Nutritional and Sensory Quality of Kocho Mixed with Whole Soybean and Okara

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Kocho (flat bread) is one of the food products made from enset, a staple food consumed by about 20% of the Ethiopian population. It is good sources of minerals, vitamins and carbohydrate, but low in protein and fat contents. Fortification of kocho with protein and fat rich sources like soybean can makes it nutrient dense food. Thus, the present study was aimed to fortify kocho by incorporating soybean flour and okara, and evaluate its nutritional value and sensory acceptance. Kocho was mixed with whole soybean and okara flours in seven different proportions. Five point hedonic scales and AOAC methods were used to evaluate the sensory quality and proximate analysis of formulated kocho samples respectively. Sensory evaluation results showed that all the formulations were in the acceptable limits. Moisture, ash, fat, protein, fiber and carbohydrate contents of kocho was in the range of 6.81-9.41, 2.85-5.50, 3.87-10.08, 3.32-14.82, 1.61-2.98 and 60.36-78.29%, respectively. The addition of both whole soybean and okara flours significantly increased the protein and fat contents. The promotion of such important products for the users can improve the nutritional profile especially protein content of kocho products. Therefore, popularization of this product to end users is mandatory for the future.

Keywords: Soybean, okara, kocho, proximate composition, sensory quality

The problem of food and nutrition security remains a key main health and development issue in Ethiopia. With 38% of children less than five years stunted, 10% wasted and 21% of the total population undernourished, the country has one of the highest levels of chronic under nutrition in the world (FAO, 2018). Due to the high cost of protein rich foods like animal protein, the low income society are hardly able to get access to adequate protein. Food formulations help to enrich low protein content foods with other protein-rich foods to solve problems of malnutrition.

Enset (*Ensete ventricosum*) is the basis for the staple food consumed by about 20% of the Ethiopian population (Birmeta *et al*., 2004). It is relatively tolerant

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nourishment of the Ethiopian population even at extreme weather conditions. Though enset can be grown in many regions of Ethiopia, mostly the inhabitants of the central and southwestern parts are growing and using enset as a staple and co-staple crop. Owing to its multi-purpose application and adaptability, there is a potential to expand its production to other regions of Ethiopia and other African countries (Birmeta *et al*., 2002, Birmeta *et al*., 2004 and Daba and Shigeta, 2016). Kocho is one of the food products prepared from enset by spontaneous fermentation of decorticated and pulverized pseudo-stem and corm sections (Birmeta *et al*., 2002). It is the bulk of the fermented starch obtained from the mixture of the decorticated (scraped) leaf sheaths and the grated corm (Kalekirestos *et al*., 2010) and prepared by fermenting the product; baked as thin bread. Kocho is a good source of carbohydrate, Ca and Fe (Atlabachew and Chandravanchi, 2008), but is low in protein and fat.

On the other hand, legumes are most important sources of food in terms of energy as well as nutrients including protein and fats. Soybean (*Glycine max* L) is a legume widely grown for its high nutritional value, long storage times and relatively low cost in comparison to animal products. It is becoming popular in the country; and contains 40% good quality protein, 20% fat, 23% of carbohydrate and a reasonable amount of minerals and vitamins and is excellent healthy food (Slavin and Koecher, 2014). In addition to enhancing protein and fat levels, soybean addition believe to improve

Disintegrator) to obtain soybean flour as per the procedures in literature (Nwakalor and Obi 2014).

The cleaned soybean seeds were boiled in water for 10 minutes followed by discarding the hot water, soaked at ambient temperature for 12 hours, washed, and hulls removed. Then, rinsed with water and blended using juice machine (GSB-1514, Dubai, and U.A.E) and cooked at 100^{o}C for 20 minutes. The soybean milk was filtered out by using white cheese closs and collected in pre-prepared container. The remaining residue (Okara) after filtering the soymilk using cheese cloth was collected, dried and milled again as flour for blending following the procedure in literature (Alpaslan and Hayta, 2002).

Flours of kocho, whole soybean and okara were mixed as in table 1.

Kocho was prepared in a normal k*ocho* preparation procedures. The blended flour was initially mixed well, water was added, and then, followed by kneading and baking on a flat griddle (Metad) by wrapping with enset leaf to obtain flatbread (kocho). The kocho was drawn from the griddle and presented for sensory evaluation after cooling to ambient temperature for 1 hr. Kocho samples were dried for 24 h at 65 °C in an oven and ground for proximate analysis.

A semi-trained panel (a panel briefed about the scoring of sensory attribute) of 35 people evaluated each product in duplicate using a five-point hedonic scale (1= dislike very much, 2= dislike moderately, 3= neither like nor dislike, 4= Like moderately and 5=like very much). The attributes evaluated were texture, taste, color and overall acceptability (Kolapo and Oladimeji, 2008).

Crude protein, crude fat, crude fiber, moisture and ash contents of the samples (kocho, soyben flour, okara and composite products) were determined at Food Science and Nutrition laboratory of Ethiopian Institute of Agricultural Research in

Addis Abeba following standard methods (AOAC, 2016). Total carbohydrate was calculated by difference: 100 - (% Moisture +% Crude protein +% Crude fat +% Crude fiber + % Ash) (Polycarp *et al*., 2012). Energy value per 100 g was calculated using the Atwater conversion factors, where E (kcal per 100 g) [9 X crude fat (%) + 4 x crude proteins (%) + 4 x total carbohydrates (%)] (Osborne and Voogt, 1978).

The collected data were subjected to ANOVA by using SAS software version 9.3. Separation of the mean values was carried out using least significant difference (LSD) test at $p < 0.05$.

The proximate composition and energy content of the ingredients used in formulation are presented in table 2. The average moisture content of okara, soybean flour and kocho are 8.1%, 6.29 and 9.26% respectively. The average protein content of okara was 39.59% which was slightly higher than reported (31.7%) by Katayama and Wilson (2008). The higher protein content might be due to difference in variety and growth condition of the soybean. Likewise, the average fat content (26.14%) of okara reported in this study is higher than the value (14.7%) reported by these authors which may again be attributed to difference in variety and growth condition of the soybean.

The flour of soybean variety used in this study contains about 42.82% protein. This value is in appreciable agreement with previously reported 46.06% protein content of soybean flour in a literature (Redondo-Cuenca *et al*., 2007). Such high protein content of soybean flour and product makes it preferable source of protein for fortification of low protein food like kocho. Average fat content of 27.90% was also recorded for soybean flour. Being appreciable fat source is also an advantage of soybean to be considered for different food product fortification.

of protein content (3.47-4.07%) reported in previous study (Kelbessa *et al*., 2017). Similarly, average fat content of kocho (0.38%) obtained in the current study is in agreement with the result reported (0.42- 0.53% fat) by Kelbessa *et al*. (2017). The average fiber, ash, carbohydrate and energy contents reported in this study for all the ingredients are also indicated in the table 2 above. These reported values are also appreciable in soybean based products.

Proximate results of whole soybean and okara fortified kocho are presented in Table 3. Moisture content of the blend kocho was ranged from 6.81% to 9.41%, crude fat from 3.81% to 10.08%, protein from 3.32% to 14.82%, crude fiber from 1.64% to 2.98%, ash from 2.85% to 5.50%, carbohydrate from 60.36% to 78.29%, and energy(*kcal)* from 362.36 to 389.84. Crude fat and protein contents were increased significantly ($p<0.05$) as incorporation of soybean flour and okara increased. The fat content of control kocho was 3.81% and was increased to 10.08% fat for 80%kocho with 20% soybean flour. Similarly, the protein content also was increased from 3.32% for control to 14.82% protein content for 20% soybean flour substitution. In similar manner, partial substitution of kocho with okara also improved the protein and fat contents. Though it was not in a proportional way, addition of both soybean flour and okara significantly increased the ash content of kocho. The carbohydrate content of kocho-okara formulation, in general, was higher than those of kocho-soybean flour formulations (Table 3).

The sensory result of kocho fortified with soybean flour and okara is presented in Table 2. The sensory evaluation ranged from 3.30 to 4.28 for appearance, 3.55 to 4.12 for flavors, 3.46 to 4.16 for mouth feel and 3.47 to 4.17 for overall acceptability. According to the result of sensory evaluation, the kocho fortified with okara and soybean flour is generally acceptable scoring higher than three score out of five in all sensory parameters. The appearance of the kocho was

found to be slightly better when partially substituted with okara. The difference in sensory score given for flavor, mouth feel and overall acceptability are statistically non-significant for all proportions evaluated in this research. The sensory evaluation result indicated that up to 25% whole soybean and okara flour can be added to prepare acceptable kocho in sensory quality.

The present study demonstrated that addition of both whole soybean and its product okara can enhance protein and fat contents of kocho with acceptable sensory quality. This in turn shows that the product can enhance household food and nutrition security for the growing population of Ethiopia where protein-energy malnutrition affects a greater part of the country. The substitution level evaluated in the current study was only up to 25% and further study is required to investigate more substitution levels.

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