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Physicochemical Analysis of Dietary Fibre Enriched Prebiotic Biscuit

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ABSTRACT: This research study's primary goal was to assess the physicochemical analysis of freshly made biscuits. In this study, control biscuits were made without prebiotics, while experimental biscuits were made with varying prebiotic dosages. A prebiotic was used, oat powder. Customers' interest was piqued by the nutritional content of bakery goods and their potential for use in feeding programmes and crises. Physical and chemical tests revealed that the experimental treatment combination had a higher concentration of dietary fibre.

Keywords: Bakery products, carbohydrate, dietary fibre, fat, physicochemical analysis, prebiotics, protein, oats.

INTRODUCTION

It is customary to prepare biscuits primarily with wheat flour, oil, and sugar. Biscuits are ready-to-eat foods. Technology for biscuits has recently advanced quickly in order to enhance their nutritious qualities (Goubgou *et al.*, 2021). In this research, dietary fibre rich biscuit has been developed. The component of a plant that resists intestinal digestion in the human large intestine is known as total dietary fibre. Total dietary fibre has been shown to have positive impacts on human health and bodily function, therefore in modern societies, consuming a lot of dietary fibre is linked to a lower occurrence of common disorders and diseases (Parveen *et al.*, 2017).

This research study was carried out to develop dietary fibre enriched prebiotic biscuit. As a source of dietary fibre and prebiotics, oats are used in this experimental biscuit.

Aims And Objectives. The research study was carried out to evaluate the physicochemical analysis of newly prepared biscuit.

MATERIALS AND METHODS

Procurement of raw material. For preparation of biscuit, the raw ingredients like Oat powder, Wheat Flour, sugar, oil, Baking Powder were purchased from local market of Mahishadal.

Treatment combinations (Mondal *et al.*, 2022).

T_0= Oats powder (0%): Wheat Flour (80 g) + Sugar (5 g) + Salt (0.90 gm) + Butter (5 g) + Water (10) Baking at 175°C for 15 Mins.

T_1= Oats powder (10 g): Wheat Flour (70 g) + Sugar (5 g) + Salt (0.90 gm) + Butter (5 g) + Water (10) Baking at 175°C for 15 Mins.

T_2= Oats powder (15g): Wheat Flour (65 g) + Sugar (5 g) + Salt (0.90 gm) + Butter (5 g) +Water (10) Baking at 175°C for 15 Mins.

T_3= Oats powder (20 g): Wheat Flour (60 g) + Sugar (5 g) + Salt (0.90 gm) + Butter (5 g) +Water (10) Baking at 175°C for 15 Mins.

No. of Treatment: 4 +1 =5

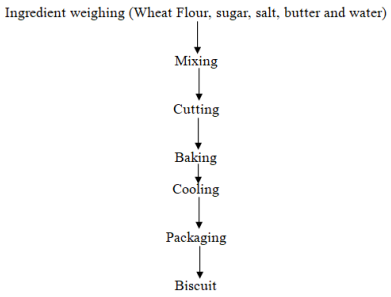
No of replication: 03

Total no of trials: 15

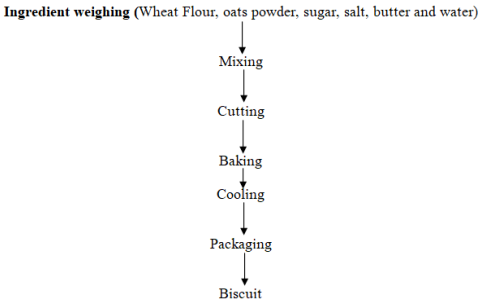
Physicochemical analysis of final products

- **Determination of carbohydrate:** The carbohydrate percent in the sample was measured by method as per Ranganna (1977).
- **Determination of protein:** The protein content of prebiotic chocolate samples was determined by method as per Ranganna (1977).
- **Determination of fat:** Fat content of prebiotic chocolate samples was determined by modified Gerber method (Kleyn *et al.*, 2001).
- **Determination of ash:** Ash content of prebiotic chocolate samples was determined according to AOAC, 2000 (AOAC, 2000).
- **Determination of moisture:** Moisture content of prebiotic chocolate samples was determined according to AOAC, 2000 (AOAC, 2000).
- **Determination of dietary fibre:** The dietary fibre percent in the sample was measured by AOAC, 2000 standard method (AOAC, 2000).

Flow chart for the preparation of biscuit (control biscuit) (Uchenna & Omolayo 2017)



Flow chart for the preparation of biscuit (experimental biscuit) (Mondal *et al*., 2022)



Statistical analysis. Factorial Analysis and Critical Difference (C.D.) were used for the physico-chemical and antioxidant parameters for developed cookies, and Two-Way Analysis of Variance (ANOVA) technique and Critical Difference (C.D.) were used for developed dough, in order to assess the statistical significance of the research findings. For all analyses, means and standard deviations were computed. The mean and standard deviation of five parallel measurements is used to express all data.

RESULTS AND DISCUSSIONS

After descriptive statistical analysis of carbohydrate, it was found that the mean value of carbohydrate content of control (T_0) biscuit was 42.26 % and mean value of carbohydrate content of experimental biscuit were 61.83, 65.72 and 67.81 respectively.

Table 1: Physicochemical analysis of newly developed biscuit.

Treatment Combination	Carbohydrates (%)	Protein (%)	Fat (%)	Ash (%)	Moisture content (%)	Total Fiber (%)
T_0	42.26	3.35	12.53	1.48	1.26	2.28
T_1	61.83	4.61	13.59	1.95	1.53	6.70
T_2	65.72	4.62	13.65	2.16	1.64	7.29
T_3	67.81	4.68	13.68	2.24	1.69	7.89

Table 2: Descriptive statistics of carbohydrate content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Observations N	3	3	3	3
Mean	42.2600	62.8300	65.7200	67.8100
Sample variance	1.3741	1.0309	1.0404	1.0201
Sample std. dev.	1.1722	1.0153	1.0200	1.0100
Std. dev. of mean SE	0.6768	0.5862	0.5889	0.5831

Table 3: One-way ANOVA of carbohydrate content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Source	Sum of squares SS	Degrees of freedom	Mean square MS	F statistic	p-value
treatment	1,231.0647	3	410.3549	231.7898	4.0996e-08
error	14.1630	8	1.7704		
total	1,245.2277	11			

Table 4: Significance and insignificance results of treatments.

Treatments pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
a vs b	25.4753	0.0010053	** p<0.01
a vs c	30.5391	0.0010053	** p<0.01
a vs d	33.2597	0.0010053	** p<0.01
b vs c	5.0638	0.0295007	* p<0.05
b vs d	7.7845	0.0025439	** p<0.01
c vs d	2.7207	0.2913018	insignificant

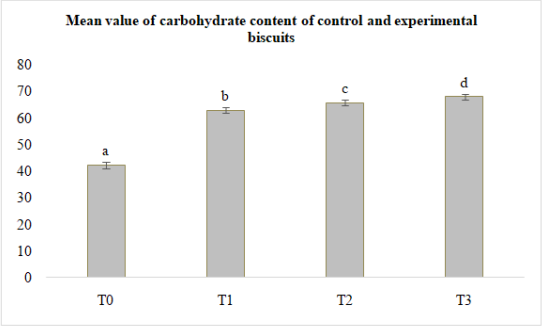


Fig. 1. Graphical representation of carbohydrate content of newly prepared biscuit.

Table 5: Descriptive statistics of protein content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Observations N	3	3	3	3
Mean	3.3500	4.6100	4.6200	4.6800
Sample variance	0.9025	1.0201	1.0404	1.0201
Sample std. dev.	0.9500	1.0100	1.0200	1.0100
Std. dev. of mean SE	0.5485	0.5831	0.5889	0.5831

After descriptive statistical analysis of protein content, it was found that the mean value of protein content of control (T_0) biscuit was 3.35 % and mean value of protein content of experimental biscuit were 4.61, 4.62 and 4.68 respectively.

After descriptive statistical analysis of fat content, it was found that the mean value of fat content of control (T_0) biscuit was 12.53% and mean value of fat content of experimental biscuit were 13.59, 13.65 and 13.68 respectively.

Table 6: One-way ANOVA of protein of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Source	Sum of squares SS	Degrees of freedom	Mean square MS	F statistic	p-value
treatment	1,231.0647	3	410.3549	231.7898	4.0996e-08
error	14.1630	8	1.7704		
total	1,245.2277	11			

Table 7: Significance and insignificance results of treatments.

Treatments pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
a vs b	25.4753	0.0010053	** p<0.01
a vs c	30.5391	0.0010053	** p<0.01
a vs d	33.2597	0.0010053	** p<0.01
b vs c	5.0638	0.0295007	* p<0.05
b vs d	7.7845	0.0025439	** p<0.01
c vs d	2.7207	0.2913018	insignificant

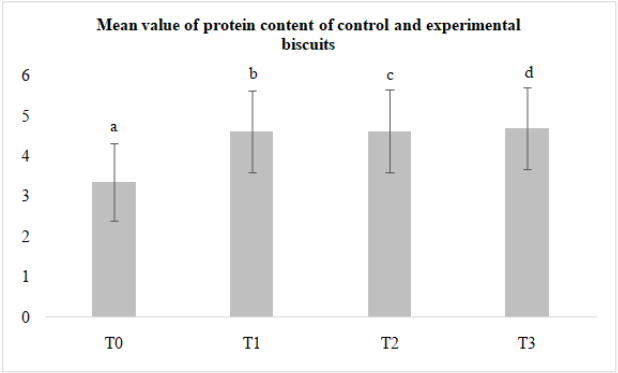


Fig. 2. Graphical representation of protein content of newly prepared biscuit.

Table 8: Descriptive statistics of fat content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Observations N	3	3	3	3
Mean	12.5300	13.5900	13.6500	13.6800
Sample variance	1.0609	1.0201	0.9801	1.0201
Sample std. dev.	1.0300	1.0100	0.9900	1.0100
Std. dev. of mean SE	0.5947	0.5831	0.5716	0.5831

Table 9: One-way ANOVA of fat of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Source	Sum of squares SS	Degrees of freedom	Mean square MS	F statistic	p-value
treatment	1,231.0647	3	410.3549	231.7898	4.0996e-08
error	14.1630	8	1.7704		
total	1,245.2277	11			

Table 10: Significance and insignificance results of treatments.

Treatments pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
a vs b	25.4753	0.0010053	** p<0.01
a vs c	30.5391	0.0010053	** p<0.01
a vs d	33.2597	0.0010053	** p<0.01
b vs c	5.0638	0.0295007	* p<0.05
b vs d	7.7845	0.0025439	** p<0.01
c vs d	2.7207	0.2913018	insignificant

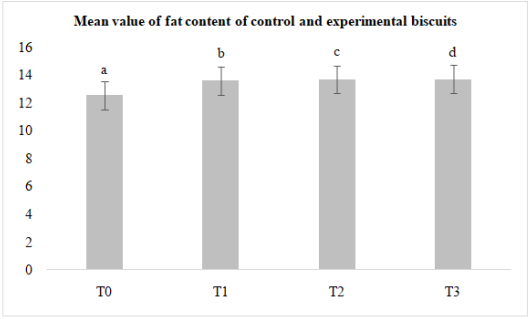


Fig. 3. Graphical representation of fat content of newly prepared biscuit.

Table 11: Descriptive statistics of ash content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Observations N	3	3	3	3
Mean	1.4800	1.9500	2.1600	2.2400
Sample variance	0.0009	0.0001	0.0001	0.0001
Sample std. dev.	0.0300	0.0100	0.0100	0.0100
Std. dev. of mean SE	0.0173	0.0058	0.0058	0.0058

After descriptive statistical analysis of ash content, it was found that the mean value of ash content of control (T_0) biscuit was 1.48 % and mean value of ash content of experimental biscuit were 1.95, 2.16 and 2.24 respectively.

Table 12: One-way ANOVA of ash of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Source	Sum of squares SS	Degrees of freedom	Mean square MS	F statistic	p-value
treatment	1.0466	3	0.3489	1,162.9167	6.7360e-11
error	0.0024	8	0.0003		
total	1.0490	11			

Table 13: Significance and insignificance results of treatments.

Treatments pair	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
a vs b	47.0000	0.0010053	** p<0.01
a vs c	68.0000	0.0010053	** p<0.01
a vs d	76.0000	0.0010053	** p<0.01
b vs c	21.0000	0.0010053	** p<0.01
b vs d	29.0000	0.0010053	** p<0.01
c vs d	8.0000	0.0021357	** p<0.01

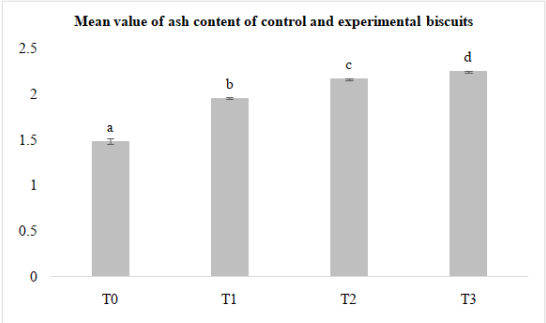


Fig. 4. Graphical representation of ash content of newly prepared biscuit.

Table 14: Descriptive statistics of moisture content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Mean	1.260	1.530	1.640	1.690
Std. Deviation (SD)	0.02000	0.03000	0.04000	0.02000
Std. Error of Mean (SE)	0.01155	0.01732	0.02309	0.01155

After descriptive statistical analysis of moisture content, it was found that the mean value of ash content of control (T_0) biscuit was 1.26 % and mean value of ash content of experimental biscuit were 1.53, 1.64 and 1.69 respectively.

After descriptive statistical analysis of *dietary fibre* content, it was found that the mean value of ash content of control (T_0) biscuit was 2.28 % and mean value of ash content of experimental biscuit were 6.70, 7.29 and 7.89 respectively.

Table 15: One-way ANOVA of moisture of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
Treatments	0.3318	3	0.1106	F (3, 8) = 134.1	P<0.0001
Residual	0.006600	8	0.0008250		
Total	0.3384	11			

Table 16: Significance and insignificance results of treatments.

Tukey's multiple comparisons test	Significant	Summary	Adjusted P Value
T_0 vs. T_1	Yes	****	<0.0001
T_0 vs. T_2	Yes	****	<0.0001
T_0 vs. T_3	Yes	****	<0.0001
T_1 vs. T_2	Yes	**	0.0068
T_1 vs. T_3	Yes	***	0.0006
T_2 vs. T_3	No	ns	0.2221

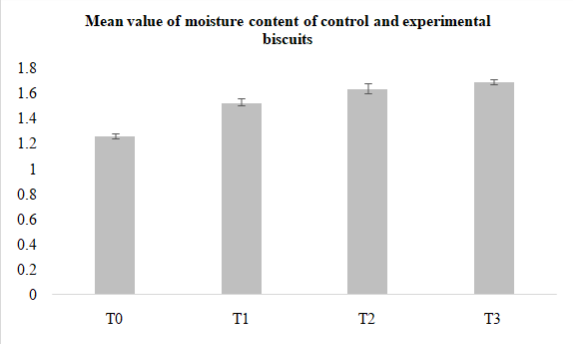


Fig. 5. Graphical representation of moisture content of newly prepared biscuit.

Table 17: Descriptive statistics of dietary fibre content of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

Treatments	T_0	T_1	T_2	T_3
Mean	2.280	6.700	7.290	7.890
Std. Deviation (SD)	0.1000	0.05000	0.09000	0.09000
Std. Error of Mean (SE)	0.05774	0.02887	0.05196	0.05196

Table 18: One-way ANOVA of dietary fibre of control (T_0) and experimental (T_1, T_2, T_3) newly developed products.

ANOVA table	SS	DF	MS	F (DFn, DFd)	P value
Treatment (between columns)	58.67	3	19.56	F (3, 8) = 2726	P<0.0001
Residual (within columns)	0.05740	8	0.007175		
Total	58.73	11			

Table 19: Significance and insignificance results of treatments.

Tukey's multiple comparisons test	Mean Diff.	Significant?	Summary
T_0 vs. T_1	-4.420	Yes	****
T_0 vs. T_2	-5.010	Yes	****
T_0 vs. T_3	-5.610	Yes	****
T_1 vs. T_2	-0.5900	Yes	***
T_1 vs. T_3	-1.190	Yes	****
T_2 vs. T_3	-0.6000	Yes	***

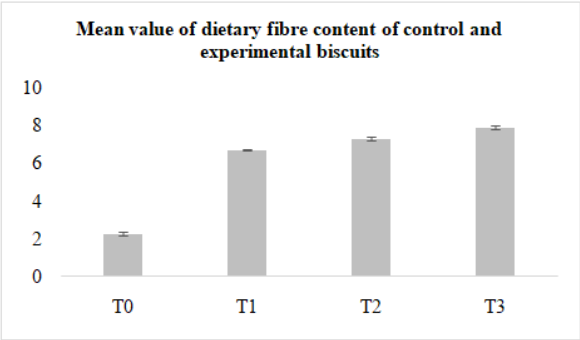


Fig. 6. Graphical representation of dietary fibre content of newly prepared biscuit.

CONCLUSIONS

Following a carbohydrate descriptive statistical analysis, it was discovered that the average carbohydrate content of the control (T_0) biscuit was 42.26% and the average carbohydrate content of the experimental biscuit was 61.83, 65.72 and 67.81, respectively. Protein content in control (T_0) biscuits averaged 3.35%, while it was 4.61, 4.62 and 4.68 in experimental biscuits, respectively. Additionally, it was discovered that the average fat content of control (T_0) biscuits was 12.53 percent, whereas the average fat content of experimental biscuits was 13.59, 13.65, and 13.68 percent, respectively. After conducting a descriptive statistical analysis of the ash content, it was discovered that the control (T_0) biscuit's mean ash content was 1.48% and the mean ash contents of the experimental biscuits were, respectively, 1.95, 2.16 and 2.24. The mean value of ash content of the control (T_0) biscuit was 1.26%, while the mean value of ash content of the experimental biscuit was 1.53, 1.64 and 1.69, respectively, according to descriptive statistical analysis of moisture content. Following a descriptive statistical study of the dietary fibre content, it was discovered that the control (T_0) biscuit's mean ash content was 2.28% and the experimental biscuit's mean ash content was 6.70, 7.29 and 7.89, respectively.

FUTURE SCOPE

Newly developed biscuit in the present research may be beneficial for human health to control different diseases against blast, which can help to boost production and productivity of foxtail millet**.**

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Conflict of Interest. None.

REFERENCES

AOAC (2000). Official Methods of Analysis, 17th Edition. Washington: Association of Official Analytical Chemists.

Goubgou, M., Songré-Ouattara, L. T., Bationo, F., Lingani-Sawadogo, H., Traoré, Y. & Savadogo, A. (2021). Biscuits: A systematic review and meta-analysis of improving the nutritional quality and health benefits. *Food Production, Processing and Nutrition*, *3*(1), 26.

Kleyn, D. H., Lynch, J. M., Barbano, D. M., Bloom, M. J., Mitchell, M. W., & Collaborators: Cooper LS Cusak E Fick M Hanks T Hesen MK Johnson J. Kleyn DH Mercer F Monahan D Peat B Petit M. (2001). Determination of fat in raw and processed milks by the Gerber method: collaborative study. *Journal of AOAC international*, *84*(5), 1499-1508.

Mondal, R., Tiwari, P., & Khalua, R. K. (2022). Sensory evaluation of dietary fibre enriched prebiotic biscuit. *International Journal of Food Science and Nutrition*, *7*(1), 54-60.

Parveen, H., Bajpai, A., Bhatia, S., & Singh, S. (2017). Analysis of biscuits enriched with fibre by incorporating carrot and beetroot pomace powder. *The Indian Journal of Nutrition and Dietetics*, *54*(4), 403.

Ranganna, S. (1977). Manual of analysis of fruit and vegetable products.

Uchenna, C. J., & Omolayo, F. T. (2017). Development and quality evaluation of biscuits formulated from flour blends of wheat, bambara nut and aerial yam. *Annals of Food Science and Technology*, *18*, 51-56.

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