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Development and qualitative estimation of high fibre enriched bread fortified with carrot pomace

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The study was conducted on development and qualitative estimation of high fibre enriched bread fortified with carrot pomace" using carrot pomace powder and refined wheat flour in varying ratio of 2.5:97g, 5:95g, 7.5:92.5g, and 10:90g, respectively. The carrot pomace was dried at 45° C and then was grinded into powder. Also a control sample without fortification was evaluated to assess the difference of physio-chemical parameters between the control and experimental samples during the storage period of 6 days. The parameters were evaluated and assessed on day 0, day 2, day 4 and day 6, respectively. Refined oil was used as shortening agent while sugar powder was added as rich supplement of free carbohydrate source for proper leavening. Preactivated yeast was used for leavening and making of dough. During storage there was loss in the amount of moisture, ash, fat, crude fiber, protein as far as physio-chemical parameters were concerned. The study conducted showed that fortification of carrot pomace directly influences the qualitative aspects of prepared bread while the organoleptic study suggested that bread was acceptable for consumption for a period of six days while T_2 having 5g of carrot pomace was desirable for acceptability on most accounts. The F test was found significant at ($P<0.05$).

Key Words : Qualitative, Fortification, Carrot, Pomace, Bread, Physio-chemical

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INTRODUCTION

By product utilization to minimize the increasing food waste from food processing industries has been an emerging trend in utilizing the wastes for development of value added products. This would rather help in useful utilization of waste for development of such product whose value exceeds the cost of reprocessing. (Manjunatha *et al*., 2003) Carrot is the excellent source of carotene and other vitamins. The carrot is utilized as raw, cooked vegetable, sweet meats or as juice and beverages (Kumar and Kumar, 2011). Carrot pomace is the by-product of carrot juice extraction process. Carrot pomace is a lignocellulosic material produced in large quantities during the process of juice extraction in the industry. Although this agricultural residue may be used as an animal feed, it is usually discarded as waste (Balat, 2011 and Yang Yu *et al*., 2013). Carrot pomace during processing, the yields of juice is only 60-70 per cent while 80 per cent of carotene is lost in the left over pomace (Bohm *et al*., 1999) and (Kumar *et al*., 2011). The left over pomace also includes vitamins, minerals and dietary fibre. The solid waste obtained from carrot juice production contains insoluble fibres which have potential to reduce cholesterol. It can be exploited to reduce the

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environmental load via development of value added products (Basantpure *et al*., 2003). Fibre rich product finds an important place in the form of non caloric bulking and inexpensive agents for partial replacement of flour, fat and sugar. They have the property to enhance water and oil retention for improving emulsions or oxidative stabilities (Elleuch *et al*., 2011). Dietary fibre inclusions have been found to be satisfactory in Bakery products including bread (Almana and Mahmoud, 1994). Moreover increase in fiber content and decrease in calorific value is one of the important features which prolongs freshness because to its capacity to retain water. This chiefly reduces economic losses (Elleuch *et al.*, 2011 and Kohajdová *et al.*, 2011). Dietary fibre has different functions in the human system. It binds water and bile acid, absorbs metals, influences the speed with which the chyme passes through intestines, lowers glucose and cholesterol levels in blood, as well as increases faeces mass (Kritchevsky 1997; Kahlon and Chow 2000; Górecka *et al*., 2002; Kahlon and Woodruf 2003 and Górecka *et al.*, 2010). The carrot (Daucus carota) is a root vegetable. It contains rich amount of β-carotene and vitamins, like thiamine, riboflavin, vitamin B-complex and minerals (Walde *et al.*, 1992). Carrots being good source of energy contain sucrose. Carrots still amounts to a low cost crop which can be converted to value added product which involves proper processing. (Basantpure *et al*., 2003).The carrot (*Daucus carota*) is a root vegetable. Carrot is also an excellent source of calcium pectate; an extraordinary pectin fiber that has the cholesterol lowering properties. It has a property to reduce the risk of high blood pressure, stroke, heart disease and some type of cancer (Bakhru, 1993). Looking at the highly nutritive aspects of carrot which has good fibrous and antioxidant properties a study was planned to investigate the effect of carrot pomace as a means of fortification for increasing the value of bread. In accordance to the above study so planned the organoleptic properties of carrot pomace fortified bread and the physio-chemical parameters were studied. The organoleptic evaluation and physio-chemical parameters, assessment was done to find out the feasibility of the correct ratio of pomace and refined wheat flour which can be useful method for attaining a value enriched product by means of fortification.

METHODOLOGY

The study on development and qualitative evaluation of high fibre enriched bread fortified with carrot pomace" was conducted at Sam Higginbottom Institute of Agricultural Technology and Sciences Allahabad (U.P.) India. The physio-chemical parameters were assessed during the storage period using dried carrot pomace powder for development of bread.

The composition of ingredients were varied by adding carrot pomace powder with a varying ratio of 2.5 per cent, 5 per cent, 7.5 per cent and 10 per cent for T_1, T_2, T_3, T_4 experimental samples. Control sample was also prepared having no fortification for ease of comparison and interpretation of the results. Materials refined wheat flour, carrot pomace powder, sugar, salt, refined oil and compressed yeast were utilized.

Procedure for carrot pomace and bread preparation:

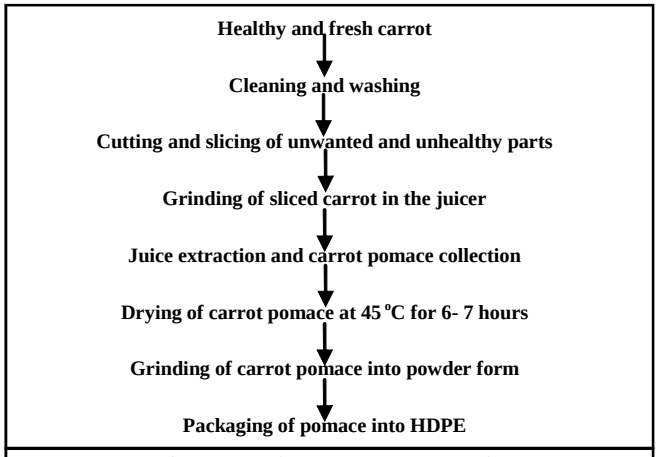

Fig. A : Process flow chart for the preparation of carrot pomace powder

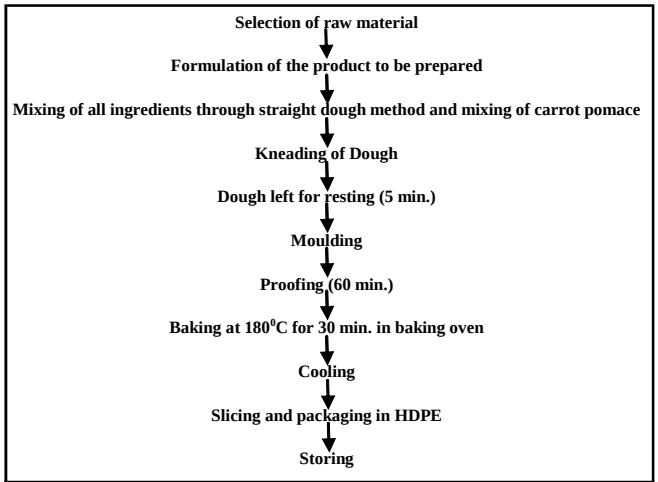

Fig. B : Process flow chart for the preparation of carrot pomace fortified bread

Table A : Experimentation plan

Sr. No.	Protocols and parameters	Levels	Description
1.	Product	1	Bread
2.	Ingredients	7	Refined wheat flour, carrot pomace, salt , sugar, butter, refined oil, bakers yeast
3.	Processing	2	Extraction of Carrot pomace, powder and preparation of bread baking of bread 180° C 30 min.
4.	Samples	4	T_0, T_1, T_2, T_3, T_4
5.	Analysis	3	Organoleptic study, physico-chemical analysis, during storage period on alternate days *i.e.* day0, day2,day4,day6
6.	Packaging materials	1	HDPE

Table B : Treatment parameters

Sr. No.	Treatments	Refined flour%	Pomace powder %
1.	T_0	100	0
2.	T_1	97.5	2.5
3.	T_2	95	5
4.	T_3	92.5	7.5
5.	T_4	90	10

Physio-chemical analysis :

The physio-chemical analysis namely moisture, ash, fat, crude fibre, protein were checked by the methods as mentioned by Ranganna (1986) in Handbook of Analysis and Quality Control for fruit and vegetable product. For organoleptic evaluation hedonic scale was used using colour, taste, flavour, texture and overall acceptability as the reference parameters. Statistical analysis was performed using Anova one way without replication model.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physio-chemical analysis :

Effect of storage period on moisture content of carrot pomace fortified bread :

Table 1 shows the effect of treatments and storage periods on per cent moisture content of control (T_0) and experimental sample (T_1, T_2, T_3, T_4) during storage period of 6 days. On evaluation of result it was found that there was a decrease in moisture content in the bread sample which may be due to the fact that as time period increases there is a loss of moisture. Also with the increasing level of carrot pomace at an increasing percentage of 2.5 per cent-10 per cent in various treatments the amount of water percentage successively decreases. It was noted that the moisture content of product on storage is an important determinant of its keeping quality. On comparing the results of moisture with Latif *et al.* (2005) it was found that moisture content was found in accordance with present study in which there is a decrease of moisture content with the passage of time. The datas so obtained were found in accordance with Rehman and Mudassar (2003). Only (T_0) sample having no fortification reported 37.645 per cent moisture which was also in very close similarity while T_1, T_2, T_3 and T_4 showed moisture within comapritive range as they were fortified with carrot pomace.

Effect of storage period on ash content of carrot pomace bread :

On evaluation of result it was found that the increased ash content was due to high percentage of mineral content present in carrot. The ash content in the bread sample increased with increasing the level of carrot pomace from 2.5 per cent to 10 per cent. But during storage it was found that the high level of ash content was found in the sample having 10 per cent of carrot

Table 1 : Effect of storage period on moisture content of carrot pomace fortified bread

Sample	Day 0	Day 2	Day 4	Day 6
T_0	38.81	38.41	37.97	35.39
T_1	37.36	37.65	36.02	35.56
T_2	37.01	36.88	34.76	33.35
T_3	33.43	32.76	32.02	30.03
T_4	32.06	31.08	30.41	29.27

pomace. Also on the last day of storage the higher amount of ash content was found in the last sample having 10 per cent of carrot pomace powder. The F value was found significant at P<0.05. On comparison it was found that the Ash content as reported by in this current study was found ranging from 0.74-1.635 while the total average ash content was found to be 1.2215 which was in close similarity to Latif *et al.* (2005).

Effect of storage period on fat content of carrot pomace fortified bread :

From Table 3 which shows that the total fat content of bread is a majorly function of externally added fat during bread preparation but fat is also influenced by the storage period and the amount of fat present in the raw material. Maximum fat was found in the control sample while least amount of fat loss was found in the last sample having 10 per cent of carrot pomace powder. With the increase of storage period fat was found to decrease but it was found that the fat degradation was high in control samples To but was found low in experimental samples containing carrot pomace powder. This may be due to the fat retention property of carrot pomace.The results were in close similarity to Latif *et al*. (2005). The F test was found significant at P<0.05 probability level.

Effect of storage period on crude fibre content of carrot pomace fortified bread :

From Table 4 it can be conclude that carrot pomace incorporation increased the total crude fibre content significantly in bread samples due to the higher content of these nutrients in carrot pomace. But it was observed that the loss of crude fibre was more in control sample as compared to the experimental samples during storage. This is certainly due to the fact that externally added fibre in form of pomace directly influences the entire characteristics of the final product. The F test was found significant at P<0.05 probability level. The results of experimental samples were in somehow close similarity to Gayas *et al*. (2012).

Effect of storage period on protein content of carrot pomace fortified bread :

The effect of storage period on protein content as shown in Table 5 gives us an idea that protein content was influenced by the storage period. Moreover the protein content was found maximum in control sample having high refined wheat flour. But the loss of protein content was less in experimental samples having carrot pomace in it. Thus externally added fibre in form of pomace powder enhances the keeping quality of the product. The F test was found significant at P<0.05 probability level. On comparison of the results with Latif *et al*. (2005) it was found that the protein percentage is widely dependent upon the concentration of flour as carrot pomace powder does not has so much percentage of protein which is quite evident from the results.

Overall mean score for organoleptic analysis of carrot pomace fortified bread :

The organoleptic study revealed that after giving treatments of carrot pomace in the varying percentage (T_2) had scored 8.48 and was liked very much. The

Table 2 : Effect of storage period on ash content

Sample	Day 0	Day 2	Day 4	Day 6
T_0	0.97	0.88	0.65	0.46
T_1	1.24	1.10	0.94	0.75
T_2	1.53	1.42	1.20	1.01
T_3	1.68	1.52	1.31	1.23
T_4	1.89	1.76	1.51	1.38

Table 3 : Effect of storage period on fat Content of Carrot pomace fortified bread

Sample	Day 0	Day 2	Day 4	Day 6
T_0	2.06	2.00	1.93	1.86
T_1	1.97	1.93	1.88	1.82
T_2	1.94	1.90	1.86	1.81
T_3	1.90	1.88	1.85	1.79
T_4	1.86	1.83	1.80	1.77

Table 4 : Effect of storage period on crude fibre content of carrot pomace fortified bread

Sample	Day 0	Day 2	Day 4	Day 6
T_0	0.47	0.47	0.45	0.44
T_1	0.94	0.93	0.90	0.90
T_2	1.48	1.47	1.44	1.43
T_3	1.87	1.87	1.85	1.85
T_4	2.42	2.41	2.40	2.40

Table 5 : Effect of storage period on protein content of carrot pomace fortified bread

Sample	Day 0	Day 2	Day 4	Day 6
T_0	9.98	9.96	9.92	9.91
T_1	9.2	9.18	9.17	9.15
T_2	8.89	8.87	8.84	8.85
T_3	8.38	8.37	8.35	8.35
T_4	8.16	8.16	8.14	8.14

Table 6 : Organoleptic results of carrot pomace fortified bread

Sample	Colour	Taste	Flavour	Texture	Overall acceptibility
T_0	6.82	6.17	5.93	6.60	5.81
T_1	6.93	7.97	6.90	7.48	6.72
T_2	8.03	9.04	8.75	8.65	8.48
T_3	8.47	8.23	8.29	8.03	8.06
T_4	8.84	8.70	8.43	8.39	8.26

samples were assessed on alternative days for colour, taste, flavour, texture and overall-acceptability. Through the sensory data it was further revealed that on extra addition of carrot pomace powder which gives an overmasking taste the T_3 had very marginal difference than T_4 and it was thus found to have overmasked other characteristics but the overall-acceptability was found much acceptable for T_2 having 5g of carrot pomace. T_2 was thus found acceptable in most of the parameters tested. Through Anova the F test was found significant at $P<0.05$ probability level.

Conclusion :

It was hereby concluded that quality of prepared bread was enhanced by the addition of carrot pomace powder as the comparative study between control and experimental samples revealed that the deterioration was less in samples having inclusions of carrot pomace. Rather the control sample was found to have deprived in its quality faster than the experimental samples. On comparing the data it is found that the carrot pomace powder directly affects the quality of the final product which is evident after analyzing the data. Qualitatively the keeping quality of the experimental samples is enhanced as protein content loss percentage is less in the experimental samples. Also the added fiber retards the loss of fat which shows that fiber has good fat retention properties. The present study also suggested that the increased fibrous content in the experimental samples are certainly because of the variable amount of pomace powder which finally increases the mineral content of the final product while adding value to the prepared bread. Less moisture retention in the final product with high fiber content coherently suggests that shelf life will be certainly enhanced since the available moisture content will be less than control sample which deteriorated faster than experimental samples. This gives us an idea about carrot pomace which has good shelf life enhancing property which can serve as good source for maintaining keeping quality of the baked products.

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