Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2021 18(4): 3057-3064. **OPEN ACCESS**

Utilization of Soy pulp (okara) for the preparation of Yeast Leavened Pan Bread and Their physicochemical and sensorial evaluation

Tanweer Aslam Gondal[1], Anam Saba[1], Saeed Akhtar[1], Muhammad Imran[2], Sana Noreen[2*], Tabussam Tufail[2], Rab Nawaz[3], Zartasha Khalid[2], Zahra Fatima[2], Nimra Khalid[2], Laiba Nasir[2], Syeda Faiza Abid[2] and Memoona Abid[2]

[1]Institute of Food Science And Nutrition, Bahauddin Zakariya University, Multan**, Pakistan**
[2]University Institute of Diet and Nutritional Sciences, Faculty of Allied Health Sciences, The University of Lahore, **Pakistan**

***Correspondence:** sananoreen.rizwan@gmail.com **Received 12-08-2021, Revised: 30-10-2021, Accepted: 25-11-2021 e-Published: 05-12-2021**

Soybean is marvelous gift of natural surrounding for us. Soybean presented as an excellent source of good quality protein, large amount of dietary fiber, low (SF) saturated fat, and its isoflavone content makes it amazing food. Omega-3 fatty acid in soybean oil is an important (FA) fatty acid for human diet whereas in the soymilk industry, soy pulp is a by-product also called okara. In the present study, it was planned to conduct physicochemical analysis of okara and to estimate the effect of day physicochemical parameters, mineral contents, organoleptic or sensory characteristics and textural profile analysis (TPA) of okara bread. The entire research was conceded out at Institute of Food science and Nutrition, B.Z.U. Multan. All ingredients for bread making was obtained from local market and for okara soybean was purchased from Multan. In the trial, with different ratios of okara six treatments were planned. Control bread (T_1), 3% okara containing bread (T_2), 6% okara containing bread(T_3), 9 % okara containing bread(T_4), 12% okara containing bread(T_5),15% okara containing bread(T_6). Samples of bread prepared and stored at 4^0C (refrigeration temperature) Physicochemical, mineral profile, sensory and texture profile was carried out for all treatments at 0 and 5th days. In all experiments, it was concluded that the okara based bread properties from 0 to 5th days as compared to control bread. It was further concluded, that the okara could not be added up to 10 % in bread, consumers acceptance towards 3%, 6%, 9% bread rather than 12% and 15% Okara bread.

Keywords: Okara, soy pulp, bread, physicochemical and sensorial analysis

INTRODUCTION

Cereals i.e. wheat, rice, barley, millet, buckwheat and soybean are important source to feed human all over the world due to presence of health promoting bioactive components (Noreen *et al*., 2020). They are significant and promising source of energy enriched compounds which are used as daily diet to mitigate several human disorders (Orf, 2013). Among these plants, soybean is marvelous gift of nature and an excellent source of good quality protein, large amount of dietary fiber, low (SF) saturated fat, and its isoflavone content (Asif and Achaya, 2013). Soybean in Asian countries has useful nutrition and dietary ingredients because of having good proteins, omega 3 & 6 and isoflavones. It is also good source of omega-3 fatty acid and good amount of unsaturated fatty acid that is occupied

into account as part of the healthy fat group (Alpha-linolenic acid) Omega-3 fatty acid in soybean oil is an important (FA) fatty acid for human diet, that indicate it cannot produce by human (Tufail et al. 2018).

Continuous use of foods having polyunsaturated fatty acid (PUFA) reduce heart attack deaths. Soya foods are excellent source of vitamins, minerals, oligosaccharides, dietary fiber and protein, and are helpful in reduction of cardiovascular disease, diabetes (type 2), cancer risk (Khan et al. 2020), improve bone heath and aid in symptoms that related to menopause (Chen et al. 2010). Furthermore, products of soy contain phytoestrogens, isoflavones that are associated with various possible health benefits, i.e. anti-cancer causing action and bone-sparing effects (Tufail et al. 2020). In the soymilk industry, soy pulp is a by-product also called okara. In the production of soymilk, it is actually insoluble parts of soybean seed. Okara is a white yellowish in color and had been incorporated in the vegetarian's diet of western countries since 20th century (O'Toole, 1999). It is comprises of proteins 24.5 – 37.5 g /100 g of dry matter, isoflavone 0.14 g /100g, dietary fiber 14.5 - 55.4 g /100 g and lipids 9.3 – 22.3 g /100 g (Surel and Couplet, 2005). Due to this composition, it has a great role in industry of food as a useful different item (Mateos-Aparicio et al. 2010).

The bread is a primary food that is conventionally prepared from whole wheat flour. In overall world it is consumed while it has different processing techniques and a large variation in choice of ingredients (Fardet et al. 2006). The combination of non-wheat flours in process of bread making i.e. 30% sweet potato flour used in process of bread-making instead of normal wheat flour (Mohammed et al. 2012). The combination of different ingredients such as complex flour of ach, wheat, and cowpea are used to prepare bread (Zahra et al. 2020).

MATERIALS AND METHODS

The research studies declared for the "Utilization of Soy pulp (okara) for the preparation of Yeast Leavened Pan Bread" was achieved in Institute of Food Science and Nutrition (IFSN), Faculty of Agriculture Sciences and Technology, Bahauddin Zakariya University, Multan. Raw materials (white flour, okara (yellow soybean), yeast, sugar, salt and preservatives) obtained from local market, Multan. For further studies proximate analysis of soy pulp (okara) was carried out. Determination of moisture, fat, fiber, ash by Feldsine (2002) method, while protein determined by AACC (2000) method. For the determination of minerals okara sample was studied. By the method of Kirk and Sawyer (1991)

Flow Diagram for Okara

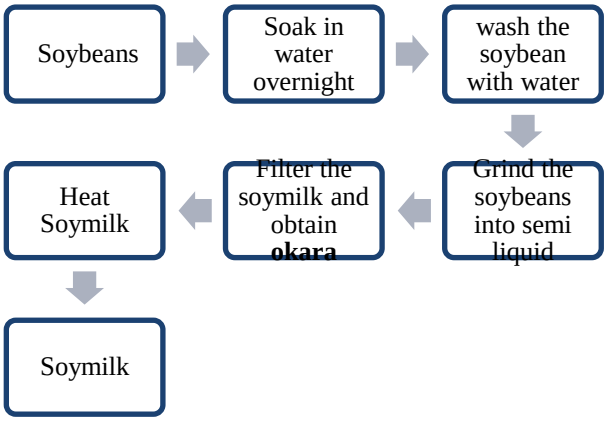

Figure 2: Flow diagram of soymilk production through the Chinese method: adapted from Liu, 1999 Okara (soy pulp) Bread making

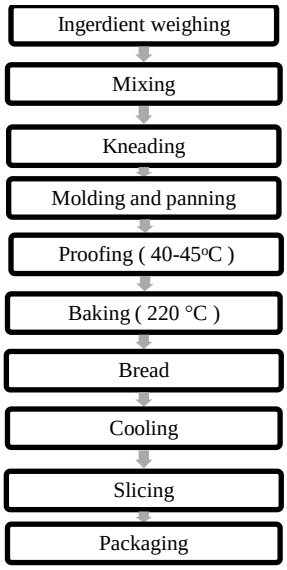

Figure. 3: Flow diagram of okara (soy pulp) bread making

Experimental plan for okara bread

For okara bread different ratio of okara was added to flour. Treatments plan of okara bread consist on different ratios:

T_1= Control bread (Without Okara)
T_2= 3% okara containing bread
T_3= 6% okara containing bread
T_4= 9% okara containing bread

T_5= 12% okara containing bread
T_6=15% okara containing bread

Study of okara bread
For analysis of bread, the samples were prepared and evaluated to physicochemical or sensory at 4^0C chilled storage at day 0 and 5th day. The moisture, fat, fiber, ash were determined by the guidelines of Feldsine (2002) method whereas protein determined by AACC (2000) method, and carbohydrate was calculated by given formula: Carbohydrate % = 100 – (moisture% + ash% + fat% + protein%+fiber%). Further, minerals contents for bread samples were determined through adopting the protocol of Kirk and Sawyer (1991).

Sensory evaluation
Faculty members and students of Institute of Food Science and Nutrition, B.Z.U Multan evaluated bread sample for sensory parameters as crust color, crumb color, crust appearance, crumb appearance, taste, texture, aroma, mouth feel and overall acceptability at 0 day and 5th day. For sensory evaluation Hedonic scale was used.

Statistical Analysis of bread
Each experiment was performed in triplicate in 0 and 5th day and data was reported as means ±(SD) standard deviations. All trials result were done in a factorial design. Statistical results in okara bread properties were determined by ANOVA (analysis of variance) range test of Duncan's multiple ($P< 0.05$).

RESULTS

Proximate Results for Okara / Soy Pulp
Byproduct of soy and soymilk is okara which is high in protein, dietary fiber and protein. In okara about 1 /3rd of the isoflavones which are existing in the soybean, remains in it (Bowles & Demiate, 2006; Jackson et al., 2002), so okara is a worthy, low-cost foundation for animal feed as well as for human consumption. For the okara sample proximate analysis was carried out (Table 1). Gopalan et al. 1971 and Katayama and Wilson, 2008, who observed that the moisture % was 8.4%, the results in the present study showed contradiction. Redondo-Cuenca et al. (2008) and Mateos-Aparicio et al. (2010) who observed 25 % protein in sample of okara. Redondo-Cuenca et al. (2008) and Mateos-Aparicio et al. (2010) who observed 10 % fat in okara sample. Redondo-Cuenca et al. (2008) and Mateos-Aparicio et al. (2010) who observed who observed 4 % ash in sample of okara, the results in the present research also showed contradiction.

Table 1: Proximate Composition of Okara (%)

Moisture	Protein	Fat	Ash	Fiber
12.35	20.45	8.7	2.94	36.88

Minerals in okara
According to Stanojevic et al.2014 the most rich minerals in raw okara were potassium (1.04−1.21 g/100g), phosphorus (0.45−0.50 g/100 g), calcium (0.26−0.39 g/100 g), and iron (5.45−10.95 mg/100 g) and according to Lu et al.2013 the potassium 9.36 mg/g,Ca 4.19 mg/g ,Na 0.96 mg/g , Mg 2.57 mg/g , Mn 0.019 , Zn 0.026 mg/g and iron 0.11 mg/g. Results for Fe correlated with the findings of Lu *et al.,*2013 who observed 0.12 mg per g of iron in okara. The results for Zn and mg contradict with the findings of Lu et al.2013, who observed Mg 2.57mg/g and Zn 0.026 mg/g in okara sample. The results for Ca and K also showed slight variations with Lu et al.2013.

Table 2: Minerals in Okara (mg/g)

Minerals	Mg	Zn	Fe	Ca	K
Content	1.42	0.18	0.12	3.4	6.43

Chemical results of Okara Bread
For okara bread, the physico-chemical analysis e.g. moisture, ash, fat, fiber, protein and carbohydrate were carried out at 0 (Table 3) and 5th (Table 5) days of storage. Moisture values showed significant difference among days and treatments. Recent results revealed that moisture % decreased at 0 to 5th day. The outcomes were correlated with the result of G. L. Wickramarathna and P. C. Arampath (2003) who observed moisture content of okara bread. Recent results revealed that 0 to 5th fat % decreased. The outcomes were contradiction with the finding of G. L. Wickramarathna and P. C. Arampath (2003) who observed fat content of okara bread. Protein The existing results revealed that 0 to 5th day protein content increased. The results were showed contradiction with the finding of G. L. Wickramarathna and P. C. Arampath (2003) who observed protein content of okara bread. Recent results revealed that fiber % increased in0 to 5th day. The outcomes were indicated contradiction with the finding of G. L. Wickramarathna and P. C. Arampath (2003) who observed fiber content of okara bread. Recent outcomes showed that ash %increase in 0 to 5th day The outcomes was indicated contradiction with the result of G. L. Wickramarathna and P. C. Arampath (2003) who observed ash content of okara bread.

Table 3: Proximate analysis of bread on 0 day

Treatments	0 day					
	Moisture	Fat	Protein	Fiber	Ash	Carbohydrates
T_1	36.02±0.01	2.67±0.02	10.01±0.11	0.14±0.22	1.82±0.11	49.48±0.02
T_2	37.4±0.02	2.87±0.02	11.03±0.12	0.18±0.21	1.89±0.10	46.82±0.11
T_3	38.88±0.01	3.04±0.02	12.9±0.11	0.22±0.22	1.96±0.11	44.03±0.03
T_4	39.92±0.03	3.24±0.02	14.66±0.12	0.26±0.33	2.12±0.10	41.65±0.22
T_5	41.14±0.01	3.41±0.03	17.01±0.13	0.3±0.31	2.19±0.11	39.17±0.21
T_6	43.71±0.02	3.61±0.02	19.02±0.14	0.34±0.21	3.06±0.10	34.25±0.31

Table 4: Proximate analysis of bread on 0 day

Treatments	5^{th} day					
	Moisture	Fat	Protein	Fiber	Ash	Carbohydrates
T_1	34±0.03	2.47±0.03	10.52±0.13	0.15±0.28	1.84±0.22	51.01±0.02
T_2	35.31±0.04	2.73±0.01	11.55±0.14	0.19±0.25	1.91±0.20	48.47±0.15
T_3	36.66±0.02	2.87±0.04	13.52±0.11	0.24±0.24	1.98±0.21	45.82±0.05
T_4	37.51±0.05	3.07±0.02	16.01±0.12	0.28±0.38	2.14±0.20	43.54±0.26
T_5	39.44±0.01	3.28±0.05	18.88±0.15	0.32±0.41	2.21±0.21	40.26±0.24
T_6	41.01±0.03	3.48±0.04	20.88±0.14	0.36±0.31	3.08±0.20	36.57±0.35

Organoleptic results of Bread

Sensory or organoleptic attributes like crust and crumb appearance, taste, crust and crumb color, aroma, volume, texture, mouth feel and overall acceptability play important role. These all parameters checked through Hedonic scale at 0 (Table 5) and 5^{th} (Table 6) days of storage. Highest value for crust appearance was 5.1% at 0 day and 4.1% at 5^{th} day. With the passage of days crust appearance of okara bread decreased. Addition of fiber effect the crust appearance of baking products. Highest value for crumb appearance was 5.8% at 0 day and 4.8% at 5^{th} day. Present studies showed that crumb appearance of okara bread decreased with passage of days. Fiber content effect the bread quality. High content of fiber mostly lower the quality attributes. Highest value for crumb appearance was 5.8% at 0 day and 4.8% at 5^{th} day. Present studies showed that crumb appearance of okara bread decreased with passage of days. Fiber content effect the bread quality. High content of fiber mostly lower the quality attributes. For crust color value was same 5.6% at 0 day and 5.6% at 5^{th} day. In sensory evaluation crust color of okara bread remain same with the passage of days. Fiber content effect the crust color. For crumb color value was same 5.5% at 0 day and 5.5% at 5^{th} day. In sensory evaluation crumb color of okara bread remain same with the passage of days. Fiber content effect the crumb color.

Highest value for aroma was 5.3% at 0 day and 4.2% at 5^{th} day. Highest value for taste was 4.8% at 0 day and 3.7% at 5^{th} day. Sensory evaluation of present studies showed that with the passage of days taste attributes decreased. Percentage of fiber also effect the qualities of products. High percentage of fiber reduce the taste quality. Highest value for volume was 5.5% at 0 day and 4.5% at 5^{th} day. In sensory evaluation volume of okara bread decreased with the passage of days. High content of fiber normally showed the lower volume of product. Highest value for mouth feel was 5.3% at 0 day and 4.3% at 5^{th} day. Highest value for softness was 5% at 0 day and 4% at 5^{th} day. Present studies showed that softness of okara bread decreased with the passage of days. Addition of fiber effect the softness of products. For control and 3% okara bread showed the maximum softness. Highest value for chewiness was 5.1% at 0 day and 4.1% at 5^{th} day. In sensory evaluation with the passage of time chewiness of okara bread decreased.

Table 5: Sensory analysis of treatments on 0 day

Treatments	0 day										
	Crust appearance	Crumb appearance	Crust color	Crumb color	Aroma	Taste	Volume	Mouth feel	softness	chewiness	Overall acceptability
T_1	9.5±0.12	9.2±0.32	9.7±0.44	9.7±0.42	9.7±0.31	9.6±0.42	9.1±0.22	9.6±0.33	9.6±0.1	8±1	9.6±0.11
T_2	8.6±0.23	8.2±0.22	9.2±0.32	8.7±0.31	9±0.29	8.6±0.32	8.5±0.18	8.7±0.28	8.6±0.1	8±1.21	8.7±0.12
T_3	7.7±0.34	7.5±0.12	8.2±0.21	8±0.21	8±0.22	7.8±0.28	7.8±0.16	7.5±0.26	7.8±0.1	7±1.20	7.5±0.11
T_4	7.1±0.12	7±0.11	7.5±0.11	7.1±0.14	7.1±0.18	7±0.18	7±0.11	6.6±0.22	7±1	6.5±0.33	6.6±0.13
T_5	6±0.23	6.1±0.14	6.1±0.13	6.3±0.12	6.1±0.12	6±0.16	6.1±0.14	5.6±0.20	6±1	5.8±0.21	5.6±0.11
T_6	5.1±0.34	5.8±0.18	5.6±0.04	5.5±0.21	5.3±0.08	4.8±0.11	5.5±0.18	5.3±0.17	5±1	5.1±0.11	5.3±0.10

Table 6: Sensory analysis of treatments on 5th day

Treatments	5th day										
	Crust appearance	Crumb appearance	Crust color	Crumb color	Aroma	Taste	Volume	Mouth feel	softness	chewiness	Overall acceptability
T_1	8.4±0.16	8.3±0.30	9.7±0.48	9.7±0.42	8.6±0.31	8.8±0.42	8.1±0.20	8.7±0.31	8.6±0.1	7±1	8.7±0.14
T_2	7.5±0.28	7.2±0.28	9.2±0.38	8.7±0.31	8±0.29	7.6±0.32	7.5±0.16	7.6±0.26	7.6±0.1	7±1.24	7.6±0.16
T_3	6.5±0.38	6.5±0.19	8.2±0.25	8±0.21	7±0.24	7.5±0.26	6.8±0.14	6.5±0.24	6.8±0.1	6±1.22	6.5±0.15
T_4	6.1±0.14	6±0.16	7.5±0.13	7.1±0.14	6.1±0.16	6±0.16	6±0.13	5.7±0.20	6±1	5.5±0.33	5.7±0.15
T_5	5±0.25	5.1±0.20	6.1±0.18	6.3±0.12	5.1±0.14	5±0.14	5.1±0.12	4.6±0.18	5±1	4.8±0.24	4.6±0.14
T_6	4.1±0.0.36	4.8±0.22	5.6±0.06	5.5±0.21	4.2±0.06	3.7±0.13	4.5±0.16	4.3±0.15	4±1	4.1±0.13	4.3±0.12

Percentage of fiber effect the quality of products. Highest value for overall acceptability was 5.3% at 0 day and 4.3% at 5th day. Overall acceptability of okara bread decreased with the addition of fiber as compared to control bread. According to Xie *et al*, 2008 showed that high percentage of fiber had lowest consumer acceptance. Fiber rich products decrease the risk of gastrointestinal disorders, heart disorders and hypercholesterolemia.

For all treatments, at 0 and 5th day physicochemical analysis carried out presented that the increasing trend in protein, fiber, carbohydrate and ash contents was observed while moisture and fat presented decreasing trend from 0 to 5th day. Sensory of okara showed that different sensory attributes (crust & crumb appearance, crust and crumb color, overall acceptability, taste, aroma, volume, mouth feel, texture and score) decreased for okara bread and also declined for control bread at 0 and 5th day. Crumb and crust appearance gradually decreased from control bread at 0 day, at 5th day crust and crumb appearance show decline score.

Minerals Determination of Bread

Minerals of okara bread for Treatment T_1, T_2, T_3, T_4, T_5 and T_6 were determined at 0 and 5th days of storage. In present research, calcium was determined and showed minimum and maximum mean value as 315mg and 316mg respectively at 0 and 5th days of storage days for Treatment T_1, Treatment T_2 showed 317mg and 318 mg mean value at 0 and 5th days of storage, Treatment T_3 showed 319mg and 320 mg at 0 and 5th days of storage and Treatment T_4 showed 322 and 324 at 0 and 5th days of storage. All treatments presented that at 5th day of study the Calcium contents increased. These findings contradiction with the Bolarinwa et al. (2019) who observed that calcium content increased with the storage days, he observed 334 mg/100mg Calcium content in bread products. Potassium content (Table 7) showed that all treatment showed increasing values of potassium with the passage of storage days. For Treatment control bread, 3%, 6%, 9%, 12% and 15% the mean values were 213, 215.5,218, 221, 224, 227. Bolarinwa et al. (2019) observed that the potassium was 224mg/100mg potassium. Zinc content in table (55) showed that the all treatments showed an increasing trend of Zinc with passage of time. For Treatment control bread, 3%, 6%, 9%, 12% and 15% the mean values were0.38, 0.41, 0.44, 0.47, 0.50 and 0.53. These somehow relate with the findings of Bolarinwa et al. (2019) who observed 0.41mg/100 mg zinc in bread.

Table 7: Minerals in okara bread

Minerals	Treatments	Storage days		Over all mean
		0	5	
Calcium	T_1	315	316	315.5
	T_2	317	318	317.5
	T_3	319	320	319.5
	T_4	322	324	323
	T_5	325	327	326
	T_6	328	330	329
Potassium	T_1	212	214	213
	T_2	215	216	215.5
	T_3	217	219	218
	T_4	220	222	221
	T_5	223	225	224
	T_6	226	228	227
Zinc	T_1	0.37	0.39	0.38
	T_2	0.40	0.42	0.41
	T_3	0.43	0.45	0.44
	T_4	0.46	0.48	0.47
	T_5	0.49	0.51	0.50
	T_6	0.52	0.54	0.53

T_1: Control bread
T_2: 3 % okara containing bread
T_3: 6 % okara containing bread
T_4: 9 % okara containing bread
T_5: 12% okara containing bread
T_6: 15% okara containing bread

CONCLUSION

The current research was carried out to develop okara based bread. Due to the okara based bread , the proximate analysis moisture and fat decreased while fiber, ash , protein and carbohydrate increased. There was a problem of beany taste and hard texture due to addition of okara in all bread. In all experiments, it was concluded that the okara based bread properties from 0 to 5th days as compared to control bread. It was further concluded, that the okara could not be added up to 10 % in bread, consumers acceptance towards 3%, 6%, 9% bread rather than 12% and 15% Okara bread. Recommendations for future researches are as; analysis of microbial load of okara based bread should be carried out. Soy flour and okara should be used in similar recipe. Defatted okara should be used in several products. There should be fortification of other ingredients with okara in bread.

CONFLICT OF INTEREST

The authors declared that present study was

performed in absence of any conflict of interest.

ACKNOWLEGEMENT

. The entire research work was based on no external source of funding or sponsorship.

AUTHOR CONTRIBUTIONS

TAG and MI: Conceptualization and methodology. TT, ZK, SA, SN and ZF: Writing original draft. TAG, NK, TT, SN and SFA: Visualization and investigation. MA, LN and SN: Data validation. TAG, SN and SA: Writing, reviewing and editing. All authors read and approved the final version

REFERENCES

Feldsine, P., Abeyta, C. and Andrews, W.H., 2002. AOAC International methods committee guidelines for validation of qualitative and quantitative food microbiological official methods of analysis. *Journal of AOAC International*, *85*(5), pp.1187-1200.

Asif, M., Acharya, M., 2013. Phytochemicals and nutritional health benefits of soy plant. *International Journal of Nutrition, Pharmacology, Neurological Diseases* 3(1), p.64.

Bolarinwa, I.F., Aruna, T.E., Raji, A.O., 2019. Nutritive value and acceptability of bread fortified with moringa seed powder. *Journal of the Saudi Society of Agricultural Sciences* 18(2), pp.195-200.

Bowles, S., Demiate, I.M., 2006. Caracterização físico-química de okara e aplicação em pães do tipo francês. *Ciência e Tecnologia de Alimentos* 26(3), pp.652-659.

Chen, H., Liu, L.J., Zhu, J.J., Xu, B., Li, R. 2010. Effect of soybean oligosaccharides on blood lipid, glucose levels and antioxidant enzymes activity in high fat rats. *Food Chemistry* 119(4), pp.1633-1636.

Jackson, C.J., Dini, J.P., Lavandier C, Rupasinghe HPV, Faulkner H, Poysa V, Buzzell D, DeGrandis S. 2002. Effects of processing on the content and composition of isoflavones during manufacturing of soy beverage and tofu. *Process Biochemistry* 37(10), pp.1117-1123.

Katayama, M., Wilson, L.A., 2008. Utilization of Okara, a Byproduct from Soymilk Production, through the Development of Soy-Based Snack Food. *Journal of food science* 73(3), pp.S152-S157.

Kirk, S., Sawyer, R., 1991. Pearson's composition and analysis of foods (No. Ed. 9). Longman Group Ltd.

Liu, K., 1999. Chemistry and nutritional value of soybean components. In Soybeans (pp. 25-113). Springer US.

Lu, F., Cui, Z., Liu, Y., Li. B., 2013a .The Effect of Okara on the Qualities of Noodle and Steamed Bread. *Advance Journal of Food Science and Technology* 5(7): pp.960-968.

Mateos-Aparicio, I., Mateos-Peinado, C., Jiménez-Escrig, A., Rupérez, P., 2010. Multifunctional antioxidant activity of polysaccharide fractions from the soybean byproduct okara. *Carbohydrate Polymers* 82(2), pp.245-250.

Mohammed, I., Ahmed, A.R., Senge, B., 2012. Dough rheology and bread quality of wheat chickpea flour blends. *Industrial Crops Products* 36:196e202

Noreen, S., Rizwan, B., Khan, M., Farooq, S., 2021. Health benefits of Buckwheat (Fagopyrum esculentum), potential remedy for diseases, rare to cancer: A mini Review. Infectious Disorders Drug Targets 21(3).

Orf, J.H., 2013. Selecting Soybean varieties for composition, Department of Agronomy and Plant Genetics, University of Minnesota.

O'Toole, D.K., 1999. Characteristics and use of okara, the soybean residue from soy milk production a review. *Journal of Agricultural and Food Chemistry* 47(2), pp.363-371.

Redondo-Cuenca, A., Villanueva-Suárez, M.J., Mateos-Aparicio, I., 2008. Soybean seeds and its by-product okara as sources of dietary fibre. *Food chemistry* 108(3), pp.1099-1105.

Tufail, T., Saeed, F., Arshad, M.U., Afzaal, M., Rasheed, R., Bader Ul Ain, H., Imran, M., Abrar, M., Farooq, M.A., Shahid, M.Z., 2020. Exploring the effect of cereal bran cell wall on rheological properties of wheat flour. *Journal of Food Processing and Preservation* 44(3), p.e14345.

Tufail, T., Saeed, F., Imran, M., Arshad, M.U., Anjum, F.M., Afzaal, M., Bader Ul Ain, H., Shahbaz, M., Gondal, T.A., Hussain, S., 2018. Biochemical characterization of wheat straw cell wall with special reference to bioactive profile. *International journal of food properties 21*(1), pp.1303-1310.

Wickramarathna, G.L., Arampath, P.C. 2003. Utilization of okara in bread making. Journal of Bioscience, 31, pp.29-33.

Xie, M., Huff, H., Hsieh, F., Mustapha, A., 2008. Puffing of okara/rice blends using a rice cake machine. Journal of food science 73(8), pp.E341-E348.

Zahra, S.M., Hussain, S., Mahmood, S., Kausar, T., Din, G.M.U., Tufail, T., Altaf, N., Yousaf, M., Quddoos, A.R., Shahid, M.Z., 2020. Shelf stable iron fortified fruit bar's development, proximate estimation and organoleptic characterization. International Journal of Biosciences 16(4), 111-135.

Khan, M., Din, M., Naeem, Z., Sajid Z, Dilawar Khan, Amjad, M.D., Zeb A., Anwar F., Akhtar, M., Noreen S., 2020. Insights Into Acute Myeloid Leukemia: Critical Analysis In Its Wide Aspects. Abasiyan journal of Life Sciences 3(2).