA FLOUR WHEAT BREAD SPICED WITH CLOVE POWDER

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ABSTRACT

Clove is a novel food ingredient enriched with polyphenolic compounds. The utilization of clove powder for the production of bread dough could improves its processing condition and thereby enhances some of the quality attributes of the bread dough. This study investigated some quality attributes of wheat flour (WF) and High-Quality Cassava Flour (HQCF) spiced with clove powder (CP). Flour blends were produced from 90% WF and 10% HQCF with inclusion of clove powder at 0.10, 0.50, 1.00, 1.50 and 2.00% respectively. Bread samples were produced from the blends while 90% WF and 10% HQCF was used as control. Water absorption capacity [WAC], Functional properties (bulk density [BD], swelling power [SP], oil absorption capacity [OAC], solubility index [SI]) and pasting properties of flour blends as well as rheological properties in terms of farinograph water absorption (FWA), dough development time (DDT), dough stability time (DST), degree of dough softness (DDS) and farinograph quality number (FQN) of the flour dough were determined using standard procedures. Data were analysed using descriptive and inferential statistics. The values of functional properties are BD, WAC, OAC and SP ranged from 0.73 to 0.78 g/ml, 1.23 to 2.12 ml/g, 1.86 to 2.51 ml/g and 3.24 to 3.8 ml/g respectively while SI decreased from 10.45 to 9.11 ml/g. Pasting viscosities (RVU) such as peak (210.71-237.25), trough (118.04-151.38), final (199.33-236.38), setback (73.96-88), plus peak time (5.13-6.98 min) and pasting temperature (71.66-73.46 0C) decreased while breakdown viscosity (69.88-96.75) increased with CP addition. FWA (62.35-62.9%) increased while FQN (71.5-98.5 mm) decreased with increased CP inclusion. In conclusion, the inclusion of clove powder had great contribution on the processing of the bread dough.

Keywords: Clove Powder, Functional properties, High-Quality Cassava, Pasting properties, Wheat

INTRODUCTION

Bread is one of the important staple foods and has been seen as the second non-indigenous food product after rice in Nigeria (Shittu *et al*., 2007). It is mostly consumed by children and adult due to its availability in the country. Bread quality produced encompasses around its method of dough preparation, baking conditions, packaging as well as sanitary conditions during processing (Cauvin, 2015). The nature of its raw material, processing condition as well as the storage stability also determines its quality. However, bread dough is prepared from wheat flour, yeast, sugar, salt, water and other ingredient when added act as spice for the purpose of maintaining an improve quality food product.

Wheat flour is the major source of raw material used for the preparation of bread. This is because of its ability to retain air, water vapour and gas in form of carbon-dioxide, then with strength in forming foam or spongy structure due to the presence of gluten (Adeniji *et al*., 2011). However, the importation of Wheat flour in the food industry is highly demanding especially in bakery and confectionery industries, and the need for the improvement of a raw material becomes necessary. The utilization of cassava flour for the production of bread becomes of necessity. Studies has shown that that composite flour can be used for the preparation of bread dough.

Considering the development in the food sectors few years back with the wide range of cassava plantation, High-Quality Cassava Flour (HQCF), a product from Cassava root has really served as supportive ingredient to wheat in developing countries for many industries, especially in the bakery and confectionery industries where products such as bread, pastries and cake are produced (Oyewole *et al*., 1996; Badifu *et al*., 2004; Echendu *et al*., 2004; Ameh *et al*., 2013; Igabbul *et al*., 2013). Supplementing High Quality Cassava Flour (HQCF), an unfermented, smooth, bland, odourless, white or off- white product with wheat flour has eventually not only improved the bread quality as ingredient during processing but also minimise the cost of production for other bakery and confectionery products in food industries present in developing nations (Shittu *et al*., 2007).

The introduction of spice to food has been of great benefits in the quality of many novel foods especially when it involves the taste, aroma and also the flavour of the food prepared. Spices are generally known as plant substances from indigenous or exotic origin, aromatic or with strong taste and used to enhance the taste of foods (Pundir *et al*., 2010). The functional behaviour of any spice can not only improve the quality of food during processing, but can also influence consumers' acceptability on the food product when considering the taste, appearance and flavour of the food. Spices have widely been used in different form and documented by researchers. Most spice are milled in powdery form and thereafter used as additives for different foods and as well as preservative to medicinal drugs. Research has shown that the use of spice during food preparation has also help to reduce other ingredient such as salt during food preparation and this has served as great benefit which spice as ingredient contribute to food industries in Nigeria (Karapinar *et al*., 1990). The addition of spice has also helped the food industries by minimizing their cost of production.

Clove (*Syzygium aromaticum*) is known as one of the valuable spices used for centuries. It has been used as food preservative and for many medicinal purposes (Karapinar, 1990). Clove is widely found in Northern part of Nigeria. Considering the inherent properties of clove as food ingredient, that is, antioxidant and antimicrobial activity, Clove has also been regarded as special ingredient and seen differently from other spices. Clove has also been known to possess more antioxidant and antimicrobial activity than other fruits and vegetables as well as other spices. Meanwhile the health benefits of spice like clove would not be rule out since its major function as a spice in food is to be considered as a functional ingredient for bakery product during processing. This demand for a special attention in the use of clove. Due to the effectiveness of clove as its antioxidant and antimicrobial capacity underpin the reason in carrying out this research.

MATERIALS AND METHODS

Procurement of the Materials

High quality cassava flour was procured in Federal Institute of Industrial Research Oshodi (FIIRO), while wheat flour, clove buds and other ingredients for baking (sugar, fat, salt, and yeast) were purchased from Kuto market Abeokuta, Ogun state.

Methods

Preparation of clove powder

Clove buds were cleaned and oven dried at 60 °C up to moisture content level below 10%. Then it was ground to fine powder (Figure 1). The ground clove was sieved (using sieve of 500 mesh size) to obtain a uniform powder which was stored in air-tight containers at room temperature (24 ± 2 °C) for subsequent use.

Flour blends preparation

Clove powder was added at four levels into the formulation of wheat and high-quality cassava flour. The proportion of the bread sample blends were as follows Wheat HQCF blends: 90:10 served as the control, while other sample blends which include composite flour from Wheat-HQCF with the inclusion of clove powder measured in different variation include 90:10:0.1; 90:10:0.5; 90:10:1; 90:10:1.5 and 90:10:2 grams. The flour blends were thoroughly mixed as the blend formulation was carried out. The introduction of clove powder to the baked food was properly monitored during preparation and then combined with other ingredient to form a dough from which the bread samples after which various analyses were carried out to access the best level of incorporation of clove powder in the bread.

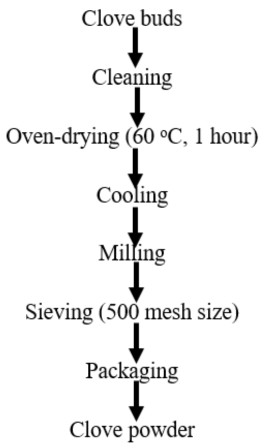

Figure 1: Production process of clove powder (Devendra and Tanwar, 2011)

Preparation of bread

Control bread dough was prepared and baked from 100 % wheat flour using the straight dough method (Chauhan *et al.*, 1992; Shittu *et al.,* 2013) in Figure 2.

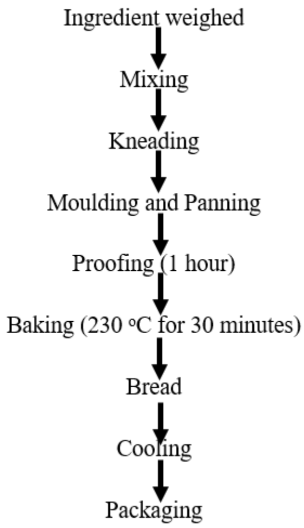

Figure 2: Flow chart for bread production (Chauhan *et al.*, 1992; Shittu *et al.,* 2013)

The supplemented bread dough with clove powder was also prepared using same method except for adding clove powder in varying quantities into the blend of wheat and high-quality cassava flour.

Analysis of the flour blends

Functional properties

Bulk density determination

The bulk density (Equation 1) was determined by the method of Wang and Kinsella (1976). A known amount of the sample was weighed into 50 ml graduated measuring cylinder. The samples were packed by gently tapping the cylinder on the bench top 10 times from height of 5 cm; the volume of the sample was recorded.

Bulk Density (gml^-1^ or gcm^3^) =

$$\frac{Weight\ of\ Sample}{Weight\ of\ the\ Sample\ After\ Tapping} \quad (1)$$

Swelling power and solubility index determination

Takashi and Sieb (1988) method were used to carry out swelling power (Equation 2) and water solubility index (Equation 3). 1 g of flour sample was weighed into 5 ml centrifuge tube and mixed with 50 ml distilled water gently. Water bath at various temperatures was used to heat the slurry for 15 minutes with gentle stirring to prevent clumping of the flour. After 15 minutes, the tube containing the paste was centrifuge at 3000 rpm for few minutes. The supernatant was immediately filtered after centrifuging. The weight of the sediment was then taken and recorded. The moisture content of the sediment gel was used to determine the dry matter content of the gel.

$$Swelling\ Power = \frac{Weight\ of\ Wet\ Mass\ Sediment}{Weight\ of\ Dry\ Matter\ sample} \quad (2)$$

$$Water\ Solubility\ Index = \frac{Weight\ of\ Soluble\ x100}{Weight\ of\ Sample} \quad (3)$$

Water absorption index determination

Water absorption index (Equation 4) was evaluated by using the modified method of (Ruales *et al.,* 1993). The flour blends sample (1.25 g) was suspended in 15 ml distilled water at 30 ^{o}C in a centrifuge tube, stirred for 30 minutes intermittently and then centrifuged at 3000 rpm for 10 minutes. The supernatant was decanted and the weight of the gel form was recorded. The water absorption index (WAI) was calculated as gel weight per gram dry sample.

$$Water\ Absorption\ Index = \frac{Bound\ Water \times 100}{Weight\ of\ Sample} \quad (4)$$

Oil absorption capacity determination

The oil absorption capacity (Equation 5) of the flour was estimated by the method of Sosulski *et al.,* (1976). One gram of sample mix with 10 ml soy bean oil (Sp. Gravity 0.9092) was allowed to stand at ambient temperature (30 ± 2 ^{o}C) for 30 minutes at 3000 rpm. Oil absorption was calculated as per cent oil bound per gram flour.

$$\%OAC = \frac{WeightAfterCentrifuge - InitialWeight}{SampleWeight} \times 100 \quad (5)$$

Pasting properties of the flour blends

Visco-analyzer [(RVA) TECMASTER, Perten Instrument Sweden] was used to carried out pasting properties in accordance with the method described by Sanni *et al.* (2006a). Slurry of the sample was made by mixing 3 g in 25 ml of water inside in the RVA can. The RVA-can was then placed into the tower and then lowered into the system. At 50 – 90 ^{o}C the slurry were heated and cool back to 50 ^{o}C within 12 min. The can rotated at a speed of 160 rpm. The content was stirred continuously using a plastic paddle. Parameters such as peak viscosity, trough, breakdown viscosity, final viscosity, set back viscosity, peak time and pasting temperature was estimated.

Rheological determination of the dough

Mixing characteristics of dough from clove powder, wheat and high-quality cassava flour blends was determined using brabender farinograph according to AACC (2000). The parameters determined are: farinograph water absorption, dough development time, dough stability time, degree of dough softness and farinograph quality number.

Statistical analyses

All data were analysed using statistical packages for social science (SPSS) 20.0 Analysis of variance (ANOVA) was used to analyse the data. Significant difference ($p<0.05$) was seen at means standard deviation conducted

RESULTS AND DISCUSSION

Functional Properties

The mean values of the functional properties of wheat and high-quality cassava flour spiced with clove powder is presented in Table 1. Generally, the mean values from bulk density, oil absorption capacity, water absorption capacity, swelling power and solubility index were significantly ($p<0.05$) different among the flour. Bulk density is a measure of heaviness of flour (Oladele and Aina, 2007), and it is an important parameter that determines the packaging requirement of a food product. Bulk density of the composite flour blends spiced with clove powder varied between 0.73 and 0.78 g/ml.

Table 1: Functional properties of wheat and high-quality cassava flour spiced with clove powder

WF-HQCF-CP	Bulk Density (g/cm^3)	Oil Absorption Capacity (%)	Water Absorption Capacity (%)	Swelling Power (%)	Solubility Index (%)
90-10-0.1	0.78±0.0^e	2.12±0.01^f	1.86±0.01^a	3.24±0.01^a	9.11±0.01^a
90-10-0.5	0.73±0.0^a	1.23±0.01^a	2.51±0.01^f	3.8±0.01^f	10.45±0.01^f
90-10-1.00	0.77±0.0^d	1.44±0.01^d	1.92±0.02^b	3.39±0.01^b	9.34±0.01^b
90-10-1.50	0.74±0.0^b	1.29±0.01^b	2.12±0.01^e	3.67±0.01^e	10.24±0.01^e
90-10-2.00	0.75±0.0^c	1.67±0.02^e	2.00±0.01^c	3.51±0.01^c	10.07±0.01^c
Control	0.74±0.0^b	1.34±0.01^c	2.06±0.01^d	3.57±0.01^d	10.12±0.01^d

Mean values with different superscripts within the same column are significantly different ($p<0.05$)
WF-Wheat Flour, HQCF-High Quality Cassava Flour, CP-Clove Powder

The variation in bulk density of the food sample could be attributed to variation in the proportion of clove powder used for the food flour preparation. The introduction of spice clove powder increased the bulk density of the composite flour blends. Composite wheat and high-quality cassava flour with 0.10% clove powder inclusion had the highest bulk density while the flour blends with 0.50% had the least. Higher bulk density is desirable for greater ease of dispersion and reduction of paste thickness (Amandikwa, 2012). Higher bulk density suggested the sustainability of the composite flour blends during processing (Suresh and Samsher, 2013).

Oil absorption capacity of the food formulation simply referred to the binding of fat by non-polar side chains (Venna and Usha, 2018) of any food substance basically protein in particular (Awuchi *et al*., 2019) during processing. The mean values for oil absorption capacity varied between 1.23 and 2.12 ml/g with 0.10% clove powder inclusion having the highest oil absorption capacity and that with 0.50% having the least. For composite flour of Wheat-Cassava-Clove blends, the oil absorption capacity increased with the inclusion of clove powder in the composite flour blends as reduction takes place at an increased in clove inclusion of the composite flour blends. The relatively high oil absorption capacity of the flour blends is an indication that flavour and mouth feel will be enhanced when the composite flour blends was used for the production of bakery product such as bread produced from the composite flour. This was seen during the mixing of the bread dough (Jacob and Leelavathi, 2007).

Water absorption capacity is the amount of water (moisture) taken up by the food powder in order to arrive at a desirable and stable state of keeping product quality. This actually involved the hydration of food powder due to their interaction of hydrogen bonds and water molecules (Awuchi *et al*., 2019). The result of water absorption capacity of the flour blends ranged from 1.86 to 2.51 ml/g with 0.10% addition of clove powder to have the lowest water absorption capacity while 0.50 % had the highest. There was an increase in water absorption capacity (WAC) with the addition of clove powder in the composite flour. WAC of the blends suggests that the flours can be used in formulation of some foods such as sausage, dough and bakery products. The increase in the WAC has always been associated with increase in the amylose leaching and solubility, and loss of starch crystalline structure (Chandra *et al.,* 2015) on the composite flour blends. Madu (2007) reported that water absorption capacity enables bakers to add more water to dough and so improve handling characteristics and maintain freshness of the baked products. Swelling power is an indication of the extent of associative forces within the granules (Adegunwa *et al*., 2014), while solubility is the ability of solids to dissolve in liquids and it is reported to depend on a number of factors such as source, inter-associative forces, swelling capacity and presence of other non – carbohydrate components (Moorthy, 2002). Swelling power and solubility index also ranged from 3.24 to 3.8 ml/g and 9.11 to 10.45 ml/g respectively. With 0.50% clove powder addition having the highest and 0.10% the least mean values for swelling power and solubility index, respectively. The result showed that the inclusion of clove powder contributed to the solubility which also influenced the swelling power of the dough during the preparation of the food sample.

Pasting Properties

Pasting properties are generally known to influence processing and quality attributes in the food industry as they affect texture and digestibility as well as the end use of starch-based food commodities (Adebowale *et al*., 2005). The Table 2 below showed the mean values for the pasting properties of wheat, high quality cassava composite flour with clove powder addition. It is one of the most important parameters that influence quality and aesthetic consideration in the food industry, and they affect texture and digestibility as well as end use of starch-based food commodity (Onweluzo and Nnamuchi, 2009). The peak viscosity decreased from 237.25 to 210.71 RVU with the composite flour without the addition of clove having the highest mean value while the one with 1.50% having the least peak viscosity. The mean values were not statistically ($p<0.05$) different from each other except for samples containing only wheat-HQCF (90%-10%) and wheat-HQCF-clove (90%-10%-1.5) that differed significantly ($p<0.05$). Trough significantly ($p<0.05$) increased with the inclusion of clove powder to 151.38 RVU when compared with 147.13 RVU from wheat-HQCF (90%-10%). The peak viscosity was lower for flour blends with clove powder when compared with composite flour blends without the inclusion of clove powder.

Table 2: Pasting Properties of Wheat and High-Quality Cassava Flour Spiced with Clove Powder

WF-HQCF-CP	Peak Viscosity (RVU)	Trough (RVU)	Breakdown Viscosity (RVU)	Final Viscosity (RVU)	Setback Viscosity (RVU	Peak Time (Mins)	Pasting Temperature (°C)
90-10-0.10	218.04±5.83^b	151.38±0.29^e	69.88±1.00^a	224.63±0.77^e	73.96±0.53^a	6.98±0.64^c	73.55±0.14^c
90-10-0.50	222.42±0.47^b	135.79±0.53^c	88.04±1.00^b	219.96±0.29^d	84.42±0.12^c	6.32±0.16^c	72.93±0.74^{bc}
90-10-1.00	222.5±0.47^b	126.54±1.83^b	96.75±0.24^e	207.71±0.06^c	82.46±0.06^c	6.06±0.08^b	72.09±0.47^{ab}
90-10-1.50	210.71±0.65^a	118.04±0.77^a	93.17±0.59^d	199.33±0.12^a	81.83±0.12^c	5.13±0.14^a	73.2±0.29^c
90-10-2.00	221.63±1.71^b	127.29±0.53^b	93.79±0.41^d	205.33±0.35^b	78±0.24^b	6.1±0.04^b	71.66±0.28^a
90-10-0.00	237.25±0.12^c	147.13±0.18^c	90.42±0.35^c	236.38±0.53^f	88±2.47^d	6.24±0.05^b	73.46±0.08^c

Mean values with different superscripts within the same column are significantly different ($p <0.05$). WF-Wheat Flour, HQCF-High Quality Cassava Flour, CP-Clove Powder

The significant level of peak viscosity reduced when the composite flour blend increased with the addition of clove powder. Although, low peak viscosity in the composite flour indicates that the flour may be suited for products requiring low gel strength and elasticity (Abioye *et al*., 2011). However, high peak viscosity is an indication of high starch content (Awolu *et al*., 2016). One of the reasons for reduction in peak viscosity could be due to the decrease in starch gelatinization caused by the inclusion of clove powder. Peak viscosity is an index of the ability of starch-based foods to swell freely before their physical breakdown (Sanni *et al*., 2006; Adebowale *et al*., 2008). Trough is the minimum viscosity value and it measures the ability of paste to withstand breakdown during cooling (Adebowale *et al*., 2008). Trough ranged from 118.04 to 151.38 RVV with wheat-HQCF-clove (90%-10%-1.50%) having the least while wheat-HQCF-clove (90%-10%-0.10%) had the highest. The trough or holding strength reduced with addition of clove powder. The-breakdown in viscosity, sometimes called shear thinning is caused by disintegration of gelatinized starch granules structure during continued stirring and heating, thus, indicating the shear thinning property of starch (Yadav *et al*., 2011; Babajide and Olowe, 2013). The mean values of breakdown viscosity increased with addition of clove powder and ranged from 69.88 to 96.75 RVU with wheat-HQCF-clove (90%-10%-1.00%) having the highest while wheat-HQCF-clove (90%-10%-0.10%) had the least. Significant ($p<0.05$) difference was observed for the flour blends in terms of trough. The breakdown viscosity of the flour blends increased continuously after increasing the proportion of clove powder in the flour blends. The increased was seen significantly on the breakdown viscosity among the composite flour blends. Record shown by Banda *et al*. (2018) that starch is a by-polymer with amylose and amylopectin. The inclusion of cloves served as catalyst which help to increase the breakdown of the composite flour blends. This also influenced the processing condition of the composite flour during the production of bread. Adebowale *et al*. (2008), final viscosity is commonly used to define the quality of particular starch- based flour, as it indicates the ability of the flour to form viscous paste after cooking and cooling. It also gives a measure of the resistance of paste to shear force during stirring. Final viscosity reduced significantly ($p<0.05$) with clove powder inclusion from 236.38 to 199.33 RVU with wheat-HQCF-clove (90%-10%-1.50%) having the least while wheat-HQCF (90%-10%) had the highest. Final viscosity was affected. The inclusion of clove reduced the final viscosity of the flour blends. Setback is an important aspect in the pasting properties of flour, the reason being that it determines the stability of the flour. Low setback value is an indication that the starch has a low tendency to retrograde or undergo syneresis during freeze thaw cycles (Ikujenlola and Fashakin, 2005; Fasasi, 2009). A significant ($p<0.05$) difference was observed for the flour blends in terms of setback viscosity except for blends with 0.50, 1.00 and 1.50 % inclusion of clove powder. Mean values of setback viscosity varied between 73.96 and 88 RVU. Flour blends from wheat-HQCF-clove (90%-10%-0.10%) had the least while wheat-HQCF (90%-10%) had the highest. Reduction occurs in setback and this could be attributed to increase in cloves inclusion. The inclusion of cloves has a way to reduce the breakdown of starch granule. Banda *et al*. (2018) established the facts that starch is a by-polymer (containing amylose and amylopectin) which cannot be easily broken down. The breakdown of this starch during processing may be easily affected during processing of food product.

Awolu *et al*. (2016) described Peak time as an indication of the total time taken by each composite blend to attain its respective peak viscosity. The mean value of peak time increased significantly ($p<0.05$) and varied between 5.13 and 6.98 minutes. Flour blends from wheat-HQCF-clove (90%-10%-1.50%) had the least while Wheat-HQCF-clove (90%-10%-0.10%) had the highest. The peak time of the composite flour was higher than that of the control sample. At the initial state of introducing clove as to the composite flours, the flour blends had the tendency to possess a higher peak time than the flour without the introduction of cloves. The increase in the proportion of cloves decreased the peak time. This actually affect the production process of bread produced from the composite flour of Wheat-Cassava flour-clove powder. Thus, food blends with a lower peak time will cook faster than that with a higher peak time. The similarity between the peak time values indicates that the composite flour exhibited similar cooking properties. The pasting temperature provides an indication of the minimum temperature required to cook a given sample, which can also have implications on energy usage (Ragaee and Abdel-Aal, 2006). The pasting temperature decreased with clove powder inclusion and varied between 71.66 and 73.55 °C. The pasting temperature reduced as the proportion of clove powder increased in the flour blends. A high pasting temperature indicates high water-binding capacity and high gelatinization tendency of starch-based flour due to high degree of association between starch granules (Adebowale *et al*., 2008).

Rheological Properties of the Composite Flour Dough

Rheological properties of dough are of great importance for the whole processing. This is because it is actually use for proper monitoring of the food material during processing. Its process used to assess the mechanical properties of dough, molecular structure and composition of the material, to imitate behaviour during dough processing and to anticipate the quality of the final product (DapčevićHadnađev *et al*., 2011). The result of the rheological properties of flour dough samples was measured by farinograph is presented in Figure 3. Farinograph water absorption ranged from 62.35 to 63.500%. Farinograph measurements showed that the water absorption of dough made from the composite flour increased with an increase in the substitution of clove powder. Although there was no valuable difference in the samples at all levels. The increase in water absorption may be due to the inclusion of clove powder acting as additives to the composite flour used for preparation of the bread dough. Guarda *et al.* (2004) reported that addition of selected additives caused the increase in water absorption of formulation. The composition of non-wheat flour has a strong influence on the water absorption of the composite dough. Protein rich flours (Mashayekh *et al.,* 2008) increased the water absorption of dough made from the composite flours. Whereas non - wheat flour with low protein level decrease in water absorption for any composite flour of dough during processing (Miyazaki and Morita, 2005). Dough development time and dough stability time ranged from 5.33 to 7.44 min and 6.04 to 8.56 min respectively. Degree of dough softness ranged from 133.5 to 189.1 FU. Farinograph quality number indicates the quality of flour for bread making. It represents all parameters of farinograph and is more related to gluten network. If the flour has poor quality, it gets weakened early and quickly (Ali *et al.,* 2014). The Farinograph quality number ranged from 71.5 to 98.5. The result showed that there were significant ($p<0.05$) differences among all these parameters except water absorption which was not significantly ($p>0.05$) different. The substitution of the composite blend with clove powder significantly reduced the dough development time and dough stability time while degree of dough softness increased with clove powder inclusion. Increase in the percentage inclusion of clove powder increase the farinograph quality number. The higher the farinograph quality number, the better the dough handling features. Such positive contribution to the blend may be due to the starch granules in the highquality cassava flour (Abera *et al.,* 2016).

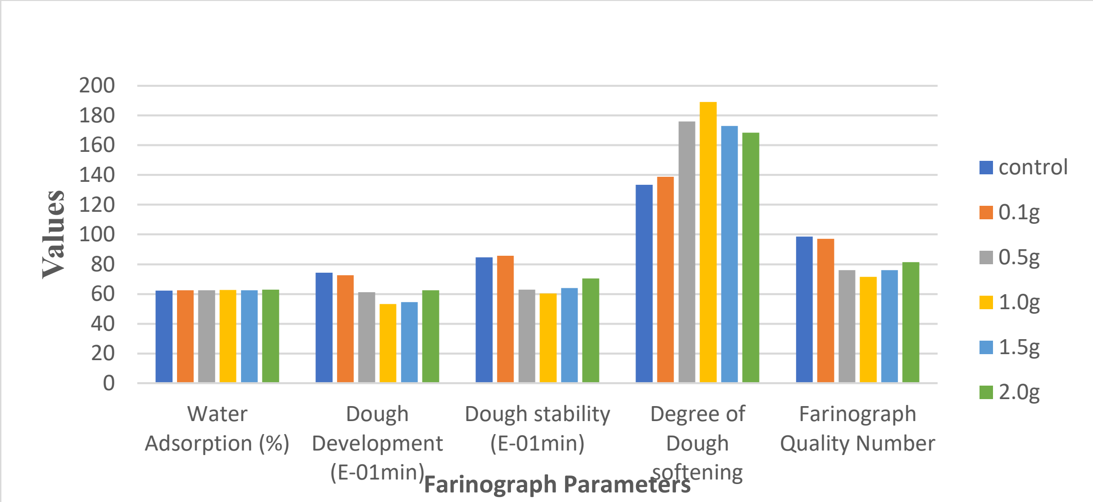

Figure 3: Rheological properties of composite flour dough from wheat-HQCF-clove

CONCLUSION

The result from this study revealed that composite flours from the mixture of wheat flour, high quality cassava flour spiced with clove powder had clear distinct pasting properties from composite flour without clove powder with peak viscosity, trough, breakdown viscosity, final viscosity and setback viscosity being most affected by the mixture ratio. The rheological parameters were significantly ($p<0.05$) influenced by the inclusion of clove powder except water absorption which was not significantly ($p>0.05$) different among the composite bread dough samples.

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