Agrosearch (2013) 13 No.1: 69 - 75 Http://dx.doi.org/10.4314/agrosh.v13i1.7

THE EFFECTS OF ADDITION OF *Moringa* LEAF WASTE FIBRE ON PROXIMATE AND SENSORY CHARACTERISTICS OF COOKIES.

*Otunola, G.A[1]., Arise, A. K[1]., Sola-Ojo, F. E.[2], Nmom, I.O.[1] and Toye, A. A.[2]
[1]Department of Home Economics and Food Science, University of Ilorin, Ilorin, Kwara State, Nigeria.
[2]Department of Animal Production, University of Ilorin, Ilorin, Kwara State, Nigeria.
*Corresponding Author: E-mail: adeglo2004@yahoo.com

ABSTRACT

The effects of incorporation of Moringa leaf fibre (a by-product of leaf processing which contains 24% Crude Fibre by dry weight at 0, 5 and 10 % substitution of wheat flour in cookies was investigated. Three products containing wheat flour: Moringa leaf fibre ratios of 100:0, 95:5, and 90:10 respectively were prepared, and a commercial cookie was used as a standard. Proximate composition of each of the products was determined and sensory evaluation of the cookies was performed on a 7-point hedonic scale (with the standard commercial cookie as control) using a 20-man sensory panel. There was no significant (P< 0.05) difference in the dry matter content of the four samples. The 10% Moringa leaf fibre cookie blend had the highest moisture, fat and crude fibre content (0.57 % CF, relative to 0.44 and 0.54% CF observed in the 0:100 and 5:95 recipes respectively), while the commercial cookie had the lowest values for these parameters (0.36% CF) but with highest value for protein. The 100% wheat flour cookie ranked best in sensory evaluation, followed by the 5% fibre substituted cookie. All the cookies were acceptable; scoring above 4 on the 7-point hedonic scale. Addition of moringa leaf waste up to 10 % in cookies is feasible, though better at 5%. Cookies with Moringa leaf by-product have the advantage of being good sources of some of the daily requirements of dietary fibre.

Keywords: Moringa leaf waste fibre, by-product, cookies, dietary fibre, sensory evaluation.

INTRODUCTION

Dietary fibre is the part of plants eaten that cannot be fully digested. It is food material, particularly plant material, that is not hydrolyzed by enzymes in the human digestive tract, but that may be digested by microflora in the gut. Dietary fibre consists of non digestible carbohydrates and lignin that are intrinsic and intact in plants which includes plant non-starch polysaccharides (for example, cellulose, pectin, gums, hemi cellulose and fibre contained in oat and wheat bran), oligosaccharides, lignin, and some resistant starch. While dietary fibre falls under the category of carbohydrates, it does not provide the same number of calories, nor is it processed the way that other sources of carbohydrates are. Sources of dietary fibres include vegetables, grains such as wheat, oats, barley, beans and fruits (IFST, 2007).

The role and benefit of dietary fibre in health and nutrition has caught public attention and has stimulated a wide range of research (O'Sullivan 1998; WHO/FAO, 2003). High dietary fibre has been said to keep the digestive system healthy and prevent constipation by making stool bulky and soft (Figuerola *et al*., 2005). It also lowers blood cholesterol and triglyceride levels, decreases the risk of colon cancer, heart disease, and digestive problems like diverticulosis, improves blood sugar in people with diabetes and controls weight gain by enhancing the feeling of satiety thus controlling food intake (Bingham *et al*., 2003; Park *et al*., 2005; IFST, 2007; Anderson *et al*., 2009).

Baked food products such as bread, biscuits and cookies are consumed and liked all over the world, and as such can be used as carriers or vehicles for incorporating fibre into the diet (Kohajdova *et al*., 2011) towards healthier/ more-balanced nutrition.

Moringa leaf waste (MLW) is the coarse material left over after Moringa leaf has been processed into powder by the use of a blending (rotary blade chopping) process. Towards sustainable agriculture, enhancement of the economic value of agricultural by-products, and the enhancement of nutritional quality of processed foods including baked goods, the use of MLW in food recipes would eliminate its disposal as waste and in turn lend it a quantifiable economic value, and contribute to the enhancement of human nutrition through its contribution of fibre to the recipes in which it finds use. The latter benefit (enhancement of human nutrition through contribution of fibre) is particularly important given the projected worldwide rise in obesity and associated metabolic derangements manifest in the metabolic syndrome cluster (Owen and Reisin, 2012) which may be prevented and/or curbed by adoption of a healthy lifestyle which incorporates consumption of healthful foods (Manore, 2012).

For MLW to find widespread use in human recipes, its contribution to the nutrient content and taste of the food produced through such recipes must be evaluated and found acceptable. This study therefore investigated the proximate composition and sensory characteristics of cookies prepared using Moringa leaf waste as dietary fibre sources.

MATERIALS AND METHODS

All materials - wheat flour, sugar, margarine, vanilla flavour were purchased from the local market. Moringa leaf waste (100%) was obtained from the Moringa Plantation, University of Ilorin. A commercial fibre cookie was purchased from a supermarket in Ilorin. All reagents used were of analytical grade.

Formulation of cookie blends

Three cookie blends were prepared according to a basic recipe described by (www.lifestylefood.com), and blends with 0 (control), 5 and 10 % wheat flour substituted with Moringa leaf waste were formulated (Table 1).

Proximate analysis

Protein, fat, crude fibre, ash and moisture contents of each cookie type were determined by use of standard methods (AOAC, 2002), while carbohydrate was determined by difference.

Sensory evaluation

A panel of twenty (20) randomly selected judges who were familiar with cookies assessed the quality of the cookies. Each of the products was evaluated on a 7-point hedonic scale where 7 represents the highest level of acceptability (like extremely) and 1 represents the lowest (dislike extremely). The cookies were evaluated for quality characteristics of aroma, taste, texture, colour and overall acceptability as described previously (Poste *et al*., 1991). Scores were subjected to non-parametric analysis of variance (ANOVA) tests and treatment means separated using appropriate statistics within SAS statistical package (SAS, 2002).

RESULTS AND DISCUSSION

The proximate composition of the control, Wheat Flour Cookie (WFC), Commercial (CC) and 5 and 10 % Moringa Leaf Waste Cookies (MLWC) is shown in Table 2. The 10% Moringa leaf waste fibre cookie blends had the highest moisture, fat and crude fibre content (0.57 % CF), relative to 0.44 and 0.54% CF observed in the 0 and 5% blends respectively), while the commercial cookie had the lowest values for these parameters (0.36% CF) but highest value for protein. Increase in the crude fibre content, 58% and 29.5% higher CF in 10% MLW Cookie than WFC, and CC cookies respectively could be attributed to the Moringa leaf waste added to the cookie mix (Ubbor and Akobundu, 2009). The commercial cookie had the highest value for carbonhydrate, although there was no significant difference between the cookie blends and the control. The 10% MLWC blend had a significantly higher ($P < 0.05$) fat content, followed by the 5 % MLWC and the WFC, while the commercial cookie had the least value.

The result for sensory evaluation of the cookies is shown in Table 3. All the cookie samples were evaluated for colour, aroma, taste, texture and overall acceptability.

Colour: The cookies scored between 3.80 and 6.00 on a 7-point hedonic scale. The colour of both the control and commercial cookies were significantly ($P < 0.05$) superior to the MLW and the WF cookies. The 10% MLWC had the least score of 3.8 for colour, but was still acceptable. Low acceptability of colour of the products agrees with the reports of Ubbor and Akobundu (2009) that all wheat cookies were superior in colour to all cassava/all watermelon flour cookies.

Aroma: There was no significant difference in the score for aroma of the control and commercial cookies. However, these values were significantly ($P < 0.05$) different from the cookies substituted with Moringa leaf waste, with the 10 % blend having the least score. 100% wheat flour cookie ranked best, followed by the 5% fibre substituted.

Taste: The cookies without MLW were superior in taste compared to those substituted with 5 and 10 % MLW, with the 5% blend exhibiting a greater acceptability than the 10% blend which gave a strong taste of Moringa. This trend of cookies taking up the taste of the fibres source was also reported by Kohajdova *et al*. (2011) in which the addition of apple fibre to cookies significantly increased fruity taste and odour of cookies.

Texture: The control and commercial cookies were superior in texture and acceptability when compared to the MLW cookies. However, the two MLW cookies were also acceptable in terms of texture.

Overall acceptability: The overall acceptability of the cookies followed the trend: commercial cookie> control> 5% MLW cookie> 10% MLW cookie.

CONCLUSION

This study showed that the use of Moringa Leaf Waste as a dietary fibre source enhanced cookie fibre content by as much as 29.54% relative to a control recipe, and 58% relative to a commercial cookie recipe. All cookies containing Moringa Leaf Waste were acceptable, scoring above 3.5 on the 7-point hedonic scale. This is an indication that addition of Moringa leaf waste fibre up to 10 % in cookies is acceptable, although inclusion at 5% was found to be more acceptable. Cookies with Moringa leaf by-product will therefore have the advantage of being a good source of some of the daily requirements of dietary fibre. Further work is underway to examine whether and to what extent beneficial heat-labile phytochemical and mineral components of Moringa leaf Waste (other than the fibre examined here) may contribute to the healthful (food and nutraceutical) benefits of the cookie recipes examined here.

ACKNOWLEDGEMENTS

Ayokunle Afolabi Toye thanks the Causal Genetics Institute CGenI and Causal Genetics LTD UK for facilitating contribution to the present study.

REFERENCES

Anderson, J. W., Baird, P., Davis, R. H., Ferreri, S., Knudston, M., Koraym, A., Waters, V. and William, CL. (2009). Health benefits of dietary fibre. *Nutrition Reviews*. 67: 188-205.

Association of Official Analytical Chemists (AOAC) (2002). Official Methods of Analysis. 17th edn Washington DC.*Association of Official Analytical Chemists*.

Bingham, S. A., Day, N. E. and Luben, R. (2003). Dietary fibre in food and protection against colorectal cancer in the European perspective investigation into cancer and nutrition (EPIC): an observational study. *Lancet* 361:1496-1501.

Figuerola, F., Hurtado, M. L., Estevez, A. M., Chiffelle, I. and Asenjo, F. (2005). Fibre concentrates from apple pomace and citrus peels as potential fibre sources for food enrichment. *Food Chemistry* 91:395-401.

Institute of Food Science and Technology (IFST) (2007). Dietary Fibre.Institute of Food Science and Technology Information Statement.5 Cambridge Court, 210 Shepherds Bush Road London W67NS.1-10.

Kohajdova, Z., Karovicova, J., Jurasova, M. And Kukurova, K. (2011). Effect of the addition of a commercial apple fibre powder on the baking and sensory properties of cookies. *Acta Chimica Slovaka*.4 (2): 88-97.

Manore, M. M. (2012). Dietary supplements for improving body composition and reducing body weight: where is the evidence? *Int J Sport Nutr Exerc Metab*. 22(2):139-54.

O'Sullivan, K. R.(1998). Fibre and its role in health and disease. *International Journal of Food Sciences and Nutrition* 49: 9-12.

Owen J and Reisin E. (2012). Non-Communicable Disease: A Welcome and Long Needed Addition to the *WHO's 2012 World Heath Statistics*. Curr Hypertens Rep. 2012 Sep 13. [Epub ahead of print].

Park, Y., David J. H. and Spiegelman, D. (2005). Dietary fibre intake and risk of colorectal cancer: a pooled analysis of prospective cohort studies. *JAMA* 294: 2849-2857.

Poste, L. M., Mackie, D. A., Butler, G. and Larmond, E. (1991).Laboratory Methods for Sensory Analysis of Food.*Research Branch, Agriculture Canada, Publication* 1864/E.

SAS (2002). SAS Systems for windows 9.0, *SAS Institute Inc*. CARY, NC, USA.

Ubbor, S. C. and Akobundu, E. N. T. (2009). Quality characteristics of cookies from composite flours of watermelon seed, cassava and wheat. *Pakistan Journal of Nutrition* 8 (7):1097-1102.

WHO/FAO (2003). Expert Consultation. *WHO Technical Report Series* 916, Geneva. Www.lifestylefood.com.au/recipes/8947/basic-cookie-recipe

Table 1: Formulation of Cookie Blends

Blend	Wheat flour (g)	MLW (g)	Margarine (g)	Sugar (g)	Flavour (g)
WFC	275.00	0.00	225.00	110.00	2
$MLWC_1$	261.25	13.75	225.00	110.00	2
$MLWC_2$	247.50	27.50	225.00	110.00	2

Values are means of 3 determinations ±SD. WFC- whole wheat flour cookie; $MLWC_1$- 5% Moringa+95% wheat flour cookie; $MLWC_2$ - 10% Moringa+95% wheat flour cookie; CC- commercial fibre cookie.

TABLE 2: Proximate Composition of Moringa Leaf Waste Cookies

Sample	Carbohydrate (%)	Moisture (%)	Protein (%)	Fat (%)
WFC	54.65	3.29	11.48	28.74
MLWC 1	55.40	2.48	11.04	29.61
MLWC 2	51.21	4.42	11.15	31.21
CC	61.70	2.28	13.12	18.74

Values are means of 3 determinations ±SD. WFC- whole wheat flour cookie; $MLWC_1$- 5% Moringa+95% wheat flour cookie; $MLWC_2$ - 10% Moringa+95% wheat flour cookie; CC- commercial fibre cookie.

TABLE 3: Sensory Evaluation of Moringa Cookies

Sample	Aroma	Colour	Taste	Texture	Overall Acceptance
WFC	5.4[a]	5.7[a]	5.9[a]	5.3[a]	5.9[a]
MLWC 1	3.8[b]	4.0[b]	3.8[b]	4.3[b]	4.1[b]
MLWC 2	3.9[b]	3.8[b]	3.4[b]	3.9[b]	3.8[b]
CC	5.8[a]	6.0[a]	5.8[a]	5.7[a]	5.8a

Values are means of 3 determinations ±SD. WFC- whole wheat flour cookie; $MLWC_1$- 5% Moringa+95% wheat flour cookie; $MLWC_2$ - 10% Moringa+95% wheat flour cookie; CC- commercial fibre cookies.