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Impact of oat incorporation and storage period on firmness of leavened bread

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Abstract
The work was carried out in the Department of Food Technology, Islamic University of Science and Technology, Awantipora during the year 2010-2011. Oat flour was incorporated into wheat flour at 0, 10, 20 and 30% substitution levels for preparation of leavened bread. Monosodium Glutamate was added at 0, 0.3 and 0.5% level. Breads prepared without oat flour were kept as control. The developed product was stored at ambient temperature. Textural evaluation was carried out at 1, 2 and 3 days of storage. The mean value for firmness statistically showed a significant increase during the storage period of three days and with the addition of oat flour and monosodium glutamate.

Keywords: Bread, Firmness, Oat flour, wheat flour

1. Introduction

Bread is a staple food, which is prepared by making dough out of water and flour. Various types of flour and ingredients are used in a number of combinations and proportions in the preparation of bread. Additionally, there are different recipes and modes of preparing bread. Because of this, bread comes in a variety of sizes, shapes, and textures. Bread is a leavened food normally produced through fermentation of sugars that have been obtained from starch (commonly wheat flour), which results in chemical interactions between a number of components in the food. Varied ingredients are used during the bread making process to ensure the development of the continuous protein network that is indispensable in guaranteeing the quality of bread (Sivam *et al*., 2010) [1]

Wheat is the most important stable food crop for more than one third of the world population and contributes more calories and proteins to the world diet than any other cereal crops (Abd-El-Haleem *et al*., 1998; Adams *et al*., 2002; Shewry, 2009) [2, 3, 4]. It is nutritious, easy to store and transport and can be processed into various types of food. Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fiber (Shewry, 2007; Simmonds, 1989) [5] Wheat flour is used to prepare bread, produce biscuits, confectionary products, noodles and vital wheat gluten or seitan.

Oat *(Avena sativa* L.) is an important food crop, distinct among the cereals due to its multifunctional characteristics and nutritional profile. It is used both for human and animal nutrition. Before using in human nutrition, oat was used for medicine purposes. Oat is a nutritious source of protein, carbohydrate, fiber, vitamins and minerals. In comparison to other cereals, these are characterized by large amount of total protein, carbohydrate (primary starch content), crude fat, dietary fibre (non-starch), unique antioxidants and considerable vitamins and mineral content. A good taste and an activity of stimulating metabolic changes in the body make nutritive value of oats high for both people and animals (Brand and Merwe 1996; Lia *et al*., 1997; Peltonen-Sainio *et al*., 2004; Peterson 2004) [7, 8, 9, 10]. Oat β-glucan has outstanding functional properties and is of huge importance in human nutrition. Several studies have shown the cholesterol level decreasing due to increase β-glucans in human diet. The β-glucans content in oats ranges from 2 to 8 g 100 g^{-1} of oat groats and is seemingly influenced by genetic and environmental factors. In comparison to the other cereals, oat β-glucan present in higher levels and are more readily soluble - 88 % which is much higher that barley (69 %) (Arendt and Zannini 2013) [11]. Due to the increased consumer awareness regarding health and the role of various foods in the improvement of quality of life, oats hold many opportunities for development as foods, feeds, industrial and pharmaceutical products, which all add value to the oat crop.

Leavened bread contains leavening agent, usually yeast and is soft, light and fluffy in texture. It contains tiny air pockets, making it somewhat resemble a sponge. The leavening which is mixed into the bread dough causes the dough to rise both before it is baked and during baking.

"All breads fresh from oven is a good bread". There is a lot of truth in that saying. Bread loses its desirability progressively with the time it is out of the oven. Those undesirable changes that occur with time are collectively called "staling". They include toughening of the crust, firming of the crumb, a loss of flavour, an increase in the opaqueness of the crumb, and a decrease in soluble starch (Hoseney, 1994) [12].

2. Materials and methods

The work was carried out in the Department of Food Technology, Islamic University of Science and Technology Awantipora during the year 2010-2011. Oats were purchased from Srinagar and then milled in a mixer to obtain a whole flour. The flour was stored in plastic air tight containers at refrigerated temperatures until used. Refined wheat flour, shortening, compressed yeast etc. was purchased from local market of Srinagar.

The formulations of the oat enriched breads were according to the Table 1. Composite flours were prepared as mentioned in Table 2. Breads were prepared from blended flour of wheat and oats according to the procedure shown in Fig.1 as flow chart.

Table 1: Wheat-oat composite bread formulations'

Wheat flour/composite flour	150 g
Yeast	3.0 g
Sugar	6.0g
Salt	1.5g
shortening	3.0g

MSG was used at 0, 0.3, 0.5% level. The ingredients were weighed accurately and the yeast was activated in hot water. All the ingredients were mixed in a vessel and yeast was added while taking into account the amount of water. The dough was then placed in an incubator at 37 ^{0}C for fermentation. Dough was taken out after 1 hour and then knocked back to remove the excess gases. The dough was again placed in incubator for fermentation and removed after 30 minutes, knocked back, rolled and moulded into pans and then allowed to ferment for another 35 minutes. The pans were then placed in baking oven at 220 ^{0}C for 30-35min. The breads were taken out, cooled and then sliced. The breads were stored at room temperature.

Table 2: Wheat-oat composite flours used for bread formulations

Treatment		Concentration of MSG	Wheat flour (%)	oat flour (%)
T1	T_1M_1	0.0%	100%	0%
	T_1M_2	0.3%	100%	0%
	T_1M_3	0.5%	100%	0%
T_2	T_2M_1	0.0%	90%	10%
	T_2M_2	0.3%	90%	10%
	T_2M_3	0.5%	90%	10%
T_3	T_3M_1	0.0%	80%	20%
	T_3M_2	0.3%	80%	20%
	T_3M_3	0.5%	80%	20%
T_4	T_4M_1	0.0%	70%	30%
	T_4M_2	0.3%	70%	30%
	T_4M_3	0.5%	70%	30%

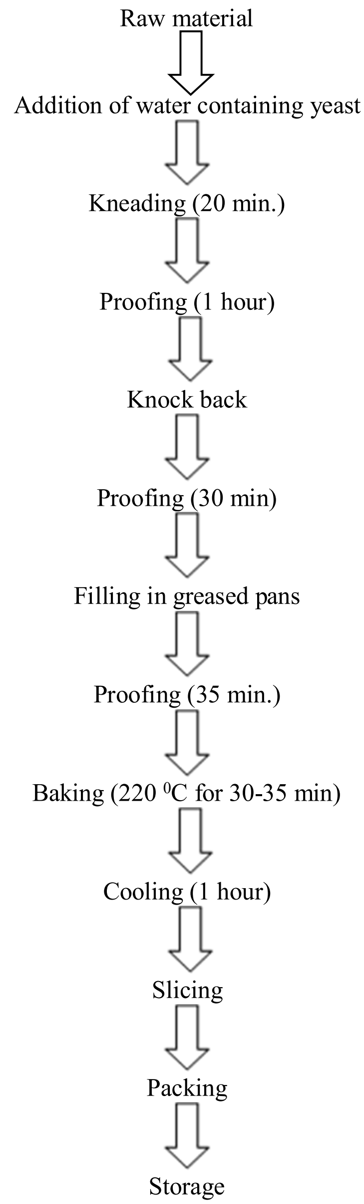

Fig 1: Flow chart for bread making

2.1 Texture Analysis

A Texture Analyzer (TA. HD. Plus, stable Micro Systems, Godalming, Surrey, U.K.) was used to measure the firmness. For firmness, the sample was removed from its place of storage and was placed centrally over the supports just prior to testing. The texture profile analysis was done at pre-test speed of 1.0 mm/s, test speed of 1.7 mm/s and a post- test speed of 10.0 mm/s using a 5 Kg load cell.

2.1.1 Firmness

Firmness is defined in this method as the force required to compress the product.

2.1.1.1 Sample Preparation:

The loaves were sliced mechanically into equal slice thickness (0.5inch). Two or three end slices of loaf were discarded.

2.1.1.2 Test set-up:

The sample was placed centrally under the cylindrical probe, avoiding any irregular or non- representative of crumb. The test was commenced.

2.1.1.3 Observations

Once the trigger force was attained, the probe proceeded to compress the sample until it had compressed it by 40% of the product height. It then withdrawn from the sample and returned to its starting position.

3. Results and discussion

Storage period, MSG and oat incorporation significantly affected bread firmness. Increase in storage days resulted in a significant increase in bread firmness (Table 1). These results are in alignment with those of Hoseney, (1994) [12]; Goesaert *et al*. (2009) [13]. The rate at which moisture is lost from the product depends in part on the differential in moisture content between product and atmosphere, and it proceeds faster when the moisture content of the atmosphere is lower. During storage, moisture moves from the moist crumb zone to the drier crust. In unwrapped bread, the moisture evaporates to the atmosphere, but for wrapped bread an equilibrium is reached between the crumb, crust and atmosphere in the wrapper surrounding the bread. Collectively the changes result in a reduction of the crumb moisture content and an increase in that of the crust. The gelatinised starch (amylopectin) network, present in soft, fresh bread, is gradually transformed into an extensive, partially crystalline, permanent amylopectin network, with amylopectin crystallites acting as junction zones. This network increasingly accounts for the bulk rheological behaviour of aging bread crumb. Furthermore, as amylopectin retrogradation proceeds, moisture migration within the crumb structure occurs, and more and more water is immobilised within amylopectin crystallites. The crystalline hydrate water can no longer plasticise the different networks, which goes hand in hand with increased crumb firmness and decreased crumb resilience, due to a less flexible gluten network. As is evident from Table 1, the increase in firmness during storage was less for oat incorporated bread as compared to control. Oat has excellent moisture retention properties that keep breads fresher for longer periods of time. Addition of oat, oat starch, or oat lecithin to wheat bread might retard also the staling rate of the bread. These results are in alignment with those of Flander *et al*. (2007) [14]; Forssell *et al*. (1998) [15]; Zhang *et al*. (1998) [16], who reported retention in freshness of oat incorporated bread during storage. The increase in oat flour level resulted in increased firmness of bread due to dilution of gluten resulting in lower volume bread. These results are in alignment with those of Oomah (1983) [17]; Zhang *et al.* (1998) [16] who reported that the volume of a wheat-oat loaf is smaller than that of a wheat loaf.

Table 3: Change in Firmness (N) of bread at different time intervals and with addition of Oat flour and MSG.

	T_1				T_2				T_3				T_4			
	M_1	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**
D_1	7.68	11	15.1	11.26	13.01	15.17	19.88	16.02	16.3	17.93	20.24	18.15	26.03	27.02	30.69	27.91
D_2	18.11	23.92	27.55	23.19	17.75	21.03	25.12	21.3	20.67	22.46	26.76	23.29	28.38	30.37	33.51	30.75
D_3	28.38	36.83	42.17	35.79	23.54	26.9	29.54	26.66	25.46	27.01	32.42	28.29	31.61	34.32	35.453	33.79
	18.05	23.9 1	28.27	23.41	18.1	21.033	24.84	21.32	20.8	22.46	26.47	23.25	28.67	30.57	33.21	30.82

CD $P \leq 0.05$

Treatment (T): 0.011
MSG (M): 0.009
T × M: 0.019

Treatment (T): 0.011
Storage: 0.009
T × S: 0.019
T × M × S = 0.032

Storage: 0.009
MSG (M): 0.009
T × M: 0.016

T_1 = Control bread (100% W.F)
T_2 = 10% W.F: 90% O.F.
T_3 = 20% W.F: 80% O.F.
T_4 = 30% W.F: 70%

M_1 = 0% MSG
M_2 = 0.3% MSG
M_3 = 0.5%MSG
W.F = Wheat flour.

D_1 = Day 1
D_2 = Day 2
D_3 = Day 3
O.F = Oat flour

4. Conclusion

The study revealed that firmness of oat-wheat leavened bread increased significantly during the storage period of three days. Oat flour incorporation and MSG also caused a significant increase in bread firmness. Oat flour addition resulted in higher values of firmness as the incorporation level increased but reduction of bread firmness during storage as compared to control due to higher moisture retention property of oats. It was concluded from the present studies that breads made from 10% oat flour blend were better than other blended breads as far as firmness was concerned.

5. References

1. Sivam AS, Sun-Waterhouse D, Quek SY, Perera CO. Properties of bread dough with added fibre polysaccharides and phenolic antioxidants: A review. Journal of Food Science. 2010; 75:163-174.
2. Abd-El-Haleem SHM, Reham MA, Mohamed SMS, Abdel-Aal ESM, Sosulski FW, Hucl P *et al* Origins, characteristics and potentials of ancient wheats. Cereal Foods World. 1998; 43:708-715.
3. Adams ML, Lombi E, Zhao FJ, McGrath SP. Evidence of low selenium concentrations in UK bread-making wheat grain. Journal of the Science of Food and Agriculture. 2002; 82:1160-1165.
4. Shewry PR. The healthgrain programme opens new opportunities for improving wheat for nutrition and health. Nutrition Bulletin. 2009; 34(2):225-231.
5. Shewry PR. Improving the protein content and composition of cereal grain. Journal of Cereal Science. 2007; 46:239-250.
6. Simmonds DH. Inherent Quality Factors in Wheat. Wheat and Wheat Quality in Australia. Australia Wheat Board, Melbourne. 1989, 31-61.
7. Brand TS, Merwe JP. Naked oats (Avena nuda) as a substitute for maize in diets for weanling and grower-finisher pigs. Animal Feed Science and Technology. 1996; 57:139-147.
8. Lia A, Andersson H, Mekki N, Juhel C, Senft M, Lairon D *et al*. Postprandial lipemia in relation to sterol and fat excretion in ileostomy subjects given oat bran and wheat test meals. American Journal of Clinical Nutrition. 1997; 66:357-365.
9. Peltonen-Sainio P, Kontturi M, Rajala A. Impact dehulling oat grain to improve quality of on-farm produced feed. I. Hullability and associated changes in

nutritive value and energy content. Agricultural and Food Science. 2004; 13:18-28.
10. Peterson DM. Oat – a multifunctional grain. In: Peltonen-Sainio, P., Topi- Hulmi, M. (Eds.), Proceedings, 7th International Oat Conference. Agrifood Research Reports 51. MTT Agrifood Research, Jokioinen, Finland, 2004, 21-26.
11. Arendt EK, Zannini E. Oats, Cereal grains for the food and beverage industries. Cambridge: Woodhead Publishing. 2013; 243-282
12. Hoseney RC. Principles of Cereal Science and Technology. Second Edition, *American Association of Cereal Chemistry*. Inc., St. Paul, Minnesota, USA, 1994.
13. Goesaert H, Slade L, Levine H, Delcour AJ. Amylase and bread firming – an integrated view Journal of Cereal Science. 2009; 50(3):345-352.
14. Flander L, Salmenkallio-Marttila M, Suortti T, Autio K. Optimization of ingredients and baking process for improved wholemeal oat bread quality LWT. 2007; 40, 860-870.
15. Forssell P, Shamek S, Ha rko nen H, Poutanen K. Effects of native and enzymatically hydrolysed soya and oat lecithins in starch phase transitions and bread baking. Journal of the Science of Food and Agriculture. 1998; 76: 31-38.
16. Zhang DC, Moore WR, Doehlert DC. Effects of oat grain hydrothermal treatments on wheat–oat flour dough properties and bread baking quality. Journal of Cereal Chemistry. 1998; 75:602-605.
17. Oomah BD. Baking and related properties of wheat–oat composite flours. Cereal Chem. 1983; 60:220-225.