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Some Quality Attributes of Locally Produced Wheat Flour in Storage

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Abstract: *Wheat flour is an excellent source of complex carbohydrate which is also used for the production of all sorts of pastries and confectionaries. Locally produced wheat flour in Nigeria has been in recent times reconstituted into dough and eaten with soup to replace the popular Amala (yam flour dough) due to its numerous nutritional and health benefits. The aim of this work is to evaluate the effect of selected packaging materials and storage duration on some proximate and physical properties of locally produced and packaged wheat flour in storage. Thirty kilograms (30kg) of wheat was sorted, milled and sieved. Initial proximate and physical properties of wheat flour were determined using standard methods. One kilogram (1kg) each was packaged in hessian bag, polyethylene bag, and covered plastic container; with unpackaged samples as control. All the samples were stored on a shelf at the normal room temperature (27 – 35^{o}C). Packaged samples was stored for 3 months at 3 replicates (3x3x3 = 27samples) with the proximate and physical properties determined on monthly basis. The data collected were analyzed statistically using the SPSS 15.0 statistical package. The results shows that the wheat flour had an initial moisture content of 9.2%, crude protein 11.5%, fat 1.8%, ash 1.4%, crude fiber 2.2%, carbohydrate 73.6%, loose bulk density 0.36, packed bulk density 0.58, pH 5.8, swelling capacity 1.3%, water absorption capacity 145% and least gelatin concentration of 6.0%. Statistical analysis shows that packaging types and storage duration has significant effects ($p \leq 0.05$) on the moisture content, swelling capacity, water absorption capacity and pH. The packaging types and the storage duration however does not have significant effects on the crude protein, fat, ash, crude fiber, carbohydrate and least gelatin concentration of locally produced wheat flour stored for three months. It is recommended that wheat flour should be packed in airtight and moisture proof bag especially in areas of high humidity to prevent mold growth and maintain it qualities when stored under room temperature.*

Keywords*: Wheat, packaging types, storage, quality attributes*

I. Introduction

The world production of wheat was 607 million tons in 2007, making it the third most popular after maize and rice [1]. The cultivation of wheat in Nigeria dates back to the 16th century though it was grown on small scale mainly in the Sahel and Sudan savanna zones. The varieties of the wheat grown in Nigeria include Siete ceros, Florence Aurore 8193, pavon 76 and Seri 82 and these were among the varieties release by the institute of Agricultural research, Zaria [2]. The local wheat grown in Nigeria was originally process in house-holds into various local dishes especially in the northern part on the country. The nutritional value of wheat is extremely important as it takes an important place among the few crop species being extensively grown as staple food sources. The importance of wheat is mainly due to the fact that its seed can be milled into flour; semolina etc. which forms the basic ingredients of pasta, bread and other bakery products [3, 4].

Globally, wheat is the leading source of vegetable protein in human food, having higher protein content to maize, rice, and other major cereals. Wheat flour is an excellent source of complex carbohydrate. Depending on the flour type, the percentage of the calories from protein ranges from 9 to 15 percent, except the gluten, which has 45% protein content. Wheat flour is a very hygroscopic material like any other flour and its moisture changes with the changes in temperature and humidity of the storage environments. Flour moisture changes can support the acidity alterations caused by enzymatic reactions [5, 6, 7].

Wheat flour contains manganese, phosphorus, magnesium and selenium in very large quantities. It is also rich in zinc, copper, iron, potassium, vitamin B_6, niacin, thiamine, foliate, riboflavin and panthothenic acid but however low in calcium, vitamin E and vitamin K. Consumption of whole wheat is necessary for a healthy metabolism, as it prevent breast cancer, gallstones, childhood asthma and heart risks. Definitely as essential food intake for woman for gastro-intestinal health, it also reduce reduces risk of high blood pressure, diabetics and high cholesterol. Wheat has phytonutrient which promote better health though maintaining high blood levels [8, 9]. Locally produced wheat flour in Nigeria has been in recent times reconstituted into dough and eaten with soup to replace the popular *Amala* (yam flour dough) due to its numerous nutritional and health benefits. The aim of this work is to evaluate the effect of selected packaging materials and storage duration on some proximate and physical properties of locally produced and packaged wheat flour in storage.

II. Materials And Methods

Thirty kilograms (30kg) of wheat was obtained from a local market in Ogbomoso, Nigeria. The sample was sorted, milled and sieved. The experiment was carried out at Kappa Biotechnology Laboratories, Ibadan, Nigeria. Initial proximate and physical properties of wheat flour were determined using the AOAC standard methods [10]. One kilogram (1kg) each was packaged in hessian bag, polyethylene bag, and covered plastic container with unpackaged samples as control. All the samples were stored on a shelf at the normal room temperature (27 – 35^{o}C). Packaged samples was stored for 3months at 3 replicates (3x3x3 = 27samples) with the proximate and physical properties determined on monthly basis. The data collected was analyzed statistically using the SPSS 15.0 statistical package to determine the Analysis of Variance and the means separated.

III. Results And Discussion

The results shows that the wheat flour used for this experiment had an initial moisture content of 9.2%, crude protein 11.5%, fat 1.8%, ash 1.4%, crude fiber 2.2%, carbohydrate 73.6%, loose bulk density 0.36, packed bulk density 0.58, pH 5.8, swelling capacity 1.3%, water absorption capacity 145% and least gelatin concentration of 6.0%. These properties are similar to the properties of wheat flour as reported by other researchers [8, 9, 11]. Statistical analysis shows that packaging types and storage duration has significant effects ($p \leq 0.05$) on the moisture content, swelling capacity, water absorption capacity and pH. The packaging types and the storage duration however does not have significant effects on the crude protein, fat, ash, crude fiber, carbohydrate and least gelatin concentration of locally produced wheat flour stored for three months.

The results shows that the moisture content of wheat flour packaged in hessian bag and the control samples increased from 9.3% to 10.73% and 11.2% respectively after three months of storage. The moisture content of samples packaged in polyethylene bags also increased to 9.7% and 9.5% for samples packaged in covered plastic container after three months of storage. Statistical analysis show that there was significant increase ($p \leq 0.05$) in moisture content of wheat flour packaged in hessian bags and the control samples while the increases were not significant in the flour packaged in polyethylene bags and covered plastic container throughout the storage period. The increase in moisture content in the flour was probably due to the hygroscopic nature of flour and the properties of the packaging materials which were not totally airtight. Increase in moisture content can enhance the activities of microorganisms which can lead to deterioration of the wheat flour. Wheat flour with high moisture content (over 14.5%) will attract mold, bacteria, and insects, which can all cause deterioration during storage. Wheat flour with low moisture content is more stable during storage. Moisture content can be an indicator of profitability in milling [11].

The swelling capacity of the wheat flour packaged in hessian bag and control sample (unpackaged) increase from 1.3% to 1.50% after three months of storage, while it increases to 1.4% in both polyethylene and covered plastic container samples. In hessian bag, the swelling capacity of the wheat flour increased significantly ($p<0.05$) for the period of storage, while there was no significant differences ($p<0.05$) in the swelling capacity of the wheat flour packaged in both polythene and covered plastic container throughout the storage period.

The water absorption capacity increase from 145% to 150% for hessian bag and control sample and 140% to 145% in samples packaged in polyethylene bag and covered plastic container. These increases were in the first week of storage and thereafter remain constant to the end of the storage period. The analysis of variance shows that the packaging materials and storage duration had significant effect ($p<0.05$) on the water absorption capacity present in the wheat flour in storage.

There were no significant increases in the crude protein, fat, ash, crude fiber, carbohydrate, loose and packed bulk densities of locally produced and packaged wheat flour after three months of storage. Protein content is a key specification for wheat flour purchasers since it is related to many processing properties, such as water absorption and gluten strength. Protein content can also be related to finished product attributes, such as texture and appearance. Low protein content is desired for crisp or tender products, such as snacks or cakes.

High protein content is desired for products with chewy texture, such as pan bread and hearth bread.

Bakers use protein content results to anticipate water absorption and dough development time for processes and products, because higher protein content usually requires more water and a longer mixing time to achieve optimum dough consistency [11, 8].

The ash content in wheat flour has significance for milling. Millers need to know the overall mineral content of the wheat to achieve desired or specified ash levels in flour. Since ash is primarily concentrated in the bran, ash content in flour is an indication of the yield that can be expected during milling. Ash content also indicates milling performance by indirectly revealing the amount of bran contamination in flour. Ash in flour can affect color, imparting a darker color to finished products. Some specialty products requiring particularly white flour call for low ash content while other products, such as whole wheat flour, have high ash content [12, 13, 14].

IV. Conclusion

It can be concluded that the packaging type and storage duration had significant effects on some of the proximate properties of wheat flour in storage especially on the moisture content. Increase in moisture will provide a suitable environment for microbiological activities which can result in spoilage. It is therefore recommended that wheat flour should be packed in airtight and moisture proof bag especially in areas of high humidity to prevent mold growth and maintain it qualities when stored under room temperature.

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