Journal of Academia and Industrial Research (JAIR)
Volume 5, Issue 2 July 2016

ISSN: 2278-5213

RESEARCH ARTICLE

Influence of Substitution of Sesame Seeds with Seinat Seeds in the Production of Sudanese Traditional Food Khemiss-Tweira

Mohamed Ismael Ahmed[1,2*], Ali Osman Ali[3], Elamin A. Elkhalifa[3] and Zhang Lingfu[1]
[1]School of Food Science and Technology, Jiangnan University, Wuxi, China; [2]Dept. of Food Science and Technology, Nyala Technical College, South Darfur State, Sudan; [3]Dept. of Food Science and Technology, Faculty of Engineering and Technology, Gezira University, Sudan
mohamedis75@yahoo.com*; +8618800574016

Abstract

This investigation was carried out to study the effect of utilization of low-fiber Seinat seeds flour fraction instead of sesame seeds in the production of Sudanese traditional food Khemiss-Tweira, as regard to the nutritional value and quality of the product. The proximate analysis of the flour was conducted in terms of percentages of moisture, crude protein, fat, crude fiber, ash and carbohydrates. The findings showed that the low-fiber Seinat seeds flour contained 5.52% moisture, 33.35% crude protein, 30.64% crude fat, 3.90% fiber, 2.14% ash and 29.97% carbohydrates. Flour obtained from low-fiber Seinat seeds was utilized to make Khemiss-Tweira in the ratios of 4:1 and 4:2 (dry kisra: Seinat flour) instead of sesame seeds and compared with control sample 6:1 (dry kisra: sesame seeds). The protein content of Khemiss-Tweira 4:1 and 4:2 (dry kisra: Seinat flour) were 15.61% and 23.90% respectively. *In vitro* protein digestibility for those samples 4:1 and 4:2 were increased to 80.14% and 82.5% when compared with the control sample (79.9%). The statistical analysis of sensory evaluation showed that there were no significant differences between the samples of Khemiss-Tweira in flavor and overall acceptability, while significant differences in appearance, color and texture has been observed. However, a higher score of overall acceptability for sample (4:2) was given by panelists. The variability in the profile and quantity of essential amino acids indicated the feasibility of selecting (4:2), which is rich in both crude protein and amino acids, for the production of Khemiss-tweira.

Keywords: Khemiss-Tweira, Seinat, Sesame, chemical composition, nutritional value, sensory evaluation.

Introduction

Khemiss-Tweira is a food product confined to the region of Darfur and seems to be made from pearl millet only. The usefulness and attractiveness of this food should have been enough incentive to justify its widespread production in the country (Dirar, 1993). It is widely eaten in Western Sudan because of its convenience as a good food for travelers, boarding pupils, soldiers and rural workers. The main constituents of Khemiss-Tweira is thin sweet millet bread locally known as kisra-assala (Honey-sweet Kisra) which is important in its own right as food for travelers and is commonly used by farmers and gum Arabic workers in Western Sudan. Kisra assala may further be processed into the more sophisticated Khemiss-Tweira. For this purpose, sesame seeds are lightly roasted in a hot tajin. Then the dry, crumbled Kissra assala is mixed with the roasted sesame in the ratio of 6:1 respectively and a little sugar and a dash of salt are added to taste. The mixture is bounded in a mortar to give a coarse meal comprising Khemiss-Tweira. The product is a dry meal of a pleasant sweetish and slightly salty flavor. Nutritionally Khemiss-Tweira should provide a balanced meal, containing the necessary carbohydrates, proteins, oil, minerals and vitamins and its name "five birds" probably refers to the five ingredients: millet flour, millet malt flour, sesame, sugar and salt.

The food is consumed after the addition of pure water to the level of attaining the consistency desired by the consumer. It is a very useful food and can be used as a breakfast cereal or snack in urban areas and as a relief food during famine. Khemiss-Tweira is very much liked by children who consume it dry without any added water. It is as well a food for all ages including the toothless elderly and babies. Melon (*Cucumis melo* L.) is a polymorphic species that has been classified into several groups. In Sudan, five types of melons are known which are Adjour, Shamam, Tibish, Humaid and Seinat. The Seinat seeds are mainly eaten after being roasted, including the seed coat (Mohamed and Pitrat, 1999). The Seinat melon has been described by Pitrat *et al.* (2000) as oval fruit, small size, and dark green with light green stripes, white firm flesh, no sugar, and no aroma and with small seeds. Recently, increased attention has been focused on the utilization of underutilized agricultural products to produce food and feed. Such utilization would help maximize the utility of available resources. The Seinat is mostly grown under rained in Darfur, Kordofan and other parts of Sudan where there is no enough information about this crop. Preliminary studies have shown that Seinat seeds are rich in oil, protein and fiber.

Because of high shortage of protein worldwide, especially in developing countries, the search for new sources of protein is very important to substitute or supplement the existing protein. Keeping the above mentioned in view, the objective of this study was to investigate the possibility of utilizing Seinat seeds in the production of Khemiss-Tweira and improve its nutritional value by supplementing it with various levels of Seinat seeds flour.

Materials and methods

Raw materials: Specific raw materials including millet, sesame and Seinat seeds were obtained from the local market of Wad Medani town, Sudan. The seeds were cleaned from foreign materials, washed and dried. Seinat seeds were roasted, milled and sieved to produce a fibrous fraction and low-fiber Seinat seeds flour. Two types of Khemiss-Tweira were made and compared with the conventional traditional Khemiss-Tweira which was made from dried kisra assala and roasted sesame seeds.

*Khemiss-Tweira production:*Traditional method described by Dirar (1993) was followed whereby kisra assala was baked from pearl millet flours obtained from equal parts of malted and unmalted millet grains. Water was added to the whole millet flour in the ratio of 2:1 respectively to form a batter (ajien). The batter was allowed to ferment for 10 h. The fermented dough was cooked into porridge (aceda), and then it was kneaded with malt flour after it has been cooled to room temperature. About 30 min was given until amylolysis proceeded to the correct degree. Then the water was added to thin the batter and incubated overnight for fermentation. The dough was then baked on a hot steel plate (saj) in a process known as "owasa" which is a unique Sudanese art producing thin sheet of Kissra assala. The baked kisra sheets were then dried in the sun and crumbled and finally pounded by mortar and pestle to coarse crystals of kisra assala. Khemiss-Tweira formulation was carried out by mixing the coarse kisra assala with the roasted Seinat flour in the ratio 4:1 and 4:2 parts and designated as KHS1 and KHS2, respectively, also the coarse kisra assala was mixed with roasted sesame seeds in the ratio 6:1 respectively. Amounts of 200 g sugar and 15 g of salt were added to 1000 g of each of the above mixtures. Then the mixtures were well mixed to comprise the various types of Khemiss-tweira. The produced samples were bottled and kept at room temperature for further studies

Chemical analysis: Proximate analyses were carried out on the Seinat flour, sesame seeds and three types of Khemiss-Tweira. Moisture and crude protein were determined by the methods of AACC (1983). The crude fat and fiber contents were determined according to AOCS methods (1985), while the ash content was determined according to AOCS (1995).

The amino acids composition of the KH and KHS2 samples was measured on hydrolysates using an amino acid analyzer (sykam-57130) following the method of Moore and Stein (1963), the *in vitro* protein digestibility of the samples was determined according to the method of Hsu *et al*. (1977).

Organoleptic evaluation: The developed Khemiss-Tweira products as well as the traditionally known Khemiss-Tweira were prepared and subjected to a panel of 12 members to determine preference for color, mouth feel (texture), flavor and overall acceptability following a method described by Larmond (1977) and using a 9 point Hedonic scale (1= dislike extremely and 9 like extremely). The results obtained were converted to scores and statistically analyzed by Duncan's multiple range test (Duncan, 1955).

In vitro protein digestibility: In vitro protein digestibility of the different types of Khemiss-Tweira were carried out according to the three-enzyme method as described by Hsu *et al.* (1977) and Satterlee *et al.* (1979) in which a multi-enzyme solution of (1.6 mg trypsin, 3.1 mg chymotrypsin and 1.3 mg peptidase per mL) was used in the determination.

Results and discussion

The results reported in Table 1 for the proximate analysis of Seinat seed flour showed that the moisture, protein and fiber contents were higher than that of the dehulled roasted sesame seeds while the fat, ash and carbohydrate contents were lower than their contents in the dehulled and roasted sesame seeds as reported by Elseed (2008). The fat content of Seinat seeds flour (30.64%±0.8) was also lower than the range of 37-63% of the fat content of sesame seeds reported by Swern (1979) and Bernardini (1986). The data presented in Table 2 showed the chemical composition and the *in vitro* protein digestibility (IVPD) of the three types of Khemiss-Tweira. As indicated in Table 2, there was a slight variation in the moisture content of the types of Khemiss-Tweira. However, the lower the moisture in the various types of Khemiss-Tweria, the better will be the quality and the longer shelf life of the product. The protein content progressively increased from 10.87% for the traditional (control) Khemiss-Tweira to 15.6% and 23.9% for KHS1 and KHS2 thus increasing the protein content by 43.6% and 78% for KHS1 and KHS2, respectively. This increase is due to the increased addition of Seinat seed flour in Khemiss-Tweira formulation.There is also a concomitant increase in the *in vitro* protein digestibility with the increased addition of Seinat seed flour as well. The results also show that there is an increase in the fat, crude fiber and ash contents with the increase in the amount of Seinat seed flour addition in the developed Khemiss-Tweira, while there is a decrease in the carbohydrate content.

Table 1. Chemical composition of Seinat seed flour and dehulled roasted sesame seeds (Analysis reported on dry mater basis).

Components (%)	Seinat	Dehulled roasted sesame seed*
Moisture	5.52±0.5	1.92±0.07
Protein	33.35±0.3	15.75±0.06
Fat	30.64±0.8	43.47±0.3
Crude fiber	3.9±0.4	ND
Ash	2.14±0.4	4.94±0.04
Carbohydrate	29.97±0.1	35.84±0.2

All results are means of triplicates analysis± standard deviation. *Source: Elseed (2008); ND: Not determined.

Table 2. Chemical composition and *in vitro* protein digestibility of three types of Khemiss-Tweira (on dry matter basis).

Components (%)	KH	KH1	KH2
Moisture	8.32±0.14	8.40±0.22	8.00±0.17
Protein	10.87±0.21	15.61±0.2	23.90±0.1
Fat	7.94±0.2	11.14±0.1	16.93±0.1
Crude fiber	2.64±0.4	2.75±0.5	4.69 ±0.3
Ash	2.20±0.26	2.35±0.12	3.31v0.15
Carbohydrate	76.35±0.24	68.33±0.22	51.17±0.15
TVPD	79.96	80.14	82.49

KH = 6 Kisra assala: 1 sesame seeds, KH1 = 4 Kisra assala: 1 Seinat flour, KH2 = 4 Kisra assala: 2 Seinat flour.

Table 3. Amino acid composition of conventional and developed Khemiss-Tweira.

Amino acid	KH	KHS2	FAO/WHO 1973
Methionine	1.98	2.1	-
Cystine	0.23	0.26	
Total Sulphar amino acids	2.21	2.36	3.5
Tyrosine	2.02	1.66	-
Phenylalanine	5.21	5.94	-
Total aromatic amino acid	7.23	7.60	6.00
Threonine	2.21	3.43	4.00
Leucine	11.85	10.76	7.00
Isoleucine	5.73	5.28	4.00
Lysine	1.36	2.10	5.50
Valine	7.44	7.57	5.00
Tryptophan	ND	ND	1.00
Total non-essential amino acid	38.03	39.1	36.00
Histidine	1.98	2.32	-
Arginine	7.19	11.38	-
Aspartic acid	7.60	8.35	-
Glutamic aid	20.50	18.25	-
Serine	2.73	2.8	-
Glysine	0.84	2.19	-
Alanine	10.40	8.71	-
Proline	9.74	6.	-
Total non-essential amino acid	60.98	60.97	-

Note: level of blends; KH = (6 kisra assala: 1 sesame seeds), KHS2 (4 Kisra assala: 2 Seinat flour).

Table 4. Mean score for sensory attributes of various types of Khemiss-Tweira.

Product	Appearance	Texture	Color	Flavor	Overall acceptability
KH	6.16_{b}	6.66_{d}	6.83_{f}	7.00_{g}	7.00_{k}
KH1	7.00_{ab}	7.41_{cd}	7.66_{ef}	7.66_{g}	7.33_{k}
KH2	7.83_{ab}	7.91_{c}	8.08_{e}	7.30_{g}	7.91_{k}

Any two mean values having different superscript letter(s) in each column differ significantly ($p>0.01$ and <0.05); KH = 6 Kisra assala: 1 sesame seeds; KH1 = 4 Kisra assala: 1 Seinat seeds flour; KH2 = 4 Kisra assala: 2 Seinat seeds flour.

The *in vitro* protein digestibility values obtained here is comparable to the findings of Mohammed who reported a value of 80-84% for sorghum bread (Kissra) supplemented with 30% of defatted sesame flour and the finding to Sulieman *et al.* (2003) who reported values of 83.6% to 84.2% for cookies fortified with 10-30% cow pea flour. The results reported in Table 3 shows the amino acid composition of the three types of Khemiss-Tweira. There is an increase in the amount of the total essential amino acids in the developed Khemiss-Tweira product (KHS2) in comparison with the conventional Khemiss-Tweria (KH). There is also an increase in the amount of sulphur-containing amino acids as well as lysine. As shown in Table 4, the two types of Khemiss-Tweira made from different blends of dry kisra assala using low fiber Seinat seed flour did not show any significant differences as regard to the overall acceptability in comparison to the control one. The results reported here show no significant difference in flavor and overall acceptability between the control sample (KH) containing sesame seeds and the samples (KHS1) and (KHS2) containing Seinat seeds flour. However, the panelists gave higher scores for Khemiss-Tweira that contained 4:2 dry kisra to Seinat seeds flour. There were significant differences in appearance, texture and color between sample (KHS2) and the control sample (KH) whereby (KHS1) and (KHS2) showed superiority to the control sample. Generally the panelists accepted the KHS2 type than the other types. This is an indication of a great potential for the utilization of Seinat flour in the production of this traditional food, which will add value to this neglected crop.

Conclusion

It could be concluded that the nutritive value of Khemiss-Tweira was improved as a result of substitution of sesame seeds by the Seinat seeds flour and that these newly developed types of Khemiss-Tweira, especially the KHS2 were highly acceptable. The Seinat seeds flour addition also resulted in an increase in the protein *in vitro* protein digestibility and increased the amount of the essential amino acids particularly lysine and the sulphur containing amino acids.

Acknowledgements

We express our gratitude to the laboratories staff members of Food Technical Dept., Nyala Technical College and University of Gezira for their assistance during the period of the study.

References

1. AACC. 1983. Method 46–13. Crude protein micro Kjeldahl method. In: Christensen EA (ed) Approved methods of the AACC. American Association of Cereal Chemists, St. Paul, MN.
2. AOCS. 1985. Official Tentative Methods of Analysis 4th edition American Oil Chemists society. Champaign, 111. USA.
3. AOCS. 1995. Official and Tentative Methods of the A.O.C.S., 4th edition. American Oil Chemists' Society, Champaign, IL.
4. Bernardini, E. 1986. Oilseeds, oils and fats encyclopedia. Rome, B.E. oil tech publ. House 2nd edition.
5. Dirar, H.A. 1993. The indigenous fermented foods of the Sudan and Nutrition. A study in African food and nutrition. 1st edition, Cambridge university press, Cambridge, UK, pp.169-176.
6. Duncan, D.B. 1995. Multiple range and multiple F test. *Biometr.* 11: 1-42.
7. Elseed, A.N.B. 2008. The effect of sesame paste centrifugation on Thania confection quality and the quality characteristics of the separated oil. M.Sc., university of Gezira, Wad Medani, Sudan. 2008.
8. FAO/WHO. 1973. Energy and protein requirements. Report of FAO nutritional meeting series No. 52, FAO, Rome
9. Hsu, H.W., Vavak, D.L, Salter L.D. and Miller, G.A. 1977. A multienzyme technique for estimating protein digestibility. *J. Food Sci.* 42: 1269-1273.
10. Larmond, E. 1977. Laboratory Methods for sensory evaluation of food Research Branch, Canada, Department of agriculture, Publication 1637 Oltawa, Canada.
11. Mohammed, E. and Pitrat, M. 1999. Tibish, melon type from Sudan. Cucurbit genetics cooperative report. INRA Station, Monfavet codex, France, 22:21-23.
12. Mohammed, S.A., Ali, A.O. and Elkhalifa, E.A. 2007. Supplementation of fermented sorghum bread (Kisra) with defatted and defatted sesame flour, Gezira. *Agri. Sci.* 5(2): 181-189.
13. Moore, S. and Stein, W.H. 1963. Chromatographic determination of amino acids by automatic recording equipments. In methods of enzymology, S.P Colowick of N.O. Kaplan Academic Press, New York.
14. Pitrat, M., Hanelt, P. and Hammer, K. 2000. Some comments on intraspecific classification of cultivars of melon. Proc. Cucurbitaceae 2000 Eds. N. Katzir and H.S. Paris, *Acta Hort*. 510: 29-36.
15. Satterlee, L.D., Marshall, H.F. and Tennyson, J.M. 1979. Measuring protein quality. *J. Am. Oil Chem. Soc*. 56: 103-109.
16. Sulieman, A.M.E., Osman, Y. and Yousif, H. 2003. Nutritional aspects of cow pea *(Vigna unguiculata)* fortified cookies. *Agri. Sci.* 11(3): 10-13.
17. Swern, D. 1979. Baily's industrial oil and fat products. Vol. 1, New York, Wiley, 4th edn., pp.179-203.