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Influence of Oats(Avena Sativa L.) on the Physicochemical Characteristics of Cookies

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Abstract:- **Oat (Avena SativaL.)belonging to Family Gramineae containing high amounts of valuable nutrients, phytochemicals, antioxidants and phytochemicals provides protection against cardiovascular diseases and certain type of cancer. Whole grain oat results in cookies with high fiber and energy. Studies showed that spread ratio decreased with increased in oat flour concentration at levels of 5%, 10% and 20%, as a result of binding of starch polymer molecules tightly. Biochemical analysis like protein, fat and ash showed an increasing pattern with increase in the oat proportion. Further improvement may be done in the formulation of fortified cookies.**

***Keywords*: Oat, cookies, spread ratio.**

I. INTRODUCTION

as a result of ill eating habits and lack of time to follow a healthy diet regime. Oat (Avena sativa) is a cereal commonly eaten in the form of Oat meals or as an ingredient in breakfast cereals and in baked goods(Oat cakes, Oat cookies and Oat bread) that helps to reduce various health risks. Oats are loaded in dietary fiber than any other grain and have a range of healthy cholesterol lowering properties. Dietary fiber is rich in a specific type of fiber called beta-glucan that is known to lower levels of bad cholesterol. Recommended daily intake of fiber is 25 g for women and 38 g for men. Oats contain Manganese, Selenium, Phosphorus, Fiber, Magnesium and Zinc. Oats are also rich in carotenoids, TocolsTocols (vitamin E), Flavonoids and avenanthramides class of polyphenols. The U.S. Food and Drug administration claims that Oats, as part of an overall heart healthy diet. A study entitled " Oats at 10 years",
published in American Journal of Lifestyle Medicine, found that eating foods rich in whole-Oat sources of soluble fiber (Oats, Oat bran and Oat flour) may help reduce the risk of coronary heart disease. Every additional 10 g in fiber in diet helps to reduce the risk of developing colorectal cancer by10%.

1. Materials and Method Materials required
- Refined Wheat Flour
- Oat Powder
- Shortening
- Baking Powder
- Milk Powder
- Butter

II. METHOD

Table (A) Formulation table for oat fortified cookies

Ingredients	5%	10%	20%
Wheat flour (g)	50	50	50
Shortening (g)	15	15	15
Sugar (g)	15	15	15
Baking powder (g)	2	2	2
Skim milk powder (g)	4	4	4
Oat flour (g)	5	10	20

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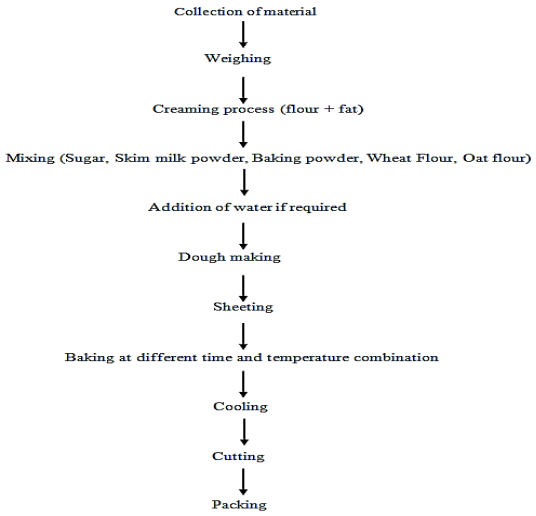
III. PREPARATION OF OATCOOKIES

Flow sheet for cookies preparation



III. PHYSIOCHEMICALANALYSIS

Response surfaces were generated using Design Expert 9.0.5 for expansion ratios namely, the spread ratio and for biochemical properties like protein, fat and ash. The observations recorded are listed in design expert (Table B). Their analysis were further encompassed with second order polynomial model and adequacy was also tested by standard statistical process. Three dimensional graphs were also developed to illustrate the variation of the parameters with respect to different levels of parameters.

Table B. Different runs of Design Expert

Run	Oat (gm)	Spread Ratio	Protein (%)	Ash (%)	Fat (%)
1	5	8.44	5.91	1.18	13.52
2	20	5.92	10.12	1.62	14.98
3	10	6.52	8.91	1.32	15.13
4	5	8.2	5.82	1.18	13.13
5	10	6.43	8.63	1.32	14.63
6	5	8.53	6.21	1.19	14.53
7	10	6.58	9.12	1.28	15.44
8	15	6.58	9.12	1.28	15.44
9	15	6.58	9.12	1.28	15.44
10	20	5.81	10.1	1.62	14.4
11	20	6.1	11.61	1.62	16.3
12	20	6	11.09	1.63	15.52
13	15	6.43	8.09	1.32	13.19
14	15	6.58	8.49	1.31	15.5
15	10	6.58	9.12	1.62	15.39
16	20	5.78	10.49	1.6	15.19
17	10	6.53	9.08	1.28	15.44
18	5	8.18	5.18	1.18	11
19	10	6.58	9.12	1.28	15.39
20	5	8.29	5.58	1.17	11.59

IV. STATISTICALANALYSIS

The data obtained for each parameter was subjected to statistical analysis of variance (ANOVA) within the treatments, packaging material and storage intervals and interaction among these parameters. The comparison of means was carried out by Complete Randomization Design (CRD) as per the methods given by Pans and Sukhatme (1967). The analysis of variance revealed at the significance of S.E and CD at 5% level is mentioned wherever required.

V. RESULT ANDDISCUSSION

1. PhysicalParameters

Spread Ratio

The polynomial model in coded terms generated by multiple regression analysis using CCRD and fitting of second degree polynomial equation for representative response surface of data between mass flow rate of spread ratio versus different coded levels of oat content (A), temperature(B) and time (C),

Table (C) Analysis of variance for spread ratio

Source	df	SS	MSS	F-value	P
Regression	9	15.87	1.76	1481.6	0.0001
Residual	10	0.012	0.001		
Total	19	15.88			

The positive coefficient at linear level indicated that there was increase in response with increase in level of selected parameters and vice versa. Negative quadratic terms indicated that the maximum value of the response was at the Centre point while positive quadratic term represents the minimum response at center point. The standard deviation, coefficient of variation, mean and predicted residual error sum of square (PRESS) values, coefficient of determination and predicted R2 and adequate precision are given (Fig. a) The response surface analysis graphs for the spread ratio as a dependent variable against combinations in pair of two different independent variables.

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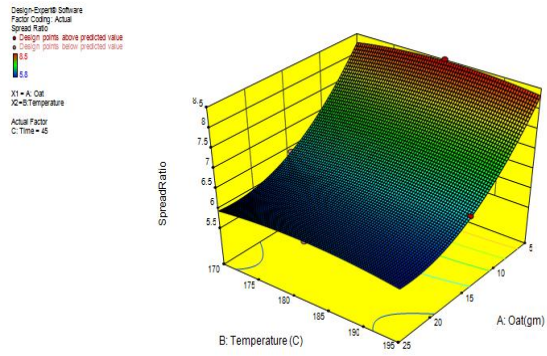

Fig.a Effect of Oat and temperature on spread ratio

This can be observed (fig. a) that the spread ratio decreases with increase in oat proportion, it also decreases with increase in temperature, however decrease was slow along the axis of temperature. As the time increased there was slow decrease in the spread ratio of the product. Decrease in spread ratio with increased in oat flour showed that starch polymer molecules are tightly bound with granules and swelling is limited in the cookies with wheat flour when heated. On cooling the starch formed a rigid gel with capacity characteristics of large molecular aggregates.

2.BiochemicalAnalysis Ash content

The polynomial model in coded terms generated by multiple regression analysis using CCRD and fitting of second degree polynomial equation for representative response surface of data between Ash content versus different coded levels of oat content (A), temperature(B) and time (C), resulted following model

Table(D) Analysis of variance for ash content

Source	Df	SS	MSS	F- value	P
Regression	9	0.50	0.056	15.78	0.0057
Residual	10	0.097	0.00971		
Total	19	0.60			

The positive coefficient at linear level indicated that there was increase in response with increase in level of selected parameters and vice versa. Negative quadratic terms indicated that the maximum value of the response was at the Centre point while positive quadratic term represents the minimum response at center point.

The standard deviation, coefficient of variation, mean and predicted residual error sum of square (PRESS) values, coefficient of determination and predicted R2 and adequate precision are given in Appendix-D and. The response surface graph was shown in Fig.4.4.

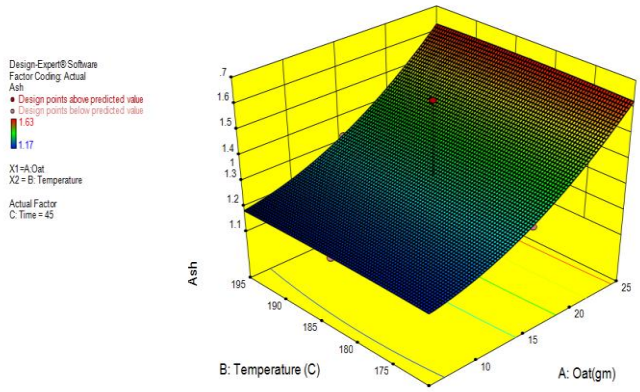

Fig.b Effect of ash content and temperature on ash content of cookies

This can be observed (Fig b) that the ash content increases with increase in oat proportion, as oat contains more minerals than wheat flour but there were negligible changes with increase in temperature, because mineral content are not denatured at this temperature. As the time increased there were negligible changes in the ash content of the product.

3. Protein content

The polynomial model in coded terms generated by multiple regression analysis using CCRD and fitting of second degree polynomial equation for representative response surface of data between protein content versus different coded levels of oat content (A), temperature(B) and time (C).

Table (E) Analysis of variance for protein content

Source	df	SS	MSS	F- value	P
Regression	9	66.51	7.39	275.98	0.0001
Residual	10	0.27	0.027		
Total	19	66.78			

The positive coefficient at linear level indicated that there was increase in response with increase in level of selected parameters and vice versa. Negative quadratic terms indicated that the maximum value of the response was at the Centre point while positive quadratic term

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represents the minimum response at center point. The response surface graphs was shown in Fig.C

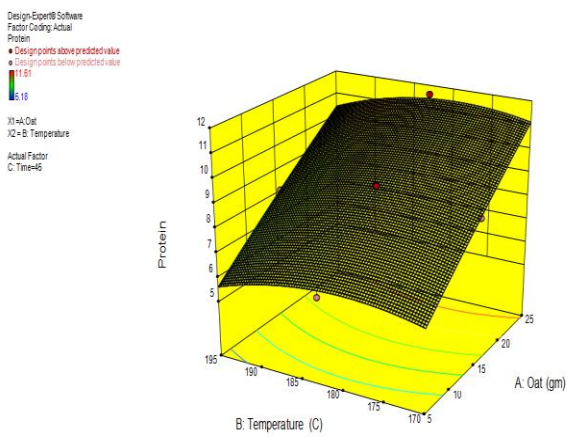

Fig.C Effect of oat content and temperature on protein content of cookies

This can be observed (Fig.C) that the protein content increases with increase in oat proportion, as oat contains more protein than wheat flour but there were decrease in content with increase in temperature, because protein denatures at higher temperature. As the time increased there was gradual decrease in the protein content of the product.

4. Fatcontent

The polynomial model in coded terms generated by multiple regression analysis using CCRD and fitting of second degree polynomial equation for representative response surface of data between fat content versus different coded levels of oat content (A), temperature(B) and time (C).

Table(F) Analysis of variance for protein content

Source	Df	SS	MSS	F- value	P
Regression	9	36.27	4.03	87.07	0.0001
Residual	10	0.46	0.046		
Total	19	36.74			

The positive coefficient at linear level indicated that there was increase in response with increase in level of selected parameters and vice versa. Negative quadratic terms indicated that the maximum value of the response was at the centre point while positive quadratic term represents the minimum response at center point. The response surface graph was shown in Fig. d.

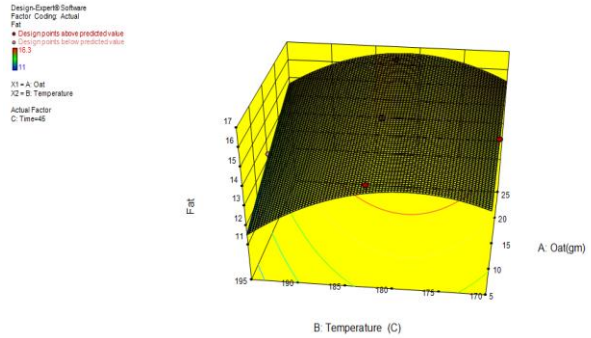

Fig. d Effect of oat content and temperature on fat content of cookies

This can be observed (Fig. d) that the fat content increases with increase in oat proportion, as oat contains more fat than wheat flour but there were decrease in content with increase in temperature, because fat denatures at higher temperature. As the time increased there was gradual decrease in the fat content of the product.

VI. CONCLUSION

The interest in the inclusion of oat in the formula is due to its high content of soluble fiber consisting especially beta-glucan, proteins, energy vitamins and minerals, which are highly beneficial to human's health. Hence, it helps to control blood glucose levels in diabetic patients very efficiently. In the product development cookies were fortified with oat flour at 5%, 10%and 20% level of incorporation. The product prepared was evaluated for expansion ratios and biochemical properties. It is interesting to note that with increase in oat concentration, the level of ash, protein and fat increased considerably thus making cookies energy rich and healthy to consume. Whereas, spread ratio showed decreasing pattern as the concentration of oat increased due to limited swelling in the cookies with wheat flour when heated.

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