Agricultural Sciences Journal
Available online at http://asj.mnsuam.net/index.php
ISSN 2707-9716 Print
ISSN 2707-9724 Online

Research Article

PRODUCTION AND QUALITY CHARACTERIZATION OF SOYMILK ENRICHED BREAD

Noman Fareed[1], Muhammad Shahbaz[1]*, Umar Farooq[1], Hafiz Nazar Faried[2], Afshan Shafi[1], Mian Shamas Murtaza[1], Khizar Hayat[1]
[1]Department of Food Science and Technology, MNS-University of Agriculture Multan, Pakistan
[2]Department of Horticulture, MNS-University of Agriculture, Multan
**Corresponding author: shahbaz.ft@mnsuam.edu.pk*

ABSTRACT

Soybean (*Glycine max*) is a valuable food crop which consists of various nutrients associated with health benefits. Large spectrums of phytochemicals having potential biological properties are associated with soybean. Soybean has 36% protein, 19 % oil, 35% carbohydrates and 5 % minerals. The USA, Brazil and Argentina are the world largest soybean producing countries. During current study soybean variety was evaluated for physicochemical composition to explore potential for utilization in bakery products. The soybean seed was subjected for soymilk production which was used as functional ingredients for the preparation of soy bread. The prepared products were analyzed for its physic-chemical analysis. The sensorial responses of products were checked by authentic 9 point hedonic scale for the boost of soymilk on industrial scale. The bread was arranged by three different concentrations of soybean which were 10%, 20% and 30%. Other constituent that were used in soy bread making were flour, sugar, oil, eggs, salt, baking powder, baking soda and water. The four treatments T0, T1, T2 and T3 were prepared with different soymilk concentration. Treatments were placed to sensory assessment and prepared products were stored for 0, 2, 4 and 6 days at room temperature. The sensory appraisal was observed by the panel of judges to use interior and exterior uniqueness of special soy bread samples. The internals uniqueness was consisted of color, taste, texture, appearance and mouth feel overall acceptability. Treatment T1 and T2 was found to be best among the other treatments and got the maximum score 8.15±0.03 and 7.98±0.03 at T1 and T2, respectively.

Keywords: Soybean seed; soymilk; nutritional & functional role; bakery product.

(Received: 27 December 2019, Accepted: 7 April 2020)
Cite as: Fareed. N., Shahbaz, M., Farooq, U., Faried. H. N., Shafi, A., Murtaza, M. S., Hayat, K.,2020 Production and quality characterization of soymilk enriched bread. Agric. Sci. J. 2(1):39-50

1. INTRODUCTION

Soybean (*Glycine max*) is a valuable crop with high nutritional content and multiple health benefits. It is cash crop that is cultivated for its protein content and having high quality oil (Dupare et al., 2008). It belongs to genus Glycine wild and family leguminosae, subfamily papilinoideae, and tribe phaseolae, tribe phaseolae is economically most important (Dupare et al., 2008; Ghani et al., 2016). It has been cultivated as cash crops, around 35 countries of the world (Masuda and Goldsmith, 2009). Globally soybean is developed in various part of the world such as USA, Brazil, Argentina and China (Hartman et al., 2011). During the last few years soybean was grown on 120.48 million hectares and 351.74 million metric tons of the soybean seed was produced globally (Hill et al., 2010). USA is the largest producer with 117.20 million metric tons followed by Brazil 114 million metric tons and Argentina 57.80 million metric tons (MMT) (Hartman et al., 2011; Ghani et al., 2016).

Soybean have most important source of protein for human being food and animal feed grazing. Soybean is grown for its protein contents and oil production. Most of the produce is used in feed production for animal uses (Agarwal et al., 2013). Globally demand has been increased up to great extent due to its high nutritional contents and low cost (Hill et al., 2010).

The compositional analysis of soybean indicated that it contains vitamins (A, D and B complex), carbohydrates, minerals (Calcium and Phosphorous), high quality of protein, which is present as a significant contribution towards dietary requirement of human (Rahim et al.,2015).

Soybean is distinguishing the maximum of lysine and methionine. The soybean protein is used in a good way of supplemented of food grain protein and enclosed must of animals. The health benefits of soy utilization range from lowering danger of heart disease such as cancer bone strength could be used to alleviate menopausal symptoms (Van Eys et al., 2004).

The presence of numerous nutrient including minerals, fibers and vitamins seems to as a food supplement. The soy flour could be used as alternative of cereals flour to reduce the allergic response caused by cereal to some important patient especially the gluten content of wheat (Dhakal et al., 2014). Due to very low quantity of saturated fatty acid and absence of lactose make it valuable for commercial uses (Phommalth et al., 2008).

Soymilk has been reported as nutritive approach to health promoting for the children when it is use as a fortified cereal-based conventional foods such soymilk bakery products (bread, cakes and biscuit) (Liu and Lin, 2008). Soymilk powder is conceder a batter choice to milk is most various age group and in patients with lactose intolerance. Lactose intolerance is a problem that prevails in modern society and children are unable to feed the complete diet (Osundahunsi et al., 2003).

Baking industry is an important stake holder by produces a variety of products includes bread, cake, and cookies. During the preparation of bakery products various ingredients are used for value addition, but soybean is important nutritional and functional role in baking process in baking industry (Alamu et al., 2018).

In our country people, irrespective of their position and age like to take snack foods during their breakfast and evening tea. Hence, challenge were made to introduce soy based bakery products like biscuits, cake, bun etc. among the urban and rural mass at the bakery outlets through training given to the bakers. The current study planned to evaluate soybean varieties for quality characteristics and its exploration in bakery products for promotion of its utilization on industrial scale.

2. MATERIALS AND METHODS

2.1. Raw material handling

Raw materials (wheat flour, soybean, refined sugar, baking agent etc.) were bought from local market of Multan and stored at ambient conditions until further usage. All chemicals/reagents were purchased from sigma Aldrich and local scientific supply store.

2.2. Determination of moisture contents of soybean seed

Soy bean moisture content was measured by standard protocol. 5 g (W1) sample was placed in hot air oven at 105±5oC for six hours to obtain constant weight. Sample cooled in desiccators and weighed (W2) (A.O.A.C., 2012):

$$\text{Moisture \%} = \frac{\text{weight of actual sample} - \text{weight of dried sample}}{\text{weight of actual sample}} \times 100$$

2.3. Determination of ash content

5g flour sample placed in a crucible and subjected for charring till the appearance of colorless fumes. After charring sample was heated in muffle furnace at 550oC until constant weight gained. The amount of ash contents was determined by the following formula (AOAC. 2012):

$$\text{Ash \%} = \frac{\text{weight of grayish residues}}{\text{weight of actual sample}} \times 100$$

2.4. Determination of crude protein contents of soybean seed

For crude protein analysis, 5g moisture free sample was taken in digestion tube and 25-30 ml of concentrated H_2SO_4 with one digestion tablet was added. Digestion was carried out till solution become clear. Digested material was diluted to 250 ml by DI water. The 10mL of diluted sample was taken in distillation tube and 25ml of 40% NaOH was added. Distilled water added for distillation process with10 mL of 4% boric acid solution using few drops of modified methyl red indicator. Titration was carried out with standard 0.1 N H_2SO_4 solutions until pink color appears.

2.5. Determination of crude fat contents

According to AOAC. (2012) crude fat was determined via using petroleum ether. Moisture free 5g sample taken in a thimble in Soxhlet glass tube of 500 ml. Following by 5-6 washings, solvent was recovered and residues were weighed. The crude fat contents of soybean seed were calculated by using following equation.

$$\text{Fat \%} = \frac{\text{weight of actual sample} - \text{fat free sample}}{\text{weight of actual sample}} \times 100$$

2.6. Crude fiber contents of soybean seed

For determination of crude fiber contents, 2g moisture free sample was digested with 1.25% H_2SO_4 in 200 ml D.I. water for 30 minutes and washed with hot water. Second digestion was done with 1.25% NaOH for 30 min and washing was done. Residues obtained were dried in an oven for a period of overnight. Dried sample placed in muffle furnace at 550 oC for 5-6 hours and crude fiber contents calculated by using the following equation AOAC. (2012).

$$\text{Fiber \%} = \frac{\text{weight loss on ignition}}{\text{weight of actual sample}} \times 100$$

2.7. Nitrogen free extract (NFE)

NFE was calculated by using this formula:

NFE =100-(Moisture % + ash% + crude protein% + fat % + crude fiber %)

2.8. Mineral profile

The minerals profiling of soybean was carried out by using flame photometer according to protocol specified by standard method AOAC (2003). Sample of 1 g was taken in tube and HNO_3 was added for overnight digestion. Further digestion was done with $HClO_4$ at 250-300ºC for 70-85 min till cleared fumes appeared. Digested sample diluted in plastic bottles and observed reading with standard protocols.

2.9. Preparation of soya milk powder

Dried and cleaned seeds of soya beans were soaked in water with 0.3% sodium bicarbonate ($NaHCO_3$) for preparation of soya milk powder. Soaked soybean's shell were removed by means of stress of two hands and cleaned with continues flow of replacement tap water. After washing soy bean seed was sun dried for its actual moisture content. The dried dehulled soy bean was grinded. Then l00g powder of soy bean was liquefied with 1000 ml of water by stirring. The milk was strained through a fine cloth to separate the residue. Soymilk was boiled at 100°C for 10-15 minutes with constant stirring (Afroz et al., 2016).

2.10. Physicochemical analysis of soymilk

2.10.1. Determination of pH and total soluble solids (TSS) of soy milk

The pre-calibrated pH meter was used to determine the pH of soymilk (Sivashankari*et al.,* 2015). The electrode was dipped in the sample and reading was recorded in triplicates for each sample. The TSS of soymilk was measured by using of hand holder refractometer (0-32°Brix) according to protocols as mentioned by (Liu and Lin 2008). Soymilk drop was put on sensor and the refractometer reading was noted in triplicate for each sample.

2.11. Product development

The grounded soybean seeds were subjected for the development of bakery products including bread and cake according to their standard procedure to elucidate the functional properties of soybean in baking products.

2.12. Preparation of soymilk bread

Soya bread was prepared by using the standard recipe and protocol as described by Nozawa*et al.*, (2014) with some amendments by using treatment plan as mentioned below (Table 1).

Table 1. Treatments plan for production of soybean bread

Treatments	Wheat Flour %	Soymilk powder %
T_O	100	00
T_1	90	10
T_2	80	20
T_3	70	30

2.13. Quality evaluation of soymilk bread

Final product was break into piece and sun dried to remove moisture. After drying of the final prepared product, proximate analysis (moisture content, ash content, protein content, fiber content and fat content) were carried out by standard method of AOAC 2012. Proximate analysis methods have been discussed earlier in previous section.

2.14. Sensory evaluation

The bread prepared with addition soybean flour was evaluated for sensory characteristics using 9 point hedonic scale. A panel of judges from faculty members and students of Food Science and Technology were asked to rank the cheese quality from 9 to 1 score according to protocol as mentioned by Amarjeet and Anita (2017) in which nine was the high test score whereas one was the lowest score (Appendix I).

2.15. Statistical analysis

The data thus obtained was analyzed statistically by using two factorial Completely Randomized Designs (CRD) and ANOVA techniques by using software statistical 8.1, according to methods described by Steel *et al.* (1997).

3. Results and Discussions

3.1. Proximate compositional analysis of soybean seed

The minimum moisture content indicates that product can stored for enough period of time. This shows that moisture is important content for growth of microorganisms in the flour sample and lowest moisture mean safe food from microbes. The ash content reveals that flour samples are important sources of minerals (Prithiviraj *et al*., 2011).

The highest protein content of the sample indicates that it could be used in the management of protein deficiency cases such as Kwashiorkor (Etiosa *et al*., 2017). This shows that sample could be used in improving the palatability of foods in which they are incorporated. The high crude fat content of shows that soya bean is a viable source of oil, going by their crude fat contents. Most legumes contain 1.5% crude fat. Soya bean crude fat is very high compared to most legumes because it is an oilseed crop. The sample contain 5.44% fiber though relatively low, but the presence of fiber in foods is known to be beneficial (Etiosa *et al*., 2017)

During study the proximate analysis of soybean seed was observed in mean values are crude protein (37.62±0.10), crude fat (27.95±0.13), crude fiber (5.34±0.11), ash (4.22±0.06), and moisture (8.0±0.10) and NFE (16.63±0.11) contents shown in Table 2. This result was found enriched in nutrients such as protein and fat (Van Eys *et al*., 2004; Eshun, 2012; Edema, 2005).

Table 2. Proximate composition of soybean seed

Composition	Mean± S.D
Moisture	8.0±0.10
Ash	4.22±0.06
Crude protein	37.62±0.10
Crude fat	27.95±0.13
Crude fiber	5.34±0.11
NFE	16.63±0.11

3.2. Mineral profiling of soybean seeds

Minerals are inorganic substances, present in all body tissues and fluids and their presence is necessary for the normal life processes there are three main needs for minerals. Building strong bones and teeth, controlling body fluids inside and outside the cells and converting the ingested food into energy (Ozcan, 2003).

The mineral (calcium, magnesium, iron, zinc and sodium) concentrations (mg/100 g) of the flour sample of the soya bean were presented in (Table 3). The calcium 300.36 mg/100 g followed by magnesium content 258.24 mg/100 g. The zinc had the lowest value of 2.7 mg/100 g of mineral while cadmium was not detected. Calcium content of 300.36 mg/100 g obtained was far higher than range of values 62.93 mg/100 g - 217.38 mg/100 g reported (Eshun, 2012; Etiosa *et al*., 2017). The magnesium content 258.24 mg/100 g was also found higher than the range of values 8.39 mg/100 g -8.53 mg/100 g reported (Eshun, 2012; Etiosa *et al*., 2017; Van Eys *et al*., 2004).

Table 3. Minerals profiling of soybean seed (mg/100g)

Mineral element	Mean± S.D
Calcium	300.26±0.10
Magnesium	258.14±0.10
Iron	16.26±0.14
Sodium	2.94±0.07
Zinc	2.63±0.06

The iron content of 16.4 mg/100 g was found higher than the values 3.86 mg/100 g - 11.51 mg/100 g reported by Etiosa *et al*., (2017). The variation in results may be due to the difference in specie used and the dictates of environmental conditions. The zinc and sodium contents of 2.7 mg/100 g and 3.0 mg/100 g obtained respectively were fairly in agreement with the values previously reported (Eshun, 2012; Etiosa *et al*., 2017; Edema, 2005).

3.3. Quality characterization of soymilk bread

Bread is essential cereal food that is consumed internationally in a large and commercials scale (Bakke and Vickers, 2007). There are many kind of bread and their manufacture method varies from area to area (Martin, 2004). Bread is the fundamental source of macronutrients for the humans and animals (Aghamirzaei *et al.*, 2013).

3.4. Moisture contents

Although combine consequence of treatment and storage time on moisture contents of soy bread was non-significant however there were little variations due to these variables. The moisture contents ranged from 31.12±0.01 lowest to 36.78±0.02 highest due to little variation in treatment as well as storage period (Fig. 1).

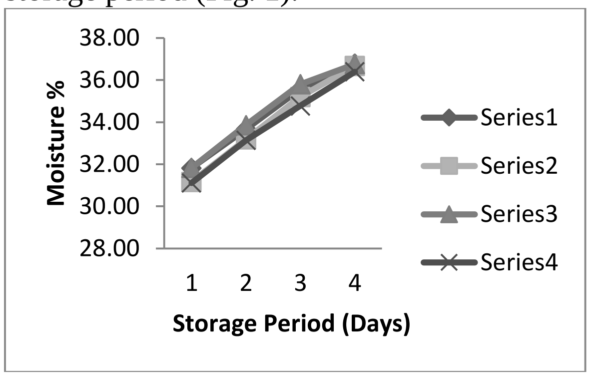

Fig 1: Significance of treatments and storage duration on spread factor of Soy bread

Proximate analyses of every treatment were done and means values are demonstrated that in table Analysis of variance for the moisture presented significant variation in various treatments (Maneju *et al.,* 2011). There was a gradual enhance in protein amount of bread with enhance in concentration of soymilk powder (Islam *et al.,* 2007).

3.5. Ash contents

Although combine effect of treatment as well as storage duration on ash scores of the soy bread was non-significant however there were little variations due to these variables. The ash amounts were ranges from 1.33 ±0.03 lowest to 2.43 ± 0.02 highest due to little variation in treatment as well as storage period (Fig. 2).

In current study ash contents of Soy bread samples were increased due to addition of soymilk, because soybean level increased (Jideani and Onwubali 2009). According to

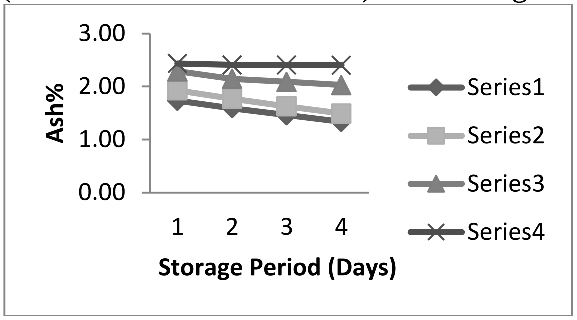

Fig 2: The treatments effect as well as storage period on spread factor of Soy bread

Ndife *et al.,* (2011), results are similar to these results.

3.6. Fat content

Although combine effect of treatment and storage time on fat concentrations of the soy bread was non-significant however there were little variations due to these variables. The fat contents were ranged from 3.61±0.17 lowest to 5.80±0.06 highest due to little variation in treatment as well as storage period (Fig. 3).

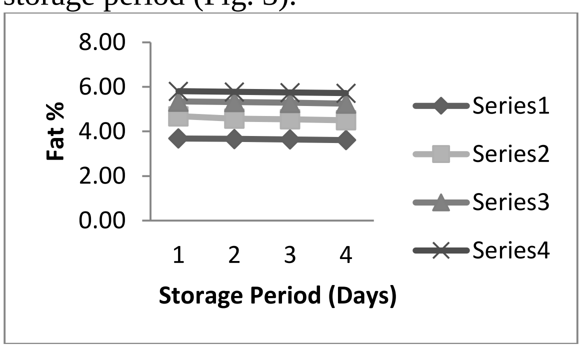

Fig 3: Significance treatments as well as storage duration on spread factor of Soy bread

In terms of their crude fat content, the samples were significantly different from each other. The fat content increased with increasing level of soy replacement. The high fat content of sample T_3 was not unexpected since it had the highest level of soy substitution (30%) compared to other samples. This result is in agreement with that of Ndife *et al.* (2011) which reported an increase in fat content of bread made with soy flour. High fat content may improve food flvour and also play a vital role in the shelf stability.

3.7. Fiber content

Although the merge consequence of treatments as well as storage time on fiber contents of the soy bread were non-significant however there were little variations due to these variables. The fiber contents were ranged from lowest 3.15±0.01 lowest to 4.94±0.03 highest due to minute variation in treatment as well as storage period (Fig 4).

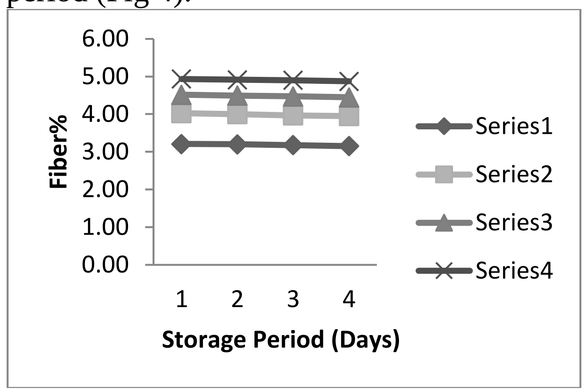

Fig 4: Effect of treatment and storage period on spread factor of Soy bread

The crude fiber content decreased significantly with increasing replacement of soy flour. This could be attributed to the lower crude fiber content of the soy flour compared to the wheat flour. Sample T_0 had the highest crude fiber content with sample T_3 having the lowest. This result is opposing to the report of Mesfin and Shimelis, (2013); Ndife *et al*. (2011).

3.8. Protein contents

Although the combine effect of treatments as well as storage duration on protein concentration of the soybread was non-significant however there were little variations due to these variables. The protein content ranges from to 6.72±0.38 lowest and 11.67±0.02 highest, due to little variation in treatment as well as storage period (Fig 5).

Addition of full-fat soy significantly increased the protein content with increasing soy proportion. This increase is expected due to the substitution of wheat flour with

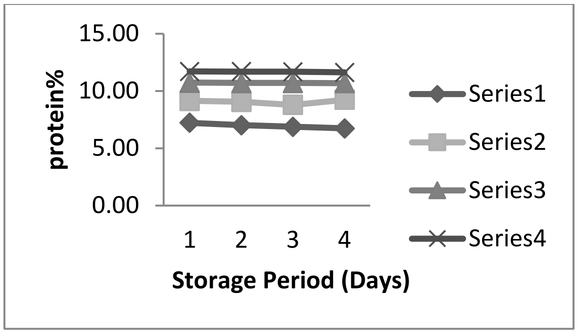

Fig 5: Significance of treatments as well as storage time on spread factor of soy bread

full-fat soy flour which was higher in protein content. This observation is in agreement with the findings of Mashayekh *et al.* (2008) and Ndife *et al.* (2011) who reported an increase in protein content of bread with increasing substitution of soy flour. There was an increase in protein content of soybread sample with increase in concentration of soymilk (Islam *et al.*, 2007). Results of this study are equal with the observation of (Dewettinck *et al.*, 2008). During the storage periods protein contents have similar increasing trend.

3.9. Nitrogen free extract

The mean value of NFE contents of different formulated bread was 49.06, %, 46.44%, 44.13%, and 41.81% of T_0, T_1, T_2 and T_3 correspondingly (Fig. 6). The results illustrate that NFE contents decreased with the additions of soya flour in bread. The similar trend for proximate compositional analysis of soy-wheat composite bread was description in the demonstrated of Ndife *et al.* (2011) and Jideani and Onwubali (2009).

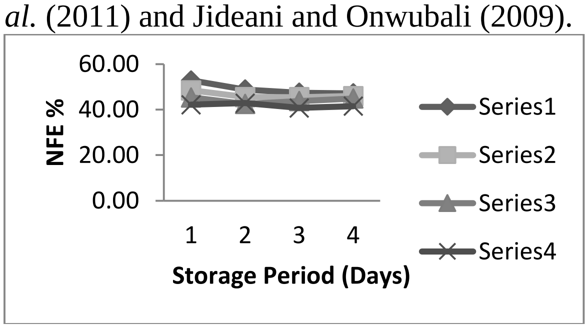

Fig 6: Significance of treatments as well as storage time on spread factor of soy bread

3.10. Sensory profiling of soy bread

3.10.1. Crust color

Although combine effect storage duration treatments on crust color of the soy bread was significant however, the crust color score was ranged from 1.80 ±0.48 lowest to 8.04 ±0.05 highest due to variation in treatment and storage period (Fig. 7).

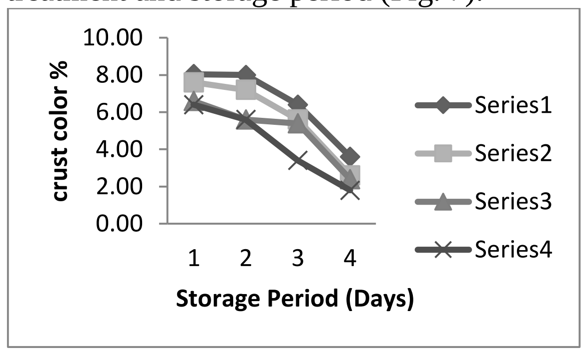

Fig 7: Effect of treatments and storage period on spread factor of soy bread

Crust color and crumb color significantly decreases with the increasing of soy flour due to the crust color and crumb color variation. In crust color study sample T_0 and T_1 were maximum light brown color while T_2 was brown and T_3 observed dark brown color (Mohsen *et al*., 2009).

3.10.2. Crumb color

Although combine consequence of treatments and storage durations on crumb color of the soy bread was significant however taste score was ranged from 1.40 ±0.32 lowest to 8.00 ±0.00 highest due to variation in treatment and storage period (Fig 8).

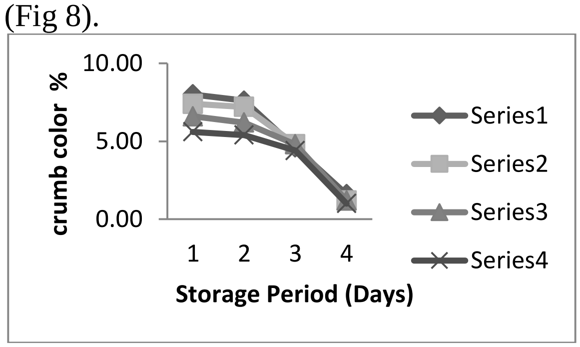

Fig 8: Significance of treatments and storage duration on spread factor of soy bread

The chocolate looks of the bread crumb developed more visible with aggregate soy replacement. This is done due to maillard and caramelization reactions (Mohsen *et al*., 2009). In soy bread crumb color was sample T_0 observed white color, sample T_1, and T2 indicated cream color while T_3 sample observed yellowish cream color (Sanful and Darko 2010).

3.10.3. Taste

Although combine treatments and storage duration effect on taste of soy bread was significant however taste score was ranged from 0.20 ±0.00 lowest to 8.00 ±0.00 highest due to variation in treatment and storage period (Fig 9).

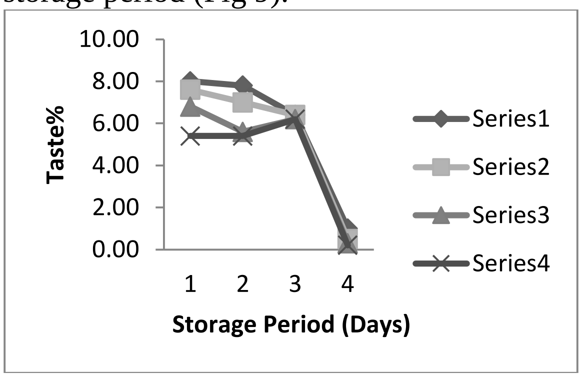

Fig 9: The treatments and storage durations effects on spread factor of soy bread

The sensory analysis was observed significant modifications in some of the treatment. The soybread taste was observed beany with aggregate soy flour replacement. Samples T_0 and T_1 were assessed appearances bread taste, the T_2 sample was observed faintly beany taste, while samples T_3 give beany taste (Menon *et al.*, 2015).

3.10.4. Crumb texture

Although combine consequence of treatments and storage durations on texture of the soy bread was significant however, the texture score was ranged from 1.40 ±0.32 lowest to 8.00 ±0.00 highest due to variation in treatment and storage period (Fig 10).

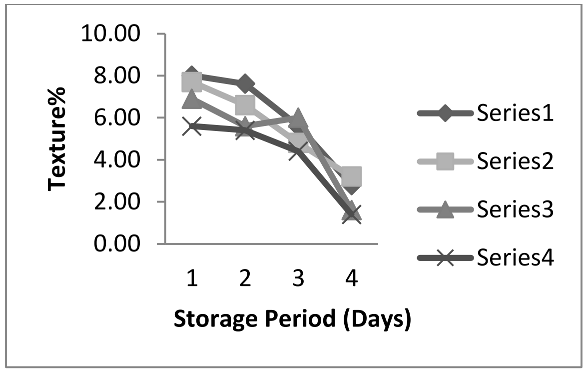

Fig 10: Consequence of treatments and storage duration on spread factor of soy bread

Crumb texture of soy bread was revealed that significantly highest T_3 sample and lowest. The crumb texture of sample E was rated the highest and lowest T_1 sample. Although, crumb texture was no substantial variance among the different bread slices. The crumb texture for samples T_2 and T_3 and observed hard while T_0 and T_1 sample were revealed as soft structure (Otegbayo *et al.*, 2018).

3.11. Loaf volume of soy bread

Although combine effect of treatments and storage duration on volume of the soy bread were considerable. However, volume score were ranged from 0.60 ±0.32 lowest to 8.00 ±0.00 highest due to variation in treatment and storage period (Fig. 11).

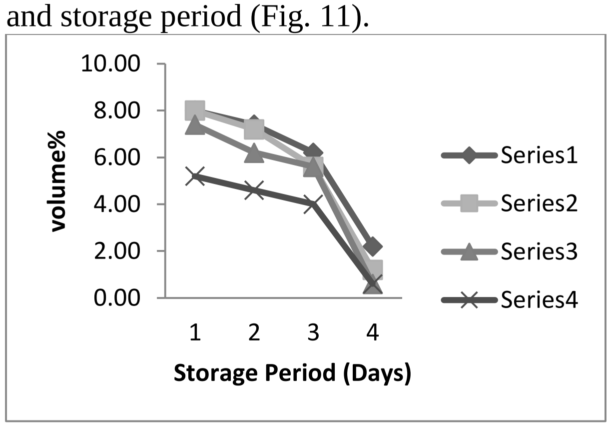

Fig 11: Consequence of treatments and storage duration on spread factor of soy bread

Loaf volume was significantly affected during baking by the presence of soy flour. The control sample T_0 observed greater loaf volume as compared to other bread samples (Ribotta *et al*. 2008). Sample T_1 had the highest volume compared to other soy enriched breads while sample T_3 observed lowermost loaf volume that was decrease volume with increasing soy flour substitution. The reduction in loaf volume could be as a result of higher soy substitution which affected a disruption of the gluten system thus high fat prevent dough volume demonstrating oven spring but affecting the dough to collapse. Sluimer (2005) showed that maximum amounts of fat in the prescription can stop bread from forming and make the dough to collapse during and after baking (Menjivar and Faridi, 1994).

3.12. Overall acceptability of soy bread

Although joint effect of treatments and storage duration on overall acceptability score of soy bread was significant however there were little variations due to these variables. The overall acceptability score were ranged from 2.20±0.26 lowest to 8.00±0.00 due to variation in treatment as well as storage period (Fig 12).

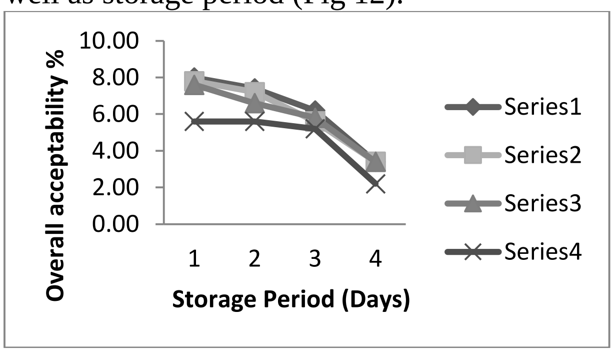

Fig 12: The treatments and storage duration effect on spread factor of soy bread

All the treatments were observed on top of standard scores of suitable results, they are in closed conformity with the findings of (Menon *et al.*, 2015). The combined baking properties of soy flour are effected and the organoleptic characteristics of the bread due to the intensity of the gluten (Mohsen *et al*., 2009).

3.13. Conclusion

Soy enrichment of bread could be used to produce a nutrient dense food with proposed great health benefit. Out of the soy-bread samples (10%, 20% and 30%), the inclusion of 10% soy flour produced bread which was nutrient dense with protein features similar to wheat bread and was more acceptable and preferred by the consumers. Soy flour presence at 10% level can be advantageous due to the increased nutritional value and acceptable consumer attitude in sensory characteristics. Therefore, it is recommended that the technology of using soymilk should be encouraged among food industries to make economic use of local raw materials to producing high quality food products rich in protein such as bread to boost food security and to improve the nutritional status of the nation.

3.14. Acknowledgement

I am grateful to my supervisor Dr. Muhammad Shahbaz, Assistant Professor, Department of Food Science and Technology, MNS-University of Agriculture Multan, Pakistan for his intellectual guidance throughout the whole journey of my thesis.

3.15. Conflict of Interest:

There is no conflict of interest in my research.

4. Reference

A.O.A.C. 2012. Offiial Methods of Analysis. Association of Offiial Analytical Chemists. 19th ed. U.S.A: Gaithersburg.

Afroz, M.F., W. Anjum, N. Islam, A. Kobir, K. Hossain and A. Sayed. 2016. Preparation of soymilk using different methods. J. Food Nutri. Sci. 4(1): 11-17.

Agarwal, D.K., S.D. Billore, A.N. Sharma, B.U. Dupare and S.K. Srivastava. 2013. Soybean: introduction, improvement, and utilization in India-problems and prospects. Agri. Res. 2: 293-300.

Aghamirzaei, A., A. Heydari-Dalfard, F. Karamiand and M. Fathi. 2013. Pseudocereals as functional ingredient: effects onbread nutritional and physiological properties-Review. Int. J. Agric. Crop Sci. 14: 1574-1580.

Alamu, E.O., I. Popoola and B. Maziya-Dixon. 2018. Effect of soybean (Glycine max (L.) Merr.) flour inclusion on the nutritional properties and consumer preference of fritters for improved household nutrition. Food Sci. Nutr. 6: 811-1816.

Amarjeet, K and K. Anita. 2017. Sensory and proximate analysis of value added bakery products Using Bael (Aegle marmelos) and stevia powder. Int. J. Curr. Microbiol. App. Sci. 6: 3749-3760.

Bakke, A. and Z. Vickers. 2007. Consumer liking of refined and whole wheat breads. J. Food Sci. 72: 473-480.

Dhakal K.H., K.H. Jung, J.H. Chae and J.G. Shannon. 2014. Variation of unsaturated fatty acids in soybean sprout of high oleic acid accessions. Food Chem. 164: 70-73.

Dupare, B.U., S.D. Billore, O.P. Joshi and S.M. Hussain. 2008. Origin, domestication, introduction and success of soybean in India. Asian Agri-History, 12(3):179-95.

Edema, M.O., L. Sanni and A.L. Sanni.2005. Evaluation of maize-soybean flour blends for sour maize bread production in Nigeria. Afr. J. Biotec. 4(9): 911-918.

Eshun G. 2012. Nutrient composition and functional properties of bean flours of three soya bean varieties from Ghana. Afr. J. Food Sci. Tech. 3(8): 176-181.

Etiosa, O.R., N.B. Chika and A. Benedicta. 2017. Mineral and proximate composition of soya bean. Asian J. Physical and Chemical Sci. 1-6.

Ghani, M., K.P. Kulkarni, J.T. Song, J.G. Shannon and J.D. Lee. 2016. Soybean sprouts: A review of nutrient composition, health benefits and genetic variation. Plant Breeding Biotech. 4: 398-412.

Hartman, G.L., E.D. West and T.K. Herman. 2011. Crops that feed the World 2. Soybean-worldwide production, use, and constraints caused by pathogens and pests. Food Security. 3: 5-17.

Hill, C.B., L. Crull, T. Herman, D.J. Voegtlin and G.L. Hartman. 2010. A new soybean aphid (Hemiptera: Aphididae) biotype identified. J. Econ. Entomol. 103: 509-515.

Islam, T.A., M. Chowdhury and S. Islam. 2007. Standardization of Bread Preparation
from Soy Flour. Int. J. Sustain. Crop Prod. 2: 15-20.

Liu, J.G. and T.S. Lin. 2008. Survival of listeria monocytogenes inoculated in retail soymilk products. Food Control. 19: 862-867.

Maneju, H., C. Udobi and J. Ndife. 2011. Effect of added brewers dry grain on the physicochemical, microbial and sensory quality of wheat bread. Am. J. Food Nutr. 1: 39-43.

Maneju, H., C.E. Udobi and J. Ndife. 2011. Effect of added brewers dry grain on the physico-chemical, microbial and sensory quality of wheat bread. Amer. J. Food Nutri. 1(1): 39 43.

Mashayekh, M., M.R. Mahmoodi and M.H. Enterazzi. 2008. Effect of fortifiation of defatted soy flur on sensory and rheological properties of wheat bread. Int. J. Food Sci. Tech. 43: 1693-1698.

Masuda, T. and P.D. Goldsmith. 2009. World soybean production: area harvested, yield, and long-term projections. Int. Food Agribusiness. Mangt. 12: 143-162.

Menjivar, J.A. and H. Faridi. 1994. Rheological properties of cookie and cracker dough. In Faridi, H. (Eds). The Science of Cookie and Cracker Production, p. 283-322. New York: Chapman and Hall.

Menon, L., S.D. Majumdar and U. Ravi. 2015. Development and analysis of composite flour bread. J. Food Sci. Tech. 52(7): 4156-4165.

Mesfin, W. and Shimelis, A. 2013. Effect of soybean/ cassava flur blend on the proximate composition of Ethiopian traditional bread prepared from quality protein maize. Afri. J. Food Agri. 13: 7985-8003.

Mohsen, M.S., H.H.M. Fadel, M.A. Bekhit, A.E. Edris and Y.S. Ahmed. 2009. Effect of substitution of soy protein isolate on aroma volatiles chemical composition and sensory quality of wheat cookies. Int. J. Food Sci. Tech. 44: 1705-1712.

Ndife, J., L.O. Abdulraheem and U.M. Zakari. 2011. Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soya bean flour blends. Afr. J. Food Sci. 5(8): 466-472.

Nozawa, M., S. Ito and E. Arai. 2014. Effects of soymilk on rising of gluten-free rice flour bread. Food Sci. Technol. Res. 20: 1063-1070.

Osundahunsi, O.F. and O.C. Aworh. 2003. Nutritional evaluation, with emphasis on protein quality, o maize based complementary foods enriched with soya bean and cowpea Tempe. Int. J. Food Sci. Technol. 38(7): 809-813.

Otegbayo, B.O., O.M. Adebiyi, O.A. Bolaji and B.A. Olunlade. 2018. Effect of soy enrichment on bread quality. Int. Food Res. J. 25(3).

Ozcan, M. 2003. Mineral Contents ofsome Plants used as condiments in Turkey. Food Chem. 84: 437-440.

Phommalth, S., Y.S. Jeong, Y.H. Kim, K.H. Dhakal and Hwang. 2008. Effects of light treatment on isoflavone content of germinated soybean seeds. J. Agri. Food Chem. 56: 10123-10128.

Prithiviraj, B., E. Manikandan, G.N. Hariharan and K.G.M. Nair. 2011. Elemental accumulation patterns of the lichen species Physcia tribacoides nyl., *Heterodermia dissecta* and *Bacidia beckhausii* Körber from the Walayar Rf Region, Tamil Nadu, India. International Journal of PIXE. 4:133-144.

Rahim, N., M. Kaleem Abbasi and S. Hameed. 2015. Soybean seed quality characteristics in response to indigenous bradyrhizobium inoculation and N fertilization in Kashmir–Pakistan. J. Am. Oil Chem. Soc. 92(8): 1165-1174.

Ribotta, P.D., S.A. Arnulphi, A.E. Leon and M.C. Anon. 2005. Effect of soybean addition on the rheological properties and breadmaking quality of wheat flur. J. Sci. Food Agri. 85:1889-1896.

Sanful, R.E. and S. Darko. 2010. Utilization of soybean flur in the production of bread. Pak. J. Nutri. 9(8): 815-818.

Sivashankari, M., A. Pare, B.K. Yadav and A. Santhakumaran. 2015. Estimation of pH of soymilk on the properties of soy protein lipid film. Trends Biosci. 8: 611-619.

Sluimer, P. 2005. Principles of bread making. Functionality of raw materials and process steps. 99-124. St. Paul, Minnesota: American Association of Cereal Chemists, Inc.

Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and Procedures of

Statistics. A biometrical Approach, 3rd Edition. McGraw Hill Book Co. Inc. NY.
Van Eys, J.E., A. Offner and A. Bach. 2004. Chemical Analysis. Manual of Quality Analysis for Soybean Products in the Feed Industry. American Soybean Association. http//www.asa-europe. org/ Library/ library_e.htm.
Van Eys, J.E., A. Offner and A. Bach. 2004. Chemical Analysis. Manual of Quality Analysis for Soybean Products in the Feed Industry. American Soybean Association. http//www.asa-europe. org/ Library/ library_e.htm.
Xiao, C.W. 2008. Health effects of soy protein and isoflavones in humans. J. Nutri. 138(6): 1244-1249.