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Sweet Lupine Recipe Development and Nutritional Content of Recipe at Holeta, Ethiopia

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Abstract
Legumes plants are important source of protein. sweet lupine is one of the legumes plant protein and mineral source. In this study sweet lupine were prepared in different common Ethiopian food preparation methods in the form of cooked food(Nefro),Roasted food (Kolo) and Shero. the nutritional content of the recipe and grain sample were analyzed using official analysis methods. The nutritional content of the recipe Shero have higher protein content(34.6%) compared to the others. Zinc(12mg/100g) and iron(21mg/100g) were higher for Nefro recipe content were as potassium and sodium were higher for shero. The sensory acceptability and nutritional content of the recipe were higher especially for shero recipe that play combating protein and micronutrient nutrition malnutrition.
Keywords: Recipe, sweet lupine and sensory acceptability

Introduction

Grain legume plants are important in human protein nutrition .Sweet Lupin is a leguminous plant.The protein content of whole lupin seeds is as high or higher than that of soya beans. Lupinus albus contains close to 35 % protein on a dry weight basis while L.luteus and L. mutabilis may have up to 44 % protein. These values are nearly double those of legumes commonly used as human foods. The protein content increases after dehulling .The protein quality of a food can be predicted based on its amino acid composition and the protein digestibility(Yanez,1979). Thus, it is important to consider not only the total amount of protein but also the amino acid composition. Lupin protein, as is true for all legumes, has a low sulphur amino acid content (FAO,1985).

The oil content of lupin is much lower than that of soya. Lupinus albus has approximately 11 % lipids while other species have less than 6 %, however L. Mutabilis may have up to 20 %. This is similar to soya and is 2-3 times the oil content of other legumes(yanez,1990). The main advantages of lupin use relative to other legumes used in human nutrition relate to their high protein content; although deficient in sulphur amino acids lupin protein is complementary to cereal proteins thus the mix will be of higher biological value(Hill,1977). Lupins have twice as much protein as beans, chick peas, lentils and other legumes. Sweet lupin seeds can be consumed directly after cooking or deep frying in a variety ways (Gross *et al*., 1982).

Dieticians and medical scientists in Europe and Australia are researching the health benefits of Australian sweet lupine, which has a low glyceamic index and could potentially play a role in combating obesity and its associated health problems of diabetes and heart disease.

Other possible health benefits of eating the lupin include a more balanced blood glucose level, a lowering of cholesterol and improved bowel health. found that eating white bread enriched with the kernel flour of Australian sweet lupin significantly reduced blood glucose and insulin responses compared to those eating plain white bread(Hall,2005).Sweet lupin flour (33%) blended with oat (25%) and wheat flour (16%) with minimal amounts of whey milk protein (5%) and sucrose (22%) has been used during the nutritional recovery of malnourished infants (mermoud,1978). Therefore in addition to the recipe developed common Ethiopian food shero, cooked food (Nefro) and Roasted food (Kolo) Additional research efforts have been directed at testing the incorporation of sweet lupine flour to commonly consumed foods, such as bread, crackers or pasta.

Materials and Methods

The sweet lupine, sample was collected from highland pulse breeding Holeta Agricultural Research Center. The recipes were prepared according to the Ethiopian traditional food recipe development procedure. Sample preparation: sweet lupine sample were graded, sorted and cleaned manually. Sweet lupine flour preparation: the sweet lupine was soaked overnight. After soaking the sample were dried in sunlight and the sweet lupine were crashed into single cotyledons.

Cooked Food (Nefro): The sweet lupine samples were socked for two day at room temperature with 200g sample socked with one liter of wate .The socked samples were cooked by adding enough water using heat until it will become ready to eat.

Roasted Food (Kolo): The sweet lupine samples were socked for two day. The socked samples were Roasted using heat until it will become ready to eat.

Shero: Sweet lupine flour preparation: the sweet lupine was soaked overnight. After soaking the sample were

dried in sunlight and roasted the sweet lupine, crashed into single cotyledons and milled to prepare shero flour.
Composition study: Nutritional studies were conducted following standard methods.

Protein content
The nitrogen content of the sweet lupin from each was determined by Kjeldahl method as stated in the AACC (2000) Method 46-11. About 1 g grind sample was weighed into Kjeldahl digestion flasks and catalyst mixture (K_2SO_4mixed with $CuSO_4.5H_20$and selenium in the ratio of (10:6:1) was added in to each flask. Then, 20 mL of concentrated H_2SO_4 (98%) was added and the sample was digested for 2 hours at a temperature of 400 ℃ until the solution was clear white. With the completion of the digestion (when the digested sample becomes colorless or light blue) the samples were allowed to cool. After the samples were cooled, 50 mL of distilled water was added into each digestion flask followed by 40 ml of 40% NaOH. Immediately the contents were distilled by inserting the digestion tube line into the receiver flasks that contain 25 mL of 2% boric acid solution. The collected ammonia distillate was then titrated against a standardized 0.1N HCl until the end of the titration is attained (where the titration color changes from blue to pink). Then the volume of HCl consumed to reach the titration end point was read from the burette and the %nitrogen content was calculated as follows:

$$\mathbf{Nitrogen}(\%) = \frac{\mathbf{V_{HCl}} \times \mathbf{N_{HCl}} \times \mathbf{14.00}}{\mathbf{sample\ weight\ in\ dry\ matter\ base}}$$

Where V_{HCl} is volume of HCl in litter consumed to the end point of titration N_{HCl} is normality of HCl used and 14.00 is the molecular weight of nitrogen. Percent nitrogen was expressed on wet matter basis and the resulting value multiplied by a factor of 6.25 to obtain protein content of each variety at each location.
Fat content by Nuclear magnetic resonance spectrophotometer (NMR)
22 gram of the sample measured and dry in to oven at 105 Degree centigrade for two hours and cool in adisicator for 30 minute. After cooling the tube inserted in to NMR and directly measure the fat content .

Mineral content
Recipes mineral contents of Ca, Fe, Na, K and Zn were determined using Atomic Absorption Spectrometer by (A.O.A.C, 1990) method.
Sensory Evaluation: The recipes were coded and randomly presented to 20 panelists in random order. In sensory evaluation five point hedonic scale (1= dislike very much, 2= dislike, 3= neither like nor dislike, 4= like, 5= like very much) were used.
Experimental Design and Data Analysis: The experiments were designed in completely randomized design (CRD). The analyses of variance (ANOVA) were performed to examine the significance level of all parameters measured. Least Significant Difference (LSD) test was used for means comparison.

Result and Discussion
Table 1: Macronutrient composition (Protein and Fat content) sweet lupine (Wolela Variety) recipe compared to Field pea variety (Bursa)

Recipe	Protein Content	Fat Content
1.Shero	34.65 ± 0.00^{a}	7.75 ± 0.07^{b}
2.Nefro(cooked food)	30.22 ± 0.035^{c}	8.35 ± 0.07^{a}
3.Kolo(Roasted Food)	30.12 ± 0.17^{c}	8.5 ± 0.14^{a}
4.Sweet Lupine grain	31.65 ± 0.00^{b}	8.3 ± 0.00^{a}
5.Bursa (Faba bean variety)	22.32 ± 0.00^{d}	3.6 ± 0.00^{c}

All results: mean±standared Deviation

Macro nutrients (Protein and Fat)
Protein: The results of the chemical compositions of the recipes and the grain are presented in Table 1. The recipe shero have high protein content (34.65%) compared to other recipe and the grain protein content. Lupine seeds have a relatively stable composition, although cultivation conditions can modify the composition. Larger and fuller seeds have more protein and less crude fiber. During industrial processing dehulling reduces the fiber while increasing protein content (Ivanovic, 1980). In this study dehulling and different processing method increase and decrease the protein content compared to the grain protein content from 31.65% - 34.65%. Compared to the field pea variety the sweet lupine has greater protein than the field pea protein content. The protein content of shero recipe higher this is good solution to combat the protein malnutrition problem of the society.
Fat content: The oil content of the sweet lupine recipes range from 7.75-8.5%.The oil content of lupin is much lower than that of soya (Gladstone, 1970). Lupinus albus has approximately 11 % lipids while other species have less than 6 %, however L. mutabilis may have up to 20 %. This is similar to soya and is 2-3 times the oil content

of other legumes (Masson *et al*.,1985).In this study the oil content of the recipes were not significance difference.

Table 2: Micronutrient composition (Zn, Fe, Ca, K and Na (mg/g) content) sweet lupine (Wolela Variety) recipe compared to field pea variety (Bursa).

Recipe	Zinc Content	Iron Content	Calcium Content	Potassium content	Sodium Content
1.Shero	9.5 ± 0.002^{ab}	3.5 ± 0.005^{c}	27 ± 0.0014^{e}	82 ± 0.75^{b}	2.5 ± 0.0021^{b}
2.Nefro	12.0 ± 0.0014^{a}	21 ± 0.012^{b}	94 ± 0.0014^{a}	18 ± 0.002^{b}	1.4 ± 0.007^{a}
3.Kolo	9.0 ± 0.0014^{ab}	20 ± 0.006^{b}	78 ± 0.0035^{b}	29 ± 0.00^{b}	2.5 ± 0.00071^{b}
4.Sweet Lupine grain	8 ± 0.00^{bc}	21 ± 0.00^{b}	69 ± 0.00^{c}	29 ± 0.00^{b}	1 ± 0.00^{b}
5.Field pea grain variety (Bursa)	5 ± 0.00c	5.2 ± 0.00^{a}	34 ± 0.00^{d}	224 ± 0.00^{a}	20 ± 0.00^{a}

All results : mean± Standard Deviation

Micronutrients (Fe, Zn, Ca, K and Na)

Legumes are very important mineral sources for human nutrition. The sweet lupine recipe Zn ,Fe, Ca, K and Na content were ranged from 8-12 mg/100g, 3.5-21 mg/100g, 27-94mg/100g, 29-82 mg/100g,1-2.5 mg/100g Respectively. Zn, Fe and Ca content of coked product(Nefro) have greater values compared to other recipe where as potassium and sodium content of the recipe shero have higher than the other recipe. Compared to the field pea (Bursa variety) the entire recipe have good zinc and calcium content as well as comparable iron, potassium and sodium content. Similar study result shows the mineral (ash) content of Australian Sweet Lupin fluctuates between 3.2 and 4.6g/100g dry matter. Typical results follow (in mg/g): calcium between 15 and 29, magnesium 11 - 20, sodium 3 - 11 and potassium 66 - 90. Results of trace elements (in mg/kg): iron 31 - 150, zinc 24 - 45, and copper 2.5 – 6.8 (Uauy *et al*.,(1995)In this study Calcium and Potassium content have higher value than Iron, Zinc and Sodium content from all the recipe.

Sensory evaluation of the recipes

The recipe Shoro shows acceptable taste, color, Texture and all over acceptability compared to the other recipe. Next to shero Roasted food (Kolo) has acceptable sensory result than cooked Food (Nefro) in which the sensory evaluation evaluated by untrained twenty panelists and using Five point hedonic scale (Figure1). In this study all the recipes have good sensory Acceptability especially shero (Ethiopian Food) have high sensory score for all the sensory parameters.

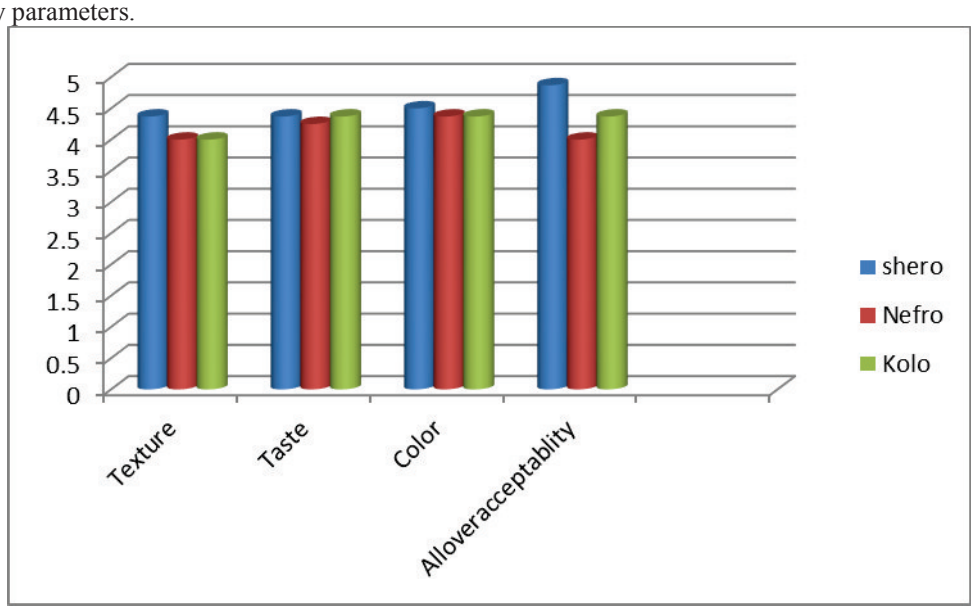

Figure 1:Sweet lupine Recipe sensory result using five point hedonic scale by 10 panelists.

Conclusion

The nutritional content and sensory acceptability point of view comparing the recipe of sweet lupine each other as well as field pea. The protein content,Fe,Zn,K,Ca,Na and sensory acceptability of shero and kolo is better to use sweet lupine as food and to combat protein and micronutrient malnutrition problems in Ethiopia compared to the other recipe and the field pea variety (bursa).

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