

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

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**Abstract:** 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. Formulation of kocho with protein and fat rich sources like soybean can makes it nutrient dense food. Thus, the study was aimed to formulate kocho with 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 kocho samples respectively. Sensory evaluation results showed that all the formulations were in the acceptable range. 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 significantly increased the protein and fat contents. Therefore, it is possible to improve nutritional quality of kocho by partially substituting with soybean flour and okara without considerable effect on consumer acceptance of the product. The substitution level evaluated in the current study was only up to 25% and further study is required to investigate the impact of more substitution levels.

**Keywords:** Soybean, Okara, Kocho, Proximate Composition, Sensory Quality

## 1. Introduction

The problem of food and nutrition security remains the main health and development issue in our country, 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 [1]. Due to the high cost of protein rich foods like animal protein, the low income and rural society are hardly able to get access to adequate protein. Food formulations technologies help enrich the food with low protein content with 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 [2]. It is relatively tolerant against drought, heavy rains and flooding,

and the crop has the potential to ensure 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 only are growing and using enset as a staple and co-staple crop. Owing to its multi-purpose application and its robustness, there is a potential to expand its production to other regions of Ethiopia and other African countries [2-4]. Kocho is one of the food products generated from enset by spontaneous fermentation of decorticated and pulverized pseudo-stem and corm sections [2]. It is the bulk of the fermented starch obtained from the mixture of the decorticated (scraped) leaf sheaths and the grated corm [5]. and prepared by fermenting the product; baked as a thin bread. Kocho is a good source of carbohydrate, Ca and Fe [6], but is low in protein and fat.

On the other hand, legumes are most important sources of

food supply in terms of food energy as well as nutrients including protein and fats. Soybean (*Glycine max* L) is a legume widely grown for its edible bean which has 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 [7]. In addition to enhancing protein and fat levels, soybean addition believe to improve the organoleptic profile of kocho based foods such as crust color, crumb body, resilience, toasting characteristics and shelf life due to the presences of essential fatty acids and amino acids [8, 9]. Thus, the study was aimed to formulate kocho with soybean flour and okara, and evaluated its nutritional value and sensory acceptance.

## 2. Materials and Methods

### 2.1. Sample Collection and Preparation

#### 2.1.1. Kocho and Soybean Flour

The squeezed out and ready kocho was bought from Jimma market and pulverized into flour and then sieved as indicated in literature [10]. Powder of fermented Kocho is popular in market for baking (bread, injera), and porridge. One Soybean varieties (Clark 30Kg) were collected from the soybean breeding research program of Jimma Agricultural Research Center and cleaned, roasted, hulls removed and milled using grain miller (FW 100 High-Speed Universal Disintegrator) to obtain soybean flour as per the procedures in literature [11].

#### 2.1.2. Okara Preparation

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) and cooked at 100°C for 20 minutes. The remaining residue (Okara) after filtering the soymilk using cheesecloth was collected, dried and milled again as flour for blending following the proposed procedure in literature [12].

#### 2.1.3. Formulation of Blends

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

**Table 1.** Formulations of kocho with soybean flour and okara.

Treatments	Formulation proportions		Treatments	Kocho-Okara
	Kocho-soybean flour			
1	85:15	4	85:15	
2	80:20	5	80:20	
3	75:25	6	75:25	
		7 (Control)	100% Kocho	

#### 2.1.4. Kocho (Flat Bread) Preparation Procedure

Kocho was prepared in a normal kocho 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 flat bread (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.

### 2.2. Sensory Analysis

A semi-trained panel (a panel briefed about the scoring of sensory attribute) of 35 people, who were consuming kocho, evaluated in duplication by using a five-point hedonic scale (1= dislike very much, 5=like very much). The attributes evaluated were texture, taste, color and overall acceptability were studied following method indicated in literature [13].

### 2.3. Proximate Analysis

Crude protein, crude fat, crude fiber, moisture and ash contents of kocho samples were determined following standard method [14]. Total carbohydrate was calculated by difference:  $100 - (\% \text{ Moisture} + \% \text{ Crude protein} + \% \text{ Crude fat} + \% \text{ Crude fiber} + \% \text{ Ash})$  [15]. Energy value per 100 g was calculated using the Atwater conversion factors, where E (kcal per 100 g)  $[9 \times \text{crude fat} (\%) + 4 \times \text{crude proteins} (\%) + 4 \times \text{total carbohydrates} (\%)]$  [16].

### 2.4. Statistical Analysis

The 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  $p < 0.05$ .

## 3. Results and Discussions

### 3.1. Proximate Compositions and Contents of Okara, Soybean Flour and Kocho

The proximate composition and energy content of the ingredient used in formulation were given in table 2 below. The average moisture content of okara, soybean flour and kocho are indicated in the table to range from 6.29 for soybean flour to 9.26% for okara. The average protein content revealed for okara, soymilk byproduct by this study was 39.59% which was slightly higher than the report (31.7%) by [17]. Slightly higher protein content reported here might be attributed to difference in variety and growth condition of the soybean. Likewise, average fat content of okara reported by this research 26.14% is also slightly higher than the value (14.7%) fat reported in previous study [17] 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 [18]. Such high protein content of soybean flour and product makes it preferable source of protein for fortification low protein food like kocho of this study. Similarly, average fat content of 27.90% for soybean

flour was reported in this study. This value is also in line with the previous fat content reported for soybean flour (20.03%) by [18]. Being appreciable fat source is also an advantage of soybean to be considered for different food product fortification.

**Table 2.** Proximate compositions and contents of okara, soybean and kocho flour.

Parameters	Okara	Soybean flour	Kocho
Moisture	8.10	6.29	9.16
Protein	39.59	42.82	3.32
Crude fat	26.14	27.90	0.38
Crude fiber	4.76	2.77	2.58
Ash	4.55	5.01	2.85
Carbohydrate	16.86	15.01	78.29
Energy	461.05	483.22	362.36

According to the finding of this study, the average protein and fat contents of kocho flour is as low as 3.32 and 0.38% respectively. The protein content reported in this study is therefore in line with range of protein content (3.47-4.07%) reported in literature [19]. Similarly, average fat content of kocho (0.38%) reported in this study is in agreement with the result reported (0.42- 0.53% fat) by [19]. It is based on this base line that fortification of kocho with high protein and fat source legumes like soybean was implemented.

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 except carbohydrate content.

### 3.2. Sensory Evaluation

The sensory result of kocho fortified with soybean flour and okara flour is presented in Table 3. The sensory evaluation ranged from 3.30 to 4.28 for appearance, 3.55 to 4.12 flavors, 3.46 to 4.16 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 sensory score 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 kocho fortified with both soybean flour and okara were in acceptable range in all parameters up 25%.

**Table 3.** Sensory results of soybean fortified kocho.

Treatment	Appearance	Flavor	Mouthfeel	Overall acceptability
2	3.30 <sup>b</sup>	3.59 <sup>ab</sup>	3.46 <sup>a</sup>	3.54 <sup>a</sup>
1	3.42 <sup>b</sup>	3.62 <sup>ab</sup>	3.58 <sup>a</sup>	3.47 <sup>a</sup>
3	3.44 <sup>b</sup>	3.55 <sup>a</sup>	3.59 <sup>a</sup>	3.67 <sup>a</sup>
4	3.75 <sup>ab</sup>	3.74 <sup>ab</sup>	3.91 <sup>a</sup>	3.79 <sup>a</sup>
5	3.83 <sup>ab</sup>	3.99 <sup>ab</sup>	3.91 <sup>a</sup>	4.03 <sup>a</sup>
6	3.62 <sup>ab</sup>	3.74 <sup>ab</sup>	3.87 <sup>a</sup>	3.74 <sup>a</sup>
7	4.28 <sup>a</sup>	4.12 <sup>a</sup>	4.16 <sup>a</sup>	4.17 <sup>a</sup>
Mean	3.66	3.76	3.78	3.77
CV (%)	9.15	5.94	8.72	7.91

Means with the same letter in a column are not significantly different ( $p>0.05$ ) T<sub>1</sub>=80% kocho& 20% soy flour, T<sub>2</sub>=85% kocho& 15% soy flour, T<sub>3</sub>=75% kocho&25% soy flour, T<sub>4</sub>=80% kocho& 20% okara, T<sub>5</sub>=85% kocho&15% okara, T<sub>6</sub>=75% kocho&25% okara, T<sub>7</sub>=100% kocho

### 3.3. Proximate Analysis

Proximate results of whole soybean and okara fortified kocho are presented in Table 3. Moisture content of the blend kocho were ranged from 6.81% to 9.41%, crude fat from 3.87% to 10.08%, protein from 3.32% to 14.82%, crude fiber from 1.61% 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 kocho with okara can also improve the protein and fat content of kocho. 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). Composition analysis of Kocho indicated that kocho has high carbohydrate and low protein content [6].

**Table 4.** Composition analysis of soybean and okara flour fortified kocho.

Treatment	Moisture	Protein	Crude fat	Crude fiber	Ash	Carbohydrate	Energy
1	7.60 <sup>cd</sup>	10.63 <sup>b</sup>	10.08 <sup>a</sup>	2.42 <sup>abc</sup>	4.58 <sup>ab</sup>	64.68 <sup>cd</sup>	386.98 <sup>ab</sup>
2	6.81 <sup>d</sup>	14.82 <sup>a</sup>	9.53 <sup>a</sup>	2.98 <sup>a</sup>	5.5 <sup>a</sup>	60.36 <sup>d</sup>	386.51 <sup>ab</sup>
3	8.55 <sup>ab</sup>	10.62 <sup>b</sup>	9.517 <sup>a</sup>	2.14 <sup>bc</sup>	4.50 <sup>ab</sup>	64.68 <sup>cd</sup>	386.85 <sup>ab</sup>
4	9.41 <sup>a</sup>	6.92 <sup>bcd</sup>	7.29 <sup>ab</sup>	1.94 <sup>bc</sup>	3.04 <sup>bc</sup>	71.40 <sup>b</sup>	372.22 <sup>ab</sup>
5	7.82 <sup>bc</sup>	5.13 <sup>cd</sup>	7.85 <sup>a</sup>	2.29 <sup>abc</sup>	3.93 <sup>abc</sup>	72.99 <sup>ab</sup>	376.46 <sup>ab</sup>
6	8.52 <sup>ab</sup>	7.63 <sup>bc</sup>	9.53 <sup>a</sup>	1.64 <sup>c</sup>	3.05 <sup>bc</sup>	69.63 <sup>bc</sup>	389.84 <sup>a</sup>
7	9.16 <sup>a</sup>	3.32 <sup>d</sup>	3.81 <sup>b</sup>	2.58 <sup>ab</sup>	2.85 <sup>c</sup>	78.29 <sup>a</sup>	362.36 <sup>b</sup>
Mean	8.27	8.44	8.23	2.28	3.92	68.86	380.17
CV (%)	6.37	26.78	25.81	20.27	23.36	4.47	4.01

Means with the same letter in a column are not significantly different ( $p>0.05$ .) T<sub>1</sub>=80% kocho & 20% soy flour, T<sub>2</sub>=85% kocho& 15% soy flour, T<sub>3</sub>=75% kocho&25% soy flour, T<sub>4</sub>=80% kocho&20% okra, T<sub>5</sub>=85% kocho&15% okra, T<sub>6</sub>=75% kocho&25% okra, T<sub>7</sub>=100% kocho.

## 4. Conclusion and Recommendation

The study has demonstrated that addition of both whole soybean and its byproduct 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%. Further study however is required to investigate the impact of substitution of soybean and okara flour to higher levels.

Therefore, it is very important to consider the use of soybean and byproduct (okara) while preparing kocho from enset both at household and different restaurants at inclusion level as high as 25% on the basis of this research report. This however is possible if the extension and demonstration activities performed to the required level and thus the extension and demonstration work will be the next part of this work by Jimma Agricultural Research Center of Ethiopian Institute of Agricultural Research. Furthermore, the work related to the industrialization of such tradition products in our country Ethiopia is less or not addressed so far and needs more and more research attentions in the future.

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