PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 9 (6): 555-557, 2010
ISSN 1680-5194

Pasting Characteristics of Wheat and Sweet Potato Flour Blends

J.O. Odedeji and R.O. Adeleke
Department of Food Technology, Osun State Polytechnic, Iree, Osun State, Nigeria

Abstract: This study was conducted to investigate the pasting characteristics of wheat and sweet potato tuber (*Ipomea batatas*) flour blends. The sweet potato tubers were bought from a local farm in Offa, Kwara State. The tubers were thoroughly sorted, washed, peeled, sliced, balanced, drained, sundried and milled into flour. Commercial wheat flour was used and purchased from Igbona market in Osogbo, Osun State of Nigeria. The wheat and sweet potato flour were blended using the following ratios (WF : SPF : 100 : 0, 90 : 10, 85 : 15, 80 : 20, 75 : 25, 0 : 100). These samples were thereafter subjected to pasting characteristics analysis. The results revealed that as more and more sweet potato flour was added to wheat flour there was improvement in the pasting properties.

Key words: Wheat, sweet potato, flour pasting characteristics

INTRODUCTION

Flour is fine powder made from cereals. It can equally be produced from other starch based produce such as cassava, maize, yam, nuts etc. Flour is the major ingredient in bakery goods production and most especially bread which constitutes a staple in the diet of many countries. The availability of adequate supply of flour has often been a major economic and political issue. Flour produced from non wheat sources are otherwise known as composite flour.

Wheat as the chief raw material in the production of wheat flour cannot thrive or survive in Nigeria soil cum weather conditions prevalent in our region therefore wheat flour has to be imported. This lead to relatively high prize of the commodity with the overall effect on the price of bakery goods. Attempt to incorporate composite flour into wheat flour resulted in net saving of income and reduced cost of bakery goods. Cassava flour has been successfully blended with wheat flour up to 15% with acceptable result.

Attempts to improve the chemical and sensory qualities of composite flour before their utilization especially instant yam flour has been reported by various authors (Ngoddy and Onuoha, 1983; Ofi, 1983; Sanni *et al.*, 2006). These flour has been incorporated with wheat flour in production of bakery goods such as cookies, bread and cake. Through this, diversified, reduced cost of production and acceptable products can be produced. Since cassava flour has been successfully incorporated with wheat flour this work therefore investigates the utilization of underutilized root especially sweet potato.

Composite flours have their properties that enhance their wide utilization which include water and oil absorption capacity, foaming capacity foam stability, bulk density, gelation capacity, emulsion capacity etc. (Adeyeye *et al.*, 1994; Abbey and Ibeh, 1988). Incorporation of sweet potato flour into wheat flour for bakery goods production is expected to produce effect in both the functional properties and pasting characteristics of the blended samples. Several studies have indicated the possibility of incorporating hulless barley, soya beans, sorghum, cowpea flour into wheat flour at various levels and the rheological and baking properties have been reported (Oftmann and Garba, 1997; Kinsella, 1979; Sathe and Salekhe, 1981).

This paper investigates the pasting properties of wheat and sweet potato flour blends. The two flour were blended using the following blend ratios (WF : SPF : 100 : 0, 90 : 10, 85 : 15, 80 : 20, 75 : 25, 0 : 100).

MATERIALS AND METHODS

The sweet potato tubers used for this work were bought from a local farm in Offa Kwara state Nigeria. Commercial wheat flour was purchased at Igbona market in Osogbo, Osun State Nigeria. Equipment used include milling machine, mechanical sieve, oven, desicators, balance, stirrer and Rapid Visco Analyzer (RVA). Other materials used include knife, water, bowls and napkin.

Production of sweet potato flour: The sweet potato tubers were thoroughly sorted to remove bad ones from the lot. The sorted tubers were washed to remove adhering soil, dirts and extraneous matters. This was followed with peeling. After peeling, the tuber were sliced to facilitate rate of drying and ease milling operation. The sliced tubers were blanched at 60^{o}C for 15 min in order to inactive enzymes that may cause browning reaction. These were then cooled, drained and followed by drying. After blanching, the chips were spread out uniformly on a stainless steel perforated tray and dried in cabinet dryer at 65^{o}C for eight hours. Following drying, the sliced tubers were milled, sieved into fine flour and packaged for further use.

Corresponding Author: R.O. Adeleke, Food Technology Department, Osun State Polytechnic, Iree, Osun State, Nigeria

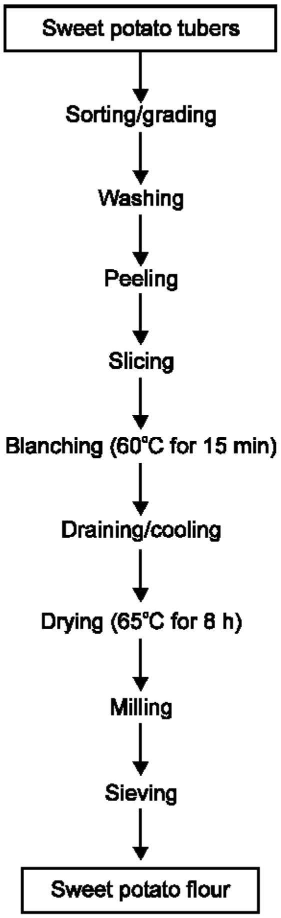

Fig. 1: Flour chart of sweet potato flour production

Sample codes and designations

Sample codes	Designation
A	100% WF
B	90% WF : 10% SPF
C	85% WF : 15% SPF
D	80% WF : 20% SPF
E	75% WF : 25% SPF
F	100% SPF

WF = Wheat Flour; SPF = Sweet Potato Flour

Pasting characteristics analysis: Pasting properties were determined using a Rapid Visco Analyzer (RVA) (Model RVA 3D +; Network Scientific, 5 Australia) described by Adebowale *et al*. (2005).

RESULTS AND DISCUSSION

Result of pasting properties of wheat and sweet potato flour blends: The results of pasting properties of wheat and sweet potato flour blends are as presented in Table 1. When starch-based foods are heated in an aqueous environment, they undergo a series of changes known as gelatinization and pasting. These are two of the most important properties that influence quality and aesthetic considerations in the food industry, since they affect texture and digestibility as well as the end use of starchy foods (Adebowale *et al*., 2005). Peak viscosity, which is the ability of starch to swell freely before their physical breakdown (Sanni *et al*., 2004) ranged from 131.42-271.08 RVU. Hundred percent sweet potato flour recorded the highest value of 271.08 RVU. High peak viscosity is an indication of high starch content (Osungbaro, 1990). It is also related to the water binding capacity of starch (Adebowale *et al*., 2005). The high peak viscosity displayed by 100% SPF implies that the flour may be suitable for products requiring high gel strength and elasticity (Adebowale *et al*., 2005). As more and more Sweet Potato Flour (SPF) was added to Wheat Flour (WF), the peak viscosity is on the increase. The trough, which is the minimum viscosity value in the constant temperature phase of the RVA profile and measures the ability of paste to withstand breakdown during cooling ranged between 86.42 and 161.08 RVU. 100% SPF had the highest value of 161.08 RVU. 100% WF recorded the lowest value of 86.42 RVU. As more and more SPF was incorporated, the trough value was on the increase. Among the blends, sample with 75% WF and 25% SPF had the highest trough value of 105.42 RVU. The breakdown viscosity value is an index of the stability of starch (Fernande and Berry, 1989). The value for the breakdown viscosity ranged between 45.00 and 110.00 RVU. 100% SPF recorded the highest value suggesting higher stability of starch. The final viscosity, which is the change in the viscosity after holding cooked starch at 50°C ranged from 166.67-246.33. Final viscosity is the most commonly used parameter to define the quality of a particular starch-based sample,

Table 1: Result of pasting properties of wheat and sweet potato flour blends

Sample	PV (RVU)	T1 (RVU)	B (RVU)	FV (RVU)	S (RVU)	PT (min)	PT (°C)
100% WF	131.42	86.42	45.00	166.67	80.25	6.00	82.35
90% WF : 10% SPF	135.58	87.50	48.08	173.75	86.25	5.80	84.45
85% WF : 15% SPF	144.83	90.00	54.88	185.00	95.00	5.53	81.54
80% WF : 20% SPF	142.17	94.50	47.67	179.33	84.83	5.47	84.25
75% WF : 25% SPF	150.58	105.42	45.17	187.33	81.92	5.73	83.35
100% SPF	271.08	161.08	110.00	246.33	85.25	4.33	80.90

Key, WF : Wheat Flour; SPF : Sweet Potato Flour.
PV = Peak Viscosity (RVU) T1 = Trough 1 (RVU) B = Breakdown (RVU) FV = Final Viscosity (RVU)
S = Setback (RVU) PT (min) = Peak Time (min) PT (°C) = Pasting Temperature (°C)

as it indicates the ability of the material to form a viscous paste or gel after cooking and cooling as well as the resistance of the paste to shear force during stirring (Adeyemi and Idowu, 1990). As more and more SPF was added to WF, the final viscosity was on the increase suggesting higher resistance of past to shear force during stirring. The setback value of 100% SPF was 85.25 RVU and it is higher than that of 100% WF (80.25 RVU). The higher the setback value, the lower the retrogradation during cooling and the lower the staling rate of the products made from the flour (Adeyemi and Idowu, 1990). The introduction of SPF into WF for bakery goods production thus resulted in increase in setback value as more and more SPF was added to WF. This will therefore reduce the retrogradation and stalling rate of bakery goods produced from their blends. The peak time, which is a measure of the cooking time, ranged between 4.33-6.00 min. 100% WF recorded the highest value of 6.00 min suggesting more processing time. SPF recorded the lowest value for peak time (4.33 min). As more and more SPF was added to the WF, the processing time for the blended samples was on the decrease. Blending of WF with SPF will therefore lead to a significant reduction in cooking or processing time.

The pasting temperature for 100% WF was 82.35°C while it was 80.90°C for 100% SPF. Pasting temperature gives an indication of the gelatinization time during processing. It is the temperature at which the first detectable increase in viscosity is measured and it is an index characterized by the initial change due to the swelling of starch (Eniola and Delarosa, 1981). 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 property of starch due to a high degree of association between starch granules (Eniola and Delarosa, 1981; Numfor *et al*., 1996).

Conclusion: The study showed that blending Wheat Flour (WF) with Sweet Potato Flour (SPF) improved the pasting properties of the blending samples. There was reduction in the retrogradation and staling rate, reduction in processing time, higher starch stability, reduced water holding capacity and longer shelf life of bakery products produced from the blends. Therefore SPF which can easily be processed from available raw material (Iponea batatss) will go a long way in saving cost of production and improved product quality.

REFERENCES

Abbey, B.W. and G.O. Ibeh, 1998. Functional properties of raw and heat processed cowpea flour. J. Food Sci., 53: 1775-19991.

Adebowale, A.A., L.O. Sanni and S.O. Awonorin, 2005. Effect of texture modifiers on the physicochemical and sensory properties of dried fufu. Food Sci. Technol. Int., 11: 373-382.

Adeyemi, I.A. and M.A. Idowu, 1990. The evaluation of pregelatinized maize flour in the development of Maissa, a baked product. Nig. Food J., 8: 63-73.

Adeyeye, E.I., A.A. Oshodi and K.O. Ipinmonti, 1994. Functional properties of some varicties of African yam bean flour. Int. J. Food Nutr., 45: 829-836.

Eniola, L. and L.C. Delarosa, 1981. Physicochemical characterizes of yam starches. J. Food Biochem., 5: 115-130.

Fernande De Tonella, M.L. and J.W. Berry, 1989. Rheological properties of flour and sensory characteristics of bread made from germinated chick peas. Internal J. Food Sci. Technol.

Kinsella, J.E., 1979. Functional properties of soy protein. J. Food Chem., 56: 242-288.

Ngoddy, P.O. and C.C. Onuoha, 1983. Selected Problems in Yam Processing. Symposium on Yam Biochemistry, Anambra State University, Anambra Nigeria, May 3, 1983.

Numfor, F.A., W.M. Walter and S.J. Schwartz, 1996. Effect of emulsifiers on the physical properties of native and fermented cassava starches. J. Agric. Food Chem., 44: 2595-2599.

Ofi, O., 1983. Fundamentals of Yam and Cocoyam Processing. Department of Mechanical Engineering, University of Ibadan, Lecture Series. University Press Ltd, Ibadan, Nigeria.

Oftmann, G.W. and V.C. Garba, 1997. Functional properties and amino acid content of protein isolate from using bean flour. J. Food Technol., 12: 434-473.

Osungbaro, T.O., 1990. Effect of differences in variety and dry milling of maize on texture characteristics of ogi. J. Food Agric., 54: 1-11.

Sanni, L.O., S.B. Kosoko, A.A. Adebowale and R.J. Adeoye, 2004. The influence of palm oil and chemical modification on the pasting and sensory properties of fufu flour. Int. J. Food Properties, 7: 229-237.

Sanni, L.O., A.A. Adebowale and S.O. Tafa, 2006. Proximate Functional, Pasting and Sensory Qualities of Instant Yam Flour. A Paper Presented at the 15th ISTRC Symposium, Central Tuber Crops Research Institute Trivandrum, Kerala State India.

Sathe, S.K. and D.K. Salekhe, 1981. Functional properties of the great northern bean protein emulsion, foaming, viscosity and gelation properties. J. Food Sci., 46: 71-76.