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Review paper

Evaluation of bread prepared from composite flour of sweet lupine and Bread wheat variety

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Sweet lupine is high in protein and dietary fiber. Incorporating sweet lupine flour with wheat produces more nutritious food. In the study the samples sweet lupine and wheat flour were collected from Holeta crop breeding and the bread product were made incorporating the sweet lupine (welela variety) flour with wheat flour (Dendea variety). The bread product were made with five interval from each treatment from Treatment 1 (100 wheat flour) control up to Treatment 9 (60 wheat flour: 40 sweet Lupine flour).From the bread product the nutritional and sensory data were collected. The result for the treatments Treatment1 up to Treatment6 (75 wheat flour: 25 sweet lupine flour) had high value in protein (11.68-20.74%) and Calcium, Zinc as well as color of bread (4.0-4.57) and taste Treatment 1-Treatment 6 (3.71-4.78). From all the treatments Treatment1- Treatment 6 had high nutritional and sensory result.

Key words: sweet lupine, Nutrition and sensory

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INTRODUCTION

Lupine flour was officially introduced as a food ingredient in the UK in 1996, in France in 1997, and in Australian 2001. Lupine is uniquely high in protein (30-40%) and dietary fiber (30%), and low in fat (4-7%). Nutrition and medical scientists are researching the health benefits of lupine, which could potentially play a role in combating obesity and its associated health problems of diabetes and heart disease.

Yeast-raised bread is highly favored worldwide because of its desirable sensory attributes. The quality and quantity of the protein in the wheat grain has very close relationship with bread making potential. The increase in protein content can improve the baking quality as a function of qualitative nature of gluten composition. Wheat protein is deficient in some essential amino acids, especially lysine which is the first limiting amino acid in wheat (Kent and Evers., 1994). This deficiency results in lowering the protein nutritional quality of products made from wheat flour (Wrigley and Bietz., 1988). The deficiency of lysine leads to the poor utilization of protein and thus results in protein malnutrition (Pellet and Ghosh, 2004).

There is great interest has been generated in supplementing wheat flour with high protein, high lysine material to increase the protein content and improve the essential amino acid balance of baked products, especially bread. The high protein and lysine content and well-balanced amino-acid composition makes cowpea an excellent source of protein with potential to enhance the protein quality (*Prinyawiwatkul et al., 1996*).

Incorporating up to 20 per cent lupin flour with wheat or whole meal flours produces more nutritious bread; the

blend of cereal and legume helps to balance out the amino acid profile and make it a more complete food. Adding more than about five percent lupin flour into most wheat flours results in a slight loss of loaf volume, because lupin proteins lack the strength and elasticity of wheat gluten (*Lucisano and Pompei., 1981*). However when stronger flours, such as hard red wheat from Canada, are used it is possible to add up to 15 percent lupin flour and still retain loaf integrity and produce a quality product. The lupin wheat combination increases the water holding capacity of the product and the resultant texture, flavor and yellow colors appealing to many consumers (*Petterson and Crosbie., 1990).*Therefore this study was done the sweet lupine blend with wheat flour to improve protein nutrition of the society as well as to increase the utilization of newly introduced sweet lupine in Ethiopia.

MATERIAL AND METHODS

Sample collection:

The sweet lupine and Bread wheat sample was obtained from highland pulse breeding and wheat breeding program of Holeta Agricultural Research Center.

Sample preparation

For both sweet lupine and bread wheat the sample was graded, sorted and cleaned manually. And it is made ready by tagging each individually.

Sweet lupine flour preparation

The bean was soaked overnight 5kg sample. After soaking the sample was dried in sunlight and the bean was crashed into single cotyledons. The crashed sample was milled into fine ground of (0.5mm) miller sieve size.

Wheat flour preparation

The manually cleaned whole Wheat grain were milled finely by using 0.5mm sieve size of sample miller and prepared for further analysis.

Flour blending

Bread wheat flour and sweet lupin flour was blended in the ratios of 95:5, 90:10, 85:15, 80:20, 75:25,70:30,65:35,60:40 and 100% wheat flour as a control with each sample weighed out into three places using a weighing balance. One hundred percent wheat flour was also weighed out into three places.

Dough and Bread preparation

The bread samples were produced in batches by mixing and kneading manually each of the above flour blends with the ingredients using a stainless steel bowel. After thorough kneading in each case, the dough was allowed to ferment and develop for 15minutes before being knocked back and then molded into cylindrical shape. After molding in each case, the dough was then placed in a well-oiled baking pan where it proofed for 40 minutes at room temperature before it was baked in a cabinet oven pre-heated. And it was set at 230oc for 25 minutes.

Proximate Analysis

The Association of Official Analytical Chemist (AOAC, 1990) procedure was used to determine the proximate compositions (carbohydrate, crude protein, moisture content, crude fat, total ash, dry matter) of the bread wheat, sweet lupine flour and bread samples made from the blends of the above flours.

Mineral Analysis

For mineral determination, wet digestion of the all samples was carried out according to the method of (Jones et al., 1990). Calcium, zinc and iron was determined by atomic absorption spectrophotometer while, potassium was measured through flame photometer phosphorus content was determined using a UV-VIS spectrophotometer.

Sensory Analysis

Sensory evaluation was carried out using a 20 untrained panelist in duplicate sample to assess the organoleptic attributes of the bread samples. The organoleptic attributes was assessed are; taste, aroma, texture, crumb color and the overall acceptability. The panelists were selected randomly from the staff. The panelists was instructed to rate the bread based on 5-point hedonic scale ranging from 5=like very much to 1=disliked very much. The raw scores were assembled and statistically analyzed using appropriate software.

Statistical Analysis

The quality characteristics of flours, as well as the baking test results of products made with sweet lupine and bread wheat flour supplementation was analyzed by one way ANOVA (Analysis of Variance) using statistical tools of SPSS version 22.

Formulation

Table 1: Formulations of samples from wheat (Denda variety) and sweet lupine (Welela)

Treatments	Wheat flours in gram	Sweat lupine flour in gram
T1	100g	0 g(Control)
T2	95 g	5 g
T3	90 g	10 g
T4	85 g	15 g
T5	80 g	20 g
T6	75 g	25 g
T7	70 g	30 g
T8	65 g	35 g
T9	60 g	40 g

Table 2: Ingredients for bread formulation

Ingredients	Quantity in grams
Water	100ml
Yeast	2g
Fat (oil)	10ml
Salt	1g

RESULT AND DISCUSSION

From the flour functional property the water absorption of the flour of wheat is greater than sweet lupine and oil absorption of sweet lupine is greater than the flour of wheat. The moisture content and ash between the treatment there is no significant different at $p<0.05$ while protein and fat between treatment were significantly different at $p<0.05$.
The sensory acceptability of the bread up to treatment T6 (75Wheat:25 sweet lupine) were acceptable by using five point hedonic scale. Generally by using the above functional property, nutrient content and sensory test up to T6 the sweet lupine utilization and palatability improved

Table 3: Functional property and nutrient content

Flour	Water absorption	Oil absorption	Moisture content	Ash	Protein content	Fat
Wheat (denda)	2.7±0.30	2.30±0.10	9.50±0.00	1.50±0.50	10.66±0.40	2.1±0.10
Sweat lupine	2.5±0.30	3.00±0.00	7.00±0.50	4.20±0.25	35.08±0.44	7.65±0.05

Table 4: Nutrient content of formulated bread

Treatment	Moisture content	Ash	Protein content	Fat
T1	33.6±0.00	1.50±0.00	12.95 ± 0.64^{cd}	6.55 ± 0.05^{h}
T2	28.50±2.90	1.50±0.00	11.68 ± 1.32^{d}	8.90 ± 0.10^{b}
T3	35.40±2.20	1.75±0.25	14.00 ± 2.12^{bcd}	8.40 ± 0.10^{cd}
T4	36.90±0.10	1.50±0.50	14.43 ± 1.67^{bcd}	8.10 ± 0.10^{de}
T5	35.70±1.30	1.75±0.25	17.77 ± 0.84^{abcd}	7.30 ± 0.10^{g}
T6	36.00±1.00	1.75±0.25	20.74 ± 6.89^{ab}	7.50 ± 0.10^{fg}
T7	37.40±0.20	2.00±0.00	11.96 ± 0.65^{d}	8.50 ± 0.10^{c}
T8	35.60±2.60	2.25±0.25	$18.87\pm2.29a^{bc}$	9.35 ± 0.15^{a}
T9	38.40±4.00	2.25±0.25	21.93 ± 2.25^{a}	7.80 ± 0.10^{et}

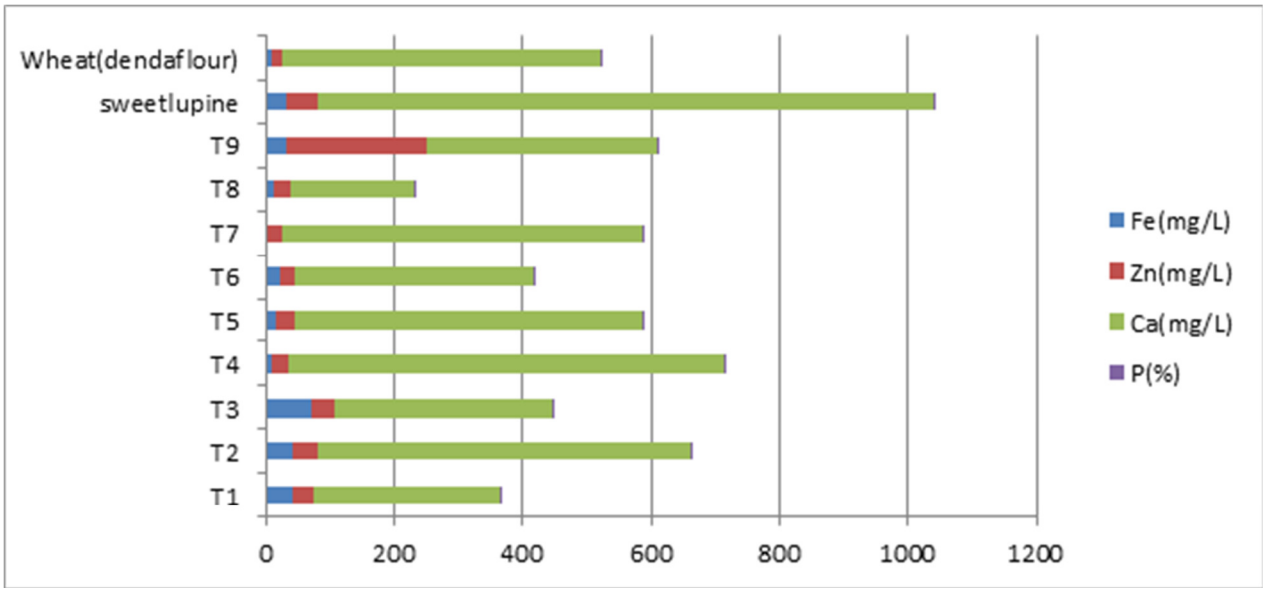

Figure 1: Mineral content of Formulated Bread

Table 5: Sensory data using five point hedonic scales

Treatment	Taste	color	Texture	Crumb color	Aroma	Over all
T1	4.78±0.71^{a}	4.57±0.14^{a}	4.50±0.07^{a}	4.14±0.14^{a}	4.42±0.14^{a}	4.60±0.21^{a}
T2	4.35±0.71^{b}	4.07±0.07^{b}	4.21±0.30^{ab}	4.21±0.21^{a}	4.14±0.00^{b}	4.07±0.07^{bc}
T3	4.35±0.71^{b}	4.53±0.036^{a}	4.28±0.20^{ab}	4.35±0.07^{a}	3.71±0.00^{c}	4.42±0.00^{ab}
T4	4.21±0.71^{b}	4.39±0.11^{a}	4.21±0.30^{ab}	4.35±0.07^{a}	3.78±0.07^{c}	4.42±0.14^{ab}
T5	3.85±0.00^{c}	4.00±0.00^{b}	3.92±0.10^{b}	4.00±0.14^{ab}	3.78±0.07^{c}	3.92±0.07^{c}
T6	3.71±0.20^{c}	3.92±0.07^{bc}	3.92±0.30^{b}	3.57±0.14^{bc}	3.35±0.07^{d}	3.78±0.07^{c}
T7	3.21±0.71^{d}	3.67±0.10^{cd}	3.07±0.10^{c}	3.50±0.21^{cd}	3.07±0.07^{e}	3.00±0.14^{d}
T8	2.92±0.71^{e}	3.50±0.00^{de}	2.92±0.10^{c}	3.07±0.07^{d}	2.71±0.00^{f}	3.00±0.00^{d}
T9	2.71±0.00^{e}	3.39±0.035^{e}	2.78±0.10^{c}	3.14±0.14^{cd}	2.64±0.07^{f}	2.85±0.14^{d}

Nutrient content of wheat and sweet lupine flour and their blend

From the flour functional property the water absorption of the flour of wheat is greater than sweet lupine and oil absorption of sweet lupine is greater than the flour of wheat. The moisture content and ash between the treatment there is no significant different at $p<0.05$ while protein and fat between treatment were significantly different at $p<0.05$. Lupine is a good source of nutrients, not only proteins but also lipids, dietary fibre, minerals, and vitamins (Martínez-Villa et al., 2009). Lupine flour showed higher level of oil absorption, protein content , fat content and ash content than wheat flour conversely wheat flour showed higher level of water absorption and moisture content.

This result confirmed by statically analysis which highly significant difference ($p<0.05$) where observed between the two type of flours. Mean ash content and protein content increased with increasing amount flour to be substituted with wheat flour with lupine flour at 5, 10, 15 respectively on dry weight basis. There was no significant difference between wheat flour and supplemented flour with different concentration of lupine flour moisture and ash content of the blend. The chemical properties of wheat flours have been studied previously by several researchers and they found that moisture content ranged between 12.5 to 14.6 % crude protein content 8.23 to 12.71 % and ash content 0.42 to 0.66 (Ahmad et al., 2001).

Protein content of lupine (38.6 %) was higher than that of a lot of legumes. Favier et al.,(1995) reported that haricot bean, lentil and soy bean contain 28.8 %, 26.7 % and 40.5 % protein, respectively. Because of the high protein content, lupine flour could be used in the human diet. Also, temperature of denaturation of these proteins is higher than animal protein, so they are technologically easier to handle (Chapleau and de Lamballerie-Anton., 2003).

Mineral content of wheat and sweet lupine flour and blend

The mineral content of wheat flour and sweet lupine flour especially the calcium content of sweet lupine higher compared to wheat flour as well as the concentration of sweet lupine flour increase the calcium content of the blend. Treatment 9(wheat 60:sweet lupine 40) were higher zinc concentration compared to other treatments. While wheat flour and sweet lupine flour zinc concentration had higher for sweet lupine concentration (47.96) compared to wheat flour (17.04). Lupin flour higher amounts of Ca, Zn, k, and P when compared to wheat flour.Similar results for mineral content of lupin flour have been reported in previous works (Trugo *et al,.* 1993; Dervas *et al.,* 1999; Doxastakis *et al.,* 2002; Lambart–Szczapa *et al.,* 2003; Martínez-Villaluenga *et al.,* 2006; Yorgancilar *et al.,* 2009).

Sensory evaluation of the blend

The sensory acceptability of the bread up to treatment T6 (75Wheat:25 sweet lupine) were acceptable by using five point hedonic scale. Bread containing lupine flour up to 30 %substitution level gave higher or similar sensory score in terms of all sensory property compared to control bread. Gorecka *et al* (2000) reported that 10% addition level of lupine flour or hull to shortcakes, ginger breads, pancakes enables preparation good quality food stuffs in terms of sensory properties.

CONCLUSION

Generally by using the above functional property, nutrient content and sensory test up to Treatment 6(75Wheat:25 sweet lupine) the sweet lupine utilization and palatability were improved. Lupine is a good source of nutrients not only proteins but also lipids ,dietary fiber, minerals and vitamins while the concentration of lupine increase in the flour proportion of wheat the concentration of protein of the bread product were increased . The mineral content of lupine flour and the mixture were higher for the concentration of calcium and zinc content as well as the color of the bread in the sensory observation was higher recorded. From this the bread product formulations have good result in industrial processing for bread production and to combat protein and micronutrient (zinc) malnutrition. Bread producers in Ethiopia up to 25% sweet lupine substitution of wheat can use to improve the society nutritional status and to produce good quality bread.

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