MAIZE GERM AND BRAN FOR VALUE ADDITION: HIGH FIBER BAKERY AND CONFECTIONERY PRODUCTS

Executive Summary

Maize is a major food crop in developing countries. The milling of maize into flours results into large amounts of maize bran and germ. The two by-products are of low economic value and dominated the livestock feed manufacturing sector hence not considered as human food.

The increasing population growth demands more food, maize is versatile with respect to product development and can satisfy the food requirements as well as provide product diversity for human nutrition with health benefits. The health benefit compounds of maize are abundantly located in the bran, such as phenols with anti-cancer properties. The Maize germ contains abundant of oil and vitamins with are good for human health.

Bread incorporated with bran, germ and

Bran and germ Cakes and Cookies

This has created the interest in the utilization of abundant maize bran and germ in developing value added bakery and confectionery products with nutritional and health benefits. The creation of awareness on the benefits of maize bran and germ as raw materials and developing guidelines for their use as human food can revolutionize the maize industry. Careful handling maize germ and bran by the millers can results into a vital raw materials for the confectionery and bakery sector. On policy level, to enhance nutrition value of bakery and confectionery product with fiber through use of maize bran and germ can be implemented and enforced in standards by both Ministry of Health and Uganda National Bureau of Standards. In the long run, this will

impact on the Food and Nutrition Policy.

What is the problem?

Introduction

Like other developing countries, Maize (Zea mays L.) is the most important cereal crop grown in Uganda. Statistics from National Household Survey (UNHS) indicated that approximately 86% of the 4.2 million agricultural households were engaged in maize production. The crop is consumed in various forms as a snack (both roasted and steamed), porridge or bread (posho). The main processing method used for maize is huller milling which results in to large amounts of Germ-Bran mixture. Traditional uses bran and germ is cantered on processing largely animal feed, which does not fetch high price. Despite, Maize germ-bran dominating the livestock feed industry; it can be used to contribute to nutritional improvement of various confectionery and bakery products when handled as a raw material. Maize bran is vital in the provision of additional fiber content in different products for human consumption. Fiber is important in the promotion of good health. It contains various minerals which are vital for the proper function of the body and

Cakes: 50% wheat and 50% maize Bran

Bran Sticks: wheat, maize bran and Germ

also it has an effect in the prevention of constipation. Maize germ, on the other hand, is highly nutritious with essential oils and proteins that are necessary for the human body. Consumption of food products incorporated with bran and germ has been associated with normalizing bowel movements, maintaining bowel health, lowering blood cholesterol linked to heart problems, controlling blood sugars associated with stimulating obesity, hence adding in maintaining health weight. This research was set out to add value to maize germ and bran and developed new and improved health products for human consumption; this was aimed at contributing to the improvement of food security, human nutrition and health. The research resulted into four viable value added bakery products with good consumer acceptability. The research has paved a way to use bran and germ innovatively to develop value added with health benefits thus providing nutritional benefits to the consumer and economic benefits to the

manufacturers both the millers and, bakery and confectionery industry.

APPROACHES AND RESULTS

The research involved maize value chain stakeholders targeting mostly the maize Millers/processors who produce maize bran and germ and the local small bakery and confectionery enterprises. The approach to the research was to use one local bakery and confectionery Enterprise and one large maize miller located in Kampala district Uganda.

The raw materials used to make BREAD, COOKES, CAKES, Buns STICKS were wheat flour, maize bran, maize germ, soy flour, fat, sugar, yeast, salt and water. Soybean flour was purchased from local soybean company. Maize bran and maize germ were obtained from Maganjo Grain Millers Limited a local grain milling company. Wheat flour, yeast, fat, sugar and salt were obtained from local Market, Kampala Capital City. Wheat flour was replaced by maize bran, maize germ and soy flour at different levels of 0%, 10%, 20%, 30% and 40% to produce enriched balanced bread. Maize bran was substituted in the range of 4 to 15% and maize germ in the range of 1to 10%. For cookies and cakes the formulations levels were up to 40% maize germ and Bran. All formulated products were baked 200°C for 30 minutes. Doneness of products was determined by the golden brown colour development. Proximate analysis was conducted on all samples to determine chemical composition. The specific volume of bread was determined using recommended methods. Bread crumb hardness was also determined. The samples made from the different combinations were evaluated in sensory evaluation laboratory by a panel of 35 untrained judges on 9-point Hedonic Scale. Sensory attributed determined were general appearance, colour, aroma, taste and overall acceptability. Aflatoxin content in bread was also determined.

Findings

- The findings indicated mixing bran, germ and soy and wheat can produce an acceptable bread product.
- At 30% substitution the bread had the highest loaf weight and crumb hardness.
- At 20 % substitution, the bread produced had the overall good general appearance and acceptability.
- Bread with maize bran and germ were added at levels ranging from 5-15% had high protein, fat ash, fiber and energy content.
- Aflatoxin content for all bread tested was less that 0.005 ppm, acceptable level.
- The optimized incorporation was 40% for maize bran while germ was 20% was obtained for the cakes and cookies with good eating qualities. Bread buns could only take a maximum of 20%. The interesting observation during the production of cookies and cakes included: the dough with maize bran during processing requires more water for mixing. This attributable to high water intake of maize bran.

- The products made with incorporation of maize bran, tasted very sweet hence reducing sugar addition in the recipe. This has the health implication of reduced sugar intake by the consumers
- The baked product made with incorporation of roasted bran, some of the bran crystals could be tasted in baked product. This kind of taste was appreciated more in the cookies than in cakes.
- Products (both the cakes & cookies) made with incorporation of maize bran have a superior crumb crust compared to 100% wheat
- The cakes made with incorporation of roasted bran had a long shelf life up to 7 days while still tasting fresh compared to other cakes with only 3-4 day shelf
- The incorporation of maize germ improved the visual appearance of the baked products and at the same time nutritional quality of the products. However care has to be exercised to keep its incorporation at low levels as its flavor is quite strong and not that well appreciated.

Implication of Findings

- Findings indicated that the maize bran and germ incorporation in wheat flour can result into bread, cookies, cakes, buns and sticks with good general appearance and overall acceptability which is equivalent to that of 100% wheat
- Incorporating and optimized maize bran and germ, it is possible to obtain bread, cakes and cookies with good eating qualities.
- Incorporation of maize bran and germ at level ranging from 20 to 30 % can result in to a good acceptable bread with without compromising on the eating quality
- Incorporation of maize bran and germ in baked product such as cookes, cakes improves the taste, visual appearance and shelf life
- Incorporation of maize bran has the effect of reducing on the amount of sugar added during dough making and increasing the amount of water added during the same process. Roasted bran has a bigger impact on the desirable sweet taste of cookies

Policy recommendations

- Policy must focus on how integrate the utilisation of maize bran and germ in foods for human consumption by processors
- Implement the mandatory inclusion of a certain percentage of maize bran and germ in the processing of bakery and confectionary products by the processors.
- A standard be formulated for maize bran and germ as raw material for production of human food
- To sensitize the population of the nutritional and health benefits of maize bran and germ when incorporated in bakery and confectionery products. Campaigns should undertaken to educate consumers about the dietary and health benefits associated with consumption of high fiber foods.
- The maize millers should be educated on how to handle the maize bran and germ as raw material of economic value and for human food production.

Conclusion

Product development is possible using maize germ and bran and produce high fiber acceptable quality baked products. However, it demands a lot of time and finances due to numerous trials. In order to penetrate the market, consumer sensitization of the health benefits of such products need to be undertaken. Product branding should be under taken to support the commercialization of viable products.

References

1. AOAC. (2002). Official Methods of Analysis of Association of Analytical Chemists International. (17th ed.). Maryland, AOAC International
2. Tajamul Rouf Shah, Kamlesh Prasad, pradyum Kumar and Faith Yildiz (2016) A Potential source of Human Nutrition and health. A review:Cogent Food and Agriculture 2:1 DOI:10.1080/23311932 2016.1166995
3. Jack Daly, Danny Hamrick, Gary Gereffi, and Andrew Guinn (2017) Policy brief: Maize Value Chain in EAast Africa Internation Growth Centre
4. Ian Dalipagic and Gabriel Elepu (2014) Agricultural Value Chain Analysis In Northern Uganda: Maize, Rice, Groundnuts, Sunflower And Sesame Action Against Hunger | ACF-International

Acknowledgements

This research has been carried out in Partnership with Makerere University, Department of Food Technology and Nutrition, Maganjo Grain Millers Limited and JOVAY School of Cookery

We are grateful to all people who participated in interviews and sensory evaluations and for their valuable contributions in the research.

The research was funded by African Centre for Technology Studies (ACTS) in collaboration with Scinnovent Centre and the Uganda National Council for Science and Technology (UNCST) under Public Private Partnership (PPT)

WHEAT -MAIZE GERM COOKIES AND BUNS (50:50%)

Contact: Prof Charles Muyanja
Email: ckmuyanja@caes.mak.ac.ug