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Evaluation of Injera Prepared from Composite Flour of Teff and Barley Variety

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Abstract
Ethiopians are dependant on teff flour to make injera as staple food in Ethiopia ,although injera could be made from different cereals . The price of teff is high and the yield is low. Thus finding alternative cheaper grain and developing blend teff improved variety and barley improved variety in different ratio with acceptable and improved nutritional value would be important . this study was conducted to evaluate the nutritional value and sensory quality of injera made from a blend of teff and barley with different ratio with 10 % interval 100,90,80,70,60,50 % the nutritional value was determined using official methods and the sensory evaluation of injera was conducted at Holeta research center food science and nutrition food product development in duplicate. The result reveled that among the treatments the micro nutrients Fe and calcium were improved and the sensory quality such as taste,color and texture were good.from the study result injera quality ranked Treatment 1 up Treatment 5 could be used as an alternative option for injera utilization and provide nutritional benefit to consumers.
Keywords: Nutritional value,blend ,injera quality
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Introduction

Injera is thin, fermented Ethiopian traditional bread made from flour, water and starter (*ersho*), which is a fluid, saved from previously fermented dough. Teff *(Eragrostis tef (Zucc)* Trotter) is the most popular grain for making *injera*, although other grains such as sorghum, maize, barley, wheat and finger millet are sometimes used(Ashagrie,.2012). Teff grain flour is widely used in Ethiopia for making *injera* (staples for the majority of Ethiopians, a fermented, pancake-like, soft, sour, circular flatbread), sweet unleavened bread, local spirit, porridges and soups(Ebba,1969). There is a growing interest on teff grain utilizations because of nutritional merits (whole grain), the protein is essentially free of gluten the type found in wheat (alternative food for consumers allergenic to wheat glutens)(Dekking *et al*,2005). The grain proteins are also presumed easily digestible because prolamins are very small (NAC,1996). Teff grain micronutrient is also apparently high. Particularly in iron, a result of agronomic practices used in Ethiopia and fermentation on *injera* making(Urga.*et.al*,1997).

Because of this, the prevalence of iron deficient anemia among teff *injera* consumers in Ethiopia is low. *injera* making and keeping quality features, teff grain appeared superior among other cereal grains. Injera is widely used food in Ethiopia. Improving the nutrient composition help people from nutrient security as well as minimize cost by mixing teff in to other grain flour such as Maize, barley and wheat. Low cost and nutrient dense food formulation is limited in the country. Therefore this study were conducted to solve food and nutrition security problem .In this case incorporating the Barley flour with Teff flour can produce low cost and nutrient dense injera in order to influence food and nutrition security positively.

Material and Methods

Plant Materials

The plant material was collected from the teff breeding and barley breeding program from Holeta research center. Both the plant materials were the new variety (the improved variety). Experiments were carried out in the Ethiopian Institute of Agricultural Research Food science and Nutrition Laboratory during the study period.

Preparation of the Blends and Preparation of *Injera*

The teff *injera* samples and mixed Injera sample were prepared in the laboratory the same way as done traditionally in every household (Table 1). Accordingly, teff flour was mixed with clean water and was knead by hand in a bowl in the traditional way. The resultant dough were allowed to ferment for 3 days at ambient temperature. After this primary fermentation, the surface water formed on the top of the dough were discarded. For every 1kg of original flour, 200ml of the fermented mixture were mixed and with 400 ml of water and brought to boil (traditionally known as '*absit*' making).Then Injera were prepared

Nutrient Analysis

The Association of Official Analytical Chemist (AOAC) procedure was used to determine the nutrient compositions (crude protein, moisture content, crude fat, total ash, dry matter) of the Teff, barley flour and Injera

samples made from the blends of the above flours. For mineral determination, wet digestion of the all samples was carried out according to the method of (Jones et al.,) Calcium, zinc and iron was determined by atomic absorption spectrophotometer while, potassium was measured through flame photometer.

Sensory Evaluation of injera

The Injera samples were coded and randomly presented to the 16 panelists. In sensory evaluation a five point hedonic scale (1= dislike very much, 2= dislike, 3= neither like nor dislike, 4= like, 5= like very much) were used. The samples in terms of color, eye evenness, appearance, flavor, taste, texture and overall acceptability.

Statistical Analysis

The quality characteristics of flours, as well as the baking test results of products was analyzed by one-way ANOVA (Analysis of Variance) using statistical tools of SPSS version 22.

Formulation

Table 1: Formulation of *Injera* from teff (Kuncho variety) and barley (EH-1807)

Treatment	Teff flour (gram)	Barley flour (gram)
T1	100	0
T2	90	10
T3	80	20
T4	70	30
T5	60	40
T6	50	50
T7	100	0

Table 2: Ingredients for *Injera* formulation

Ingredients	Quantity in grams
Water	100ml
Yeast (from a fermented mixture)	40ml
Water	112.25ml
Absit	150ml

Result and Discussion

Table 3: Functional property and nutrient content of teff flour and barley flour.

Flour	Water absorption	Moisture content	Protein content	Fat
Teff (kuncho)	3.00±0.00	29.37±0.00	13.12±1.68	3.85±0.00
Barley (EH-1807)	3.25±0.00	29.16±0.34	9.80±0.29	1.65±0.00

Table 4: Nutrient content of formulated *Injera*

Treatment	Moisture content	Ash	Protein content	Fat
T1	6.75±0.75	2.00 ± 0.00^{b}	15.09 ± 0.56^{a}	2.50±0.10
T2	5.25±0.25	1.50 ± 0.00^{b}	13.44 ± 0.16^{b}	2.25±0.15
T3	5.50±0.00	2.00 ± 0.00^{b}	14.1 ± 0.39^{ab}	2.35±0.15
T4	5.50±0.50	1.75 ± 0.25^{b}	14.50 ± 0.18^{ab}	2.40±0.10
T5	5.75±0.25	1.75 ± 0.25^{b}	14.24 ± 0.63^{ab}	2.70±0.10
T6	5.25±0.25	1.75 ± 0.25^{b}	13.86 ± 0.15^{ab}	2.75±0.05
T7	5.50±0.00	2.75 ± 0.25^{a}	11.84 ± 0.14^{c}	2.40±0.10

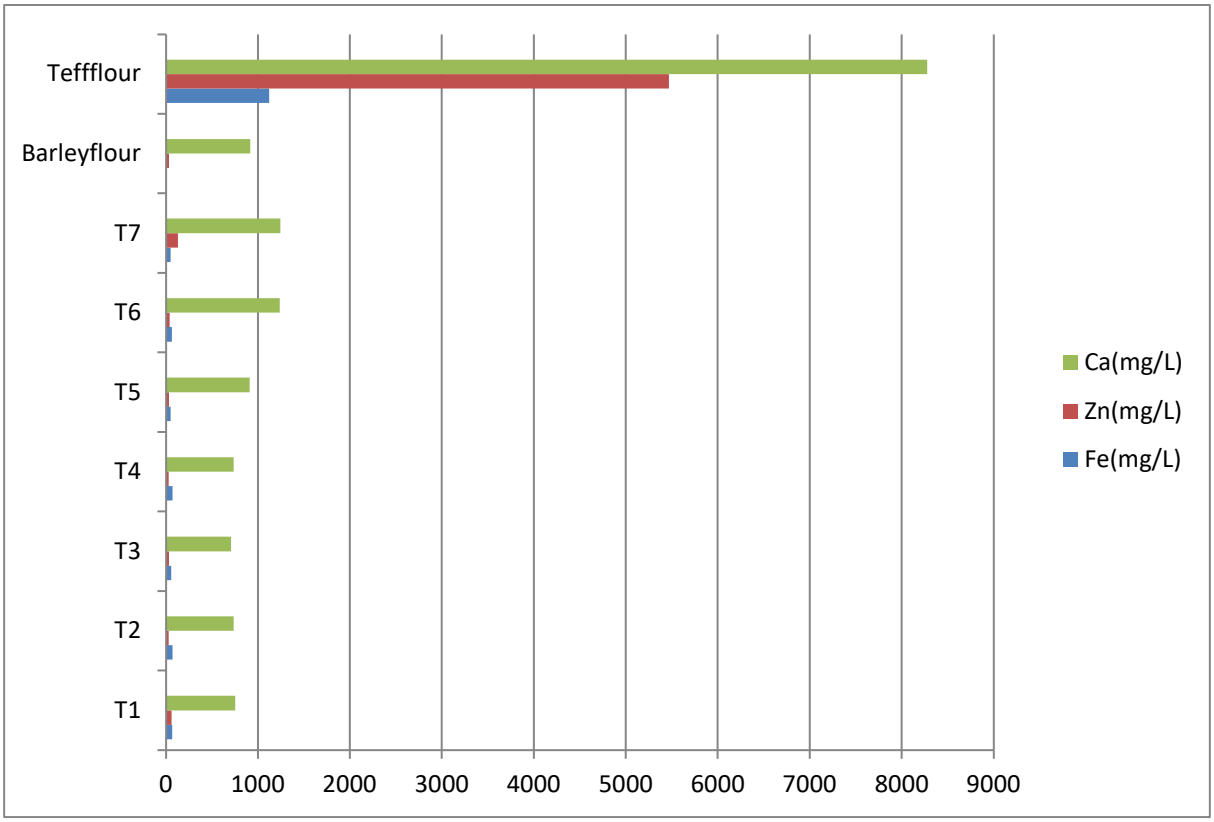

Figure 1. Mineral content of Formulated *Injera*

Table 5: Sensory data using five point hedonic scales

Treatment	Taste	color	Texture	Eye distribution	Over all
T1	4.00±0.37^{a}	4.06±0.31^{ab}	3.62±0.37^{a}	3.93±0.43^{a}	3.81±0.31^{a}
T2	3.25±0.12^{bc}	3.62±0.00^{abc}	3.31±0.18^{ab}	3.18±0.06^{c}	3.50±0.12^{ab}
T3	3.25±0.25^{bc}	3.25±0.12^{cd}	2.87±0.12^{bc}	3.25±0.12^{bc}	2.93±0.06^{b}
T4	2.68±0.18^{c}	2.75±0.12^{d}	2.50±0.12^{c}	1.75±0.00^{d}	2.12±0.00^{d}
T5	3.75±0.00^{ab}	3.75±0.12^{abc}	3.31±0.18^{ab}	2.87±0.12^{c}	3.37±0.12^{ab}
T6	3.50±0.125^{ab}	3.50±0.00^{bc}	3.43±0.18^{ab}	3.43±0.18^{abc}	3.50±0.37^{ab}
T7	4.120.125^{a}	4.18±0.18^{a}	3.75±0.12^{a}	3.87±0.00^{ab}	4.00±0.12^{a}

Result and Discussion

According to the functional property and Nutrient content of Teff flour and Barley flour the water absorption of barley flour is better compared to teff flour while the protein content and fat content of teff flour is higher compared to barley flour. The nutrient content and sensory result for the treatments (products) for protein content and ash content there were significantly different at($p<0.05$).Teff flour were better in calcium, iron, zinc and protein content than barley flour. The measured values were higher than those measured in staple cereal crops such as rice, wheat, maize and sorghum (Moreno et al., 2014). Were as in the blended form iron and calcium content of the product (*Injera*) were improved. As a result the micronutrients in the product can be improved in the blended form of Teff and Barley Injera by considering the economic benefit (low cost crop Barley) and high cost crop (teff).

The sensory quality evaluation result has demonstrated that injera made from teff had an excellent preference score compared to injera made from barley (HB-1307). In this study the sensory result shows T2,T5 and T6 is preferable sensory result compared to the reference (standard) T1. From all the Treatments (T2, T5, T6) is preferred formulation for accepted products for Injera. Injera made from different ratio used as a substitute to teff with reasonably fair cost and better nutritional value. while in rural areas farmers have experience in consuming injera made from barley flour alone as well as blending with teff. Zegeye (1997) also reported siginificant difference in acceptability of injera made from teff,sorghum,barley and maize cultivars. Study on sensory quality evaluation of injera made from different barley variety abraha et al (2013) reported that a very good quality injera comparable to teff was produced from improved barley variety.

Conclusion

From the current study the very good sensory result and nutrient content were observed for the treatments T2, T5, T6 implies that the ratio of blending could be used as substitute to the teff flour both in the urban towns and in the rural communities. More over consumers benefited from the use of injera made from this different ratio blend of teff and barley flour due to their enhanced nutritional content as well as the economic advantage due to lower prices of barley compared to teff.

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