

Development of Lemon Peel Powder and its Utilization in Preparation of Biscuit by Different Baking Methods

N.Srivastava¹ K. C. Yadav² P.Verma³ K.Kishore⁴ S.Rout⁵

^{1,2,3}Department of Food Process Engineering

^{1,2,3}Vaugh School of Agriculture Engineering Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad- 211007, Uttar Pradesh ⁴Warner School of Food and Dairy Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad- 211007, Uttar Pradesh ⁵School of Forestry & Environment, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad- 211007, Uttar Pradesh

Abstract—The study was conducted with the objective development of lemon peel powder and its utilization in preparation of biscuit by different baking methods. Lemon Peel is derived from the fruit of Citrus limon, the common lemon. Lemon Peel contains calcium, phosphorus, potassium, ascorbic acid and vitamin A, as well as volatile oil and hesperidins. Lemon Peel were sliced, dried (at 60°C) and ground to produce Lemon Peel Powder. Study was done to determine the nutritional value of the prepared Lemon Peel Powder. This powder was further used for the formulation of biscuits with the different levels of incorporation (i.e. 0%, 1%, 3%, 5%, 7% and 9% of Lemon Peel Powder). Studies were made to standardize the developed biscuits with the help of sensory evaluation and then to determine its physio-chemical characteristics. Biscuits were made by two different baking methods Comparative study of developed biscuits by different methods was conducted. The score of treatment T2 with 3% level of incorporation was found to be highest for overall acceptability (8.66) among all the treatments was nearest to the control (9.0). After comparative study it was found that Conventional baking biscuit was more acceptable than Microwave baking biscuits.

Key words: Biscuit, Lemon Peel, Quality

I. INTRODUCTION

The word biscuit derives from Danis biscoctus which is Latin for twice cooked bread and refers to bread rusks that were made for mariners (ship biscuits) from as long as the Middle Ages. The dough pieces were baked and then dried out in another cooler oven. They were very unattractive being made from more or less flour and water. 'Cookie' is chemically leavened product, also known as 'biscuit'. Generally the term biscuit like products have been made and eaten by man for centuries (Nelson's, 1980). Indian biscuit industry is the largest among all industries and has turnover of around Rs. 3000 crores. Biscuits cover over 70% of the total production of the baking industry. Although biscuits are classified in various ways based on the texture and hardness of the biscuit, on change in shape in the oven, on the extensibility or on the ways that various doughs are handled prior to biscuit formation, the three main categories in which biscuit can be classified are: Sweet biscuits, semi sweet biscuits, salt biscuits. Sweet biscuits are produced mainly from soft and short dough and have a high water and fat content. Semi-sweet biscuit are also known as tea biscuits. The principal ingredients used in the manufacture of biscuits are flour, sugar and fat. Biscuits are made from weak wheat flour obtained from soft wheat having moisture content of about 12% protein content in the range of 7-9%

and a starch content of about 70-75%.Lemon are eat only the fruit, the Lemon Peel, though not tasty on its own, is used medicinally. Lemon Peel contains calcium, phosphorus, potassium, ascorbic acid and vitamin A, as well as volatile oil and hesperidins. In Africa, Lemon Peel is used to treat colic, and in India, Lemon Peel is used to treat upset stomach (Youssef, 2007). During the baking process many changes takes place in the biscuit dough. The most important of these changes in dimensions, loss of moisture and the development of color and flavor. The baking process can thus be seen to fall into three phase. In the first phase the expansion of dough and the loss of moisture commence. In the second phase the expansion of the dough and the rate of loss of moisture both reach their maxima. In this second phase the development of biscuit color commences, particularly on any high spots on the dough surface (Gayas et. al., 2012). In the last most biscuits become thinner, the rate of loss of moisture decreases and intensity of color of product surface continuous to increase. Recent developments in the field of baking involve the introduction of microwaves. Microwaves refer to the electromagnetic waves in the frequency range of 300 to 3000000 MHz. Keeping in view of the importance the study was aimed to development of lemon peel powder and its utilization in preparation of biscuit by different baking methods.

II. MATERIALS AND METHODS

The present investigation was carried out in Laboratory, SHIATS, Allahabad. The material, process manufacturing methods, equipments, experimental setup and test parameters used to accomplish the experimental work done to attain the desired objectives of the study entitled, 'Development of Lemon Peel powder and its utilization in preparation of Biscuit by different baking methods. The effect of different proportion of lemon peel powder on organoleptic parameters, overall acceptability and the shelf life of developed biscuit by conventional and microwave method were also studied by the experimental studies. Biscuit were prepared by the standard method given by Sambhal Metz, (1998). The whole experiments had one control (T₀, 100% wheat flour and 0% lemon peel powder) and five treatments as T₁, T₂, T₃, T₄, and T₅ for both microwave and conventional biscuits.

A. Details of Treatments

T₀- 100% whole wheat flour + 0% Lemon Peel Powder
T₁- 99% whole wheat flour + 1% Lemon Peel Powder
T₂- 97% whole wheat flour + 3% Lemon Peel Powder
T₃- 95% whole wheat flour + 5% Lemon Peel Powder
T₄- 93% whole wheat flour + 7% Lemon Peel Powder

T₅- 99% whole wheat flour + 1% Lemon Peel Powder

B. Chemical Analysis:

The product was analysed for moisture content, protein, carbohydrate, fat, fiber, by using AOAC, (1995) standard procedure.

C. Organoleptic Evaluation:

Sensory evaluation of carrot cheese was done by panel of 9 judges Vaugh School of Agriculture Engineering technology Sam Higginbottom institute of Agriculture, Technology and Sciences, Allahabad. The judges scored the products with the help of nine point hedonic scale (Meilgaard et. al.,

1999). All treatments were replicated four times; mean values and standard deviation was reported. Analysis of variance (ANOVA) was performed. When the difference in ANOVA among the scores of samples was significant at 5% level pair comparison of samples were analyzed (Chandel, 1991).

III. RESULT AND DISCUSSION

The data collected on different aspects as per the methodology have been tabulated as follows

Treatments	Moisture Content(%)	Ash Content(%)	Protein Content(gm)	Carbohydrate Content(gm)	Fat Content(gm)	Fiber Content(%)	Result
T ₀	1.365	2.72	5.69	69.89	1.94	6.50	S
T ₁	1.359	2.836	5.12	68.23	4.04	6.06	S
T ₂	1.355	2.87	4.66	65.56	5.07	5.62	S
T ₃	1.352	2.90	4.08	64.55	6.05	5.22	S
T ₄	1.343	3.05	3.22	62.86	8.12	4.82	S
T ₅	1.329	3.11	2.88	60.94	10.06	4.12	S

Table 1: Quality parameters of developed biscuits by Conventional Method.

Treatments	Moisture Content (%)	Ash Content (%)	Protein Content (gm)	Carbohydrate Content (gm)	Fat Content (gm)	Fiber Content (%)	Result
T ₀	1.332	2.61	5.52	67.72	1.952	6.513	S
T ₁	1.328	2.69	4.89	66.77	4.02	6.08	S
T ₂	1.321	2.72	4.37	64.87	5.08	5.51	S
T ₃	1.319	2.82	3.96	64.23	6.01	5.12	S
T ₄	1.316	3.00	3.15	61.95	8.05	4.87	S
T ₅	1.301	2.88	2.76	60.75	10.01	4.10	S

Table 2: Quality parameters of developed biscuits by Conventional Method.

During comparison there was some difference found in biscuit which was made in Conventional oven and biscuit which is made in Microwave oven. The moisture content of control sample (T₀) was slightly decreased from 1.365 to 1.332% from conventional to microwave baking oven. There was no significant difference between these biscuits. Moisture Content of experimental sample (T₁)

changes from 1.359 to 1.328%. There was not much difference; (T₂) was 1.355 to 1.321%. there was little difference between these biscuits. (T₃) was 1.352 to 1.319%, (T₄) was 1.343 to 1.316% and (T₅) was 1.329 to 1.301%. There was significant difference between the Conventional baking biscuits and Microwave baking biscuits in all substitutions.

Chemical Parameters	Control & Treatment				
	T ₀	T ₅	Cal t	Table t (5%)	Result
Diameter	4.50	4.33	73.65	3.325	*S
Thickness	0.86	0.77	17.608	3.325	*S
Spread ratio	5.35	5.23	93.117	3.325	*S
Volume	14.5	13.6	11.421	3.325	*S
Density	0.78	0.66	28.383	3.325	*S

Table 3: Comparative scores of different Physical attributes of Lemon Peel incorporated biscuits by Conventional Method.

Chemical Parameters	Control & Treatment				
	T ₀	T ₅	Cal t	Table t (5%)	Result
Diameter	4.49	4.31	14.029	3.325	*S
Thickness	0.84	0.72	51.688	3.325	*S
Spread ratio	5.34	5.21	8.545	3.325	*S
Volume	14.6	13.2	18.625	3.325	*S
Density	0.79	1.6	40.959	3.325	*S

Table 4: Comparative scores of different Physical attributes of Lemon Peel incorporated biscuits by Microwave Method.

In Conventional method the result elucidated that T₀ exhibited maximum diameter 4.5cm, followed by T₁ (4.47cm), T₂ (4.44cm), T₃ (4.40cm) and T₄ (4.37cm) while minimum diameter (4.33cm) was observed in T₅. Similarly T₀ exhibited maximum thickness (0.86cm) followed by T₁ (0.86cm), T₂ (0.83cm), T₃ (0.82cm) and T₄ (0.80cm) while minimum diameter (0.77cm) was observed in T₅. Spread

ratio of T₀ was (5.35cm) followed by T₁ (5.33cm), T₂ (5.32cm), T₃ (5.29cm) and T₄ (5.26cm) while minimum diameter (5.23cm) was observed in T₅. Volume was also found to decrease with increase in the incorporation level of lemon peel powder i.e., T₀ (14.5 cm³). In Microwave method the result elucidated that T₀ exhibited maximum diameter 4.49cm, followed by T₁ (4.40cm), T₂ (4.38cm),

T3 (4.35cm) and T4 (4.32cm) while minimum diameter (3.31cm) was observed in T5. Similarly T0 exhibited maximum thickness (0.84cm) followed by T1 (0.81cm), T2 (0.78cm), T3 (0.76cm) and T4 (0.74cm) while minimum diameter (0.72cm) was observed in T5. Spread ratio of T0

was (5.34cm) followed by T1 (5.31cm), T2 (5.29cm), T3 (5.27cm) and T4 (5.25cm) while minimum diameter (5.21cm) was observed in T5. Volume was also found to decrease with increase in the incorporation level of lemon peel powder i.e., T0 (14.56cm³)

Control and Treatments	Colour	Taste	Flavour	Texture	Overall Acceptability
T ₀	8.66	8.66	8.0	8.66	9.0
T ₁	8.25	7.32	7.33	8.33	8.02
T ₂	8.33	8.33	8.33	8.66	8.66
T ₃	8.24	6.65	6.66	7.33	6.80
T ₄	8.12	5.12	5.12	7.32	5.52
T ₅	7.52	4.82	4.88	7.00	4.44
Result	S	S	S	S	S

Table 5: Average score of Sensory Attributes of Control and Experimental Biscuit (Conventional Method)

A. Colour

The average score for colour of Conventional baking biscuit was 8.66 scored by T₀ followed by T₁ (8.25), T₂ (8.33), T₃ (8.24), T₄ (8.12) and T₅ (7.52) respectively. The average score for colour of Microwave baking biscuit was 8.77 scored by T₀ followed by T₁ (8.12), T₂ (8.52), T₃ (8.7), T₄ (8.21) and T₅ (7.66) respectively. There was significant

difference between T₁, T₂ and T₃ of Conventional baking biscuit and Microwave baking biscuit whereas non-significant difference was found between the treatments T₀, T₄, and T₅. It is therefore concluded that the score of colour of biscuit differed significantly which may be ascribed to different ratio of Lemon peel powder and different baking methods

Control and Treatments	Colour	Taste	Flavour	Texture	Overall Acceptability
T ₀	8.77	8.66	8.0	8.68	9.0
T ₁	8.12	7.33	7.39	8.35	8.2
T ₂	8.52	8.66	8.35	8.69	8.66
T ₃	8.7	6.60	6.62	7.37	7.2
T ₄	8.21	5.10	5.22	7.35	5.88
T ₅	7.66	4.82	4.82	7	4.88
Result	S	S	S	S	S

Table 6: Average score of Sensory Attributes of Control and Experimental Biscuit (Microwave Method)

B. Taste

The average score for taste of Conventional baking biscuit was 8.66 scored by T₀ followed by T₁ (7.32), T₂ (8.33), T₃ (6.65), T₄ (5.12) and T₅ (4.82) respectively. The average score for taste of Microwave baking biscuit was 8.66 scored by T₀ followed by T₁ (7.33), T₂ (8.66), T₃ (6.60), T₄ (5.10) and T₅ (4.82) respectively. There was significant difference between T₂ of Conventional baking biscuit and Microwave baking biscuit whereas non-significant difference was found between the treatments T₀, T₁, T₃, T₄, and T₅. It is therefore concluded that the score of taste of biscuit differed significantly which may be ascribed to different ratio of Lemon peel powder and different baking methods.

T₀ followed by T₁ (8.35), T₂ (8.69), T₃ (7.37), T₄ (7.35) and T₅ (7) respectively. There was non-significant difference was found between the treatments T₀, T₁, T₂, T₃, T₄, and T₅. It is therefore concluded that the score of texture of biscuit not differed significantly.

C. Flavour

The average score for flavor of Conventional baking biscuit was 8.0 scored by T₀ followed by T₁ (7.33), T₂ (8.33), T₃ (6.66), T₄ (5.12) and T₅ (4.88) respectively. The average score for flavor of Microwave baking biscuit was 8.0 scored by T₀ followed by T₁ (7.39), T₂ (8.35), T₃ (6.62), T₄ (5.22) and T₅ (4.82) respectively. There was non-significant difference was found between the treatments T₀, T₁, T₂, T₃, T₄, and T₅. It is therefore concluded that the score of flavour of biscuit not differed significantly.

E. Overall Acceptability

The average score for overall acceptability of Conventional baking biscuit was 9 scored by T₀ followed by T₁ (8.02), T₂ (8.66), T₃ (6.80), T₄ (5.52) and T₅ (4.44) respectively. The average score for overall acceptability of Microwave baking biscuit was 9 scored by T₀ followed by T₁ (8.2), T₂ (8.66), T₃ (7.2), T₄ (5.88) and T₅ (4.88) respectively. There was significant difference between T₁, T₃, T₄, T₅ of Conventional baking biscuit and Microwave baking biscuit whereas non-significant difference was found between the treatments T₀, and T₂. It is therefore concluded that the score of overall acceptability of biscuit differed significantly which may be ascribed to different ratio of Lemon peel powder and different baking methods

D. Texture

The average score for texture of Conventional baking biscuit was 8.66 scored by T₀ followed by T₁ (8.33), T₂ (8.66), T₃ (7.33), T₄ (7.32) and T₅ (7) respectively. The average score for texture of Microwave baking biscuit was 8.68 scored by

IV. CONCLUSION

From the result summarized above, it can be concluded that highly nutritious biscuits may be prepared by incorporating a level of 3% of lemon peel powder without adversely affecting the overall acceptability of the product.

Comparative study of both the methods was done. It was therefore observed that Conventional baking method of the lemon peel incorporated biscuit obtained better acceptability than Microwave baking method.

REFERENCES

- [1] AOAC. (1995). Official methods of analysis. Washington, DC: Association of Official Analytical Chemists. (16th ed.). pp. 27–29.
- [2] Chandel, S.R.S. (1991). A handbook of agriculture statistics, 8th edition Anchal Prakashan. Kanpur.
- [3] Gayas, B., Shukla, R.N. and Khan, B.M. (2012). Physicochemical and sensory characteristics of carrot pomace powder enriched defatted soyflour fortified biscuits. International Journal of Scientific and Research Publications.2(8).
- [4] Meilgaard, M., Civille, G.V. and Carr, B.T. (1999). Sensory evaluation techniques. 3rd ed., CRC Press, Boca Raton, Florida.
- [5] Nelson nevy. (1980). Bakery products in the middle east especially in the Arab countries obtained Egypt (Agricultural Research Center). WheyProtein Effectof Navy bean protein flour Pricpke, P.E., L.S. Wei, A.I. Nelson and M.P. Steinberg.
- [6] Samphal metz. (1998). Hand book of bakery and confectionary.
- [7] Youssef, M.K.E. (2007). Foods that fight cancer. Proceedings of the sixth Conference of Woman and Scientific Research & Development in Upper Egypt. Assiut University. pp. 213-228.

