



RESEARCH ARTICLE

Quality evaluation of developed herbal high protein biscuits by incorporating *trikatu* and soya bean

E. Hasker,^{1,2} S. Radhai Sri³

¹ Research and Development Centre, Bharathiar University, Coimbatore, Tamil Nadu, India

² M. E. S. Mampad College, Kerala, India

³ P. S. G. College of Arts and Science, Coimbatore, Tamil Nadu, India

Received: 09.05.2020 Accepted: 06.07.2020

ABSTRACT

Biscuits are the most popular snack foods with high energy density and extended shelf life. Herbs like pepper, long pepper and ginger are medicinally and nutritionally important as they contain some active components which are considered to be helpful for leading a healthy life. Current study is an effort to incorporate these herbs in biscuits and to study its quality parameters. Soya bean is also added to improve the protein content of the biscuits. In Ayurveda the term *Trikatu* is used as a combination of natural herbs. It is a combination of Black Pepper (*Piper nigrum*), Indian Long Pepper (*Piper longum*) and Ginger (*Zingiber officinale*). Powdered spices of black pepper, dry ginger and long pepper were mixed and incorporated in wheat flour in 1,2,3,4,5,6,7,8,9,10,11,12 and 13 percentages for biscuit production. Analysis of wheat flour for various physico-chemical parameters were carried out. Textural properties of the flour were performed by Farinograph and Extensograph. Herbal high protein biscuits were prepared with incorporation of soya bean flour by replacing the flour by 3,4,5,6,7,8,9,10,11,12,13,14 and 15 percentages. The prepared biscuits were analyzed for physical, chemical and sensory analysis.

Keywords: Biscuits, herbs, protein, flour, quality, sensory analysis

Citation: Hasker, E. and Sri, S. R. 2020. Quality evaluation of developed herbal high protein biscuits by incorporating *trikatu* and soya bean. *Journal of Postharvest Technology*, 8 (3): 71-78.

INTRODUCTION

Biscuits are important as it occupies a wide range consumers with long shelf life. The target group of biscuits are ranging from kids to old agers. There are various varieties of biscuits which may target some specific peoples in society like diabetes. As biscuits are very popular snack item, supplementation or fortification with potential herbs will bring significant health and nutritional benefits. Bread and biscuits constitute the largest segment of consumer foods (Singh, 2014). Biscuit and other baked food products are important items belonging to the class of food that are sold in ready to serve form (Nwosu, 2013). Additions of ingredients for improving the protein level of biscuits are supportive for meeting the protein deficiency in wide range of consumers.

Herbs and spices are valued for their taste, smell and for health reasons. The various medical systems have been known for treating different types of health disorders. Medicinal plants have shown tremendous potential for the development of

the new drug molecules for serious diseases. Many plant derived products have found to play an important role in various disease conditions (Damanhour and Ahmad, 2014). Ayurvedic medicine is a system of traditional medicine native to the Indian subcontinent and is a form of alternative medicine (Meena, 2013). In Ayurveda the term *Trikatu* is used as a combination of natural herbs. It is a combination of Black Pepper (*Piper nigrum*), Indian Long Pepper (*Piper longum*) and Ginger (*Zingiber officinale*). Ayurvedic practitioners consider *trikatu* a warning formula used to awaken *Agni* (digestion) and destroy *Ama* (accumulated waste and toxin) (Shakya, 2015) Ginger (*Zingiber officinale* Roscoe) is one of the most widely used herbs that contains several interesting bioactive constituents and possesses health promoting Properties. (Chairat and Anchalee, 2008) The *Piper longum* fruit has been used in traditional medicine, including the Ayurvedic system of medicine. Globally pepper is known for its high nutritional value, health benefits and medicinal properties, (Saleh et al., 2018)

The soybean, (*Glycine max*) a grain legume, is one of the richest and cheapest sources of plant protein that can be used to improve the diet of millions of people, especially the poor and low income earners in developing countries because it produces the greatest amount of protein used as food by man (LIU, 2000). Soybean is an excellent health food and it contains 40% good quality protein, 23% carbohydrates, 20% cholesterol free oil and sufficient amounts of minerals and vitamins (Kumar et al., 2010) Incorporation of soyabean in biscuits helps to improve the protein content of the biscuits, but the quality was found to be lower if the incorporations are more than 10% of wheat flour (Banureka and Mahendran, 2011) Herb is a medicinal plant containing active component to inhibit the growth of microorganism whereby controlling the health complaints. Incorporation of these herbs in biscuits will helps to improve the nutritional status and is used for treatment for cold triggered fever, expelling out the respiratory mucus accumulation and as a good digestive agent.

Protein malnutrition is a serious problem in India due to cereal based dietary pattern. Therefore, various preparation based on cereal-pulse combination are of paramount importance to improve the protein quality of Indian diet. The requirement of supplementary food is increased to reduce malnutrition (Saghir and Mushir, 2014). As biscuits are widely accepted snack foods, it is highly effective for improving the health status of kids and adults with by utilizing herbal high protein incorporation. Therefore, present study was to formulate herbal high protein biscuit with soyabean and addition of important herbs like pepper, dry ginger and long pepper.

MATERIALS AND METHODS

Materials

Wheat flour, sugar soya flour, shortening and skimmed milk powder procured from the local market were used. Sodium chloride, sodium bicarbonate, ammonium bicarbonate vanilla essence and liquid glucose were also used for the preparation of biscuits.

Wheat flour (maida)

Moisture (AACC Method, 44-19), total ash (AACC Method, 08-01), total protein (AACC Method, 46-12), Hagberg falling numbers (AACC Method, 56-80), wet and dry gluten (AACC Method, 38-10), and sedimentation value (AACC Method, 56-60) were determined in wheat flour sample according to standard procedure.

Rheological characteristics

Brabender Farinograph (AACC Method, 54-21) and Brabender Extensograph (AACC Method, 54-10) were used to study the various rheological characteristics of the dough.

Biscuit formulation

Biscuits were formulated with the following recipe, with a basic 100gm flour weight basis. The formulation of control, herbal, and herbal high protein biscuits is given in the table 1, 2, and 3, respectively.

Table 1: Control biscuit formulation and preparation

Component	Amount in (gm/ ml)	Biscuit preparation
Flour	100	1. Mix sugar, fat, liquid glucose and
Sugar	30	essence
Fat	20	2. Dissolve chemicals in water and milk
Milk Powder	2	powder suspension in water
Sodium chloride	1	3. Mixing
Sodium bicarbonate	0.4	4. Add wheat flour to the above cream
Ammonium bicarbonate	1.5	5. Sheeting
Liquid glucose	2	6. Cutting
Essence (Vanilla)	1 ml	7. Baking
Water	18 ml	8. Cooling

Table 2: Preparation of herbal blends

Stage I	Stage II	Stage III	Stage IV
Ginger	Drying	Seiving, Powdering	
Pepper	Drying	Seiving , Powdering	Blending
Long Pepper	Drying	Seiving, Powdering	

Table 3: Soya-herbal high protein biscuits

Sl. No	Herbal mix (g)	Soya bean (g)	Wheat Flour (g)
1	1	3	96
2	2	4	94
3	3	5	92
4	4	6	90
5	5	7	88
6	6	8	86
7	7	9	84
8	8	10	82
9	9	11	80
10	10	12	78
11	11	13	76
12	12	14	74
13	13	15	72

Texture of biscuits

Texture measurement of the biscuits was done using Texture Analyser in terms of Kg force required to break the biscuit. The texture of biscuits in terms of breaking strength was measured using the Texture Analyser. The samples were rested on two supporting beams, 50 mm apart. Another beam connected to the instrument was brought down to break the biscuit at a cross head speed of 50 mm/min and load cell of 50 kg. Care was taken to keep the point of contact equidistant from the supporting beams. The peak force in grams at breaking represented the breaking strength. Averages of breaking strength of 6 biscuits were reported.

Spread ratio

Biscuits were evaluated for thickness (mm), width (mm), and spread ratio. Average of 6 biscuits was reported. Spread ratio is calculated as follows:

$$\text{Spread ratio} = \frac{\text{Width } (W)}{\text{Thickness } (T)}$$

Sensory characteristics

The sensory characteristics of the biscuits were evaluated by seven judges. The score card used for evaluation is shown in table 4. The results were analysed statistically using Duncan New Multiple range test (Duncan, 1955).

Table 4: Sensory evaluation score card

Sl. No.	Sample No.	Colour (10)	Surface Character (10)	Crumb Colour (10)	Texture (20)	Taste (20)	Mouth feel (10)	Total score (80)
---------	------------	-------------	------------------------	-------------------	--------------	------------	-----------------	------------------

RESULTS AND DISCUSSION

Chemical characteristics

Table 5 shows that the wheat flour used had a moisture content of 10-61% and ash content of 0.51%. Protein content was found to be 8.86 % and dry gluten content was 8.72%. A falling number of 842 sec shows that the flour is from ingeminated wheat with low alpha amylase activity.

Table 5: Chemical characteristics of wheat flour

Sl. No.	Parameter	Composition*
1	Moisture (%)	10.61
2	Ash (%)	0.51
3	Total proteins(%), (Nx5.7)	8.86
4	Wet gluten (%)	26
5	Dry gluten (%)	8.72
6	Falling number (sec)	842
7	Diastatic activity (mg of maltose/10g flour)	239.5
8	Damaged starch(%)	11.92
9	Zeleny Sedimentation Value	18.65
10	Reducing Sugar (mg maltose/ 10g flour)	27
11	Non-reducing sugar (mg sucrose/10g flour)	203

* Values entered on 14% moisture basis

Rheological and sensory characteristics of wheat flour-soya flour blends

The results of Farinograph characteristics of wheat flour-soya flour blends shows that incorporation of soya flour increased the water absorption of the blends (Table 6). Analysis of Farinograms showed that the dough development time (DDT) was 2 min for refined wheat flour. The DDT increased significantly with the incorporation of soya flour especially at higher levels. Increase in dough development can be due to dilution of gluten proteins by the presence of soya flour. Farinograph characteristics of wheat flour-soya flour blends showed that incorporation of soya flour increased the water absorption of the blends. Dough development time increased significantly with the incorporation of soya flour especially at higher levels.

Mixing of wheat flour with soya flour with spices long pepper, pepper, dry ginger produced protein enriched herbal biscuits. Extensograph characteristics showed a decrease in the extensibility values with the incorporation of soya flour. It also showed an increase in the resistance to extension with the incorporation of soya flour. The overall quality of the biscuits

was found to be in maximum in incorporation of soya flour with 10 % and herbal contribution to 8%. There is an increase in breaking strength of biscuits from 10 to 15% incorporation of soya flour. Estimation of protein in prepared biscuits showed a gradual increase in the protein with soya addition. The results of the Texture measurement showed that minimum breaking strength is noted in control biscuit and increases the value with incorporation of soya and spices.

Table 6: Physical properties of biscuits

Sl No.	Soya flour (g)	Herbal mix (g)	Width (W) (cm)	Thickness (T) (cm)	Spread ratio (W/T)	Breaking Strength (Kg force)
1	0	0	5.42	0.65	8.18	1.22
2	3	1	5.32	0.66	7.94	1.25
3	4	2	5.22	0.67	7.79	1.26
4	5	3	5.40	0.65	8.30	1.28
5	6	4	5.43	0.66	8.10	1.30
6	7	5	5.33	0.67	7.96	1.42
7	8	6	5.40	0.66	8.18	1.46
8	9	7	5.41	0.65	8.32	1.52
9	10	8	5.43	0.67	8.10	1.61
10	11	9	5.42	0.65	8.33	1.7
11	12	10	5.41	0.66	8.19	1.71
12	13	11	5.35	0.66	8.10	1.82
13	14	12	5.36	0.65	8.23	1.91
14	15	13	5.46	0.67	8.14	2.22

Table 7: Sensory score of most acceptable level of incorporations

Soya flour + Herbal mix	Crust Colour (10)*	Surface Characteristics (10)*	Crumb Colour (10)*	Texture (20)*	Taste (20)*	Mouth-feel (10)*	Overall Quality (80)*
0+0	8.36 ^a	8.43 ^a	8.57 ^a	17.43 ^a	17.43 ^a	8.50 ^a	68.71 ^a
10+8	7.43^b	7.36^b	6.79^b	15.43^b	15.43^a	7.36^b	59.79^b
9+7	6.50 ^c	6.07 ^c	5.43 ^c	12.29 ^c	13.00 ^b	5.57 ^c	48.86 ^c
11+9	5.00 ^d	4.43 ^d	3.79 ^d	10.29 ^d	10.86 ^c	4.29 ^d	40.07 ^d

Biscuits prepared from refined wheat flour (control biscuit) had higher sensory scores for all the parameters evaluated (Table 7). The biscuits had highly acceptable wholesome taste and mouth feel. Therefore they scored the highest for their overall quality. It was observed that the sensory quality of biscuits were improved on addition of spices especially the

flavour (Sandhya and Waghray, 2018). The biscuits with soy 10 gm and herbal mix 8 gm were found to be more acceptable compared with other combinations. The prepared herbal biscuits were with good colour and textural properties. The protein content of the biscuit was proportionate to the addition of soya flour.

CONCLUSION

Physico-chemical properties of wheat flour, Rheological properties of control and the blends were measured in Extensograph and Farinograph. Biscuits were prepared with varying amounts of soya and herbal blends. The quality of biscuits were analysed for their physical, chemical parameters and conducted the sensory evaluation. In conclusion, incorporation of pepper, long pepper and dry ginger along with soyabean flour can be used in biscuit formulations to increase the protein content of biscuits. Soyabean is a good source for providing protein to our body. As biscuits are popular food item, incorporation of soya and herbs will promote in bringing good nutritional and health status of the society by supporting the health and preventing diseases.

REFERENCES

- AACC, American Association of Cereal Chemists. 1962. Cereal laboratory methods. American Association of Cereal Chemists
- Ahmad, S., and Ahmed, M. 2014. A review on biscuit, a largest consumed processed product in India, its fortification and nutritional improvement. *Int J Sci Invent Tod*, 3, 169-186.
- Banureka, V. D., and Mahendran, T. 2011. Formulation of wheat-soybean biscuits and their quality characteristics. *Tropical Agricultural Research and Extension*, 12(2).
- Chowdhury, K., Khan, S., Karim, R., Obaid, M., and Hasan, G. M. M. A. 2012. Quality and Shelf-Life Evaluation of Packaged Biscuits Marketed in Bangladesh. *Bangladesh journal of scientific and industrial research*, 47(1), 29-42.
- Damanhour, Z. A., and Ahmad, A. 2014. A review on therapeutic potential of Piper nigrum L. Black Pepper): The King of Spices. *Med. Aromat. Plants*, 3, 161.
- Kumar, S., Rekha, S. L., and Sinha, L. K. 2010. Evaluation of quality characteristics of soy based millet biscuits. *Advances in Applied Science Research*, 1(3), 187-196.
- Liu, K. 2000. Expanding soybean food utilization. *Food technology (Chicago)*, 54(7), 46-58.
- Mehta, M. 2013. Development of low cost nutritive biscuits with Ayurvedic formulation. *International Journal of Ayurvedic and Herbal Medicine*, 3(3), 1183.

- Nwosu, J. N. 2013. Production and evaluation of biscuits from blends of Bambara Groundnut (*Vigna Subterranae*) and Wheat (*Triticum Eastrum*) flours. *International journal of food and nutrition science*, 2(1), 4-9.
- Puengphian, C., and Sirichote, A. 2008. gingerol content and bioactive properties of ginger (*Zingiber officinale* Roscoe) extracts from supercritical CO₂ extraction. *Asian Journal of Food and Agro-Industry*, 1(01), 29-36.
- Saleh, B. K., Omer, A., and Teweldemedhin, B. 2018. Medicinal uses and health benefits of chili pepper (*Capsicum* spp.): a review. *MOJ Food Process Technol*, 6(4), 325-328.
- Sandhya, A. E., and Waghray, K. 2018. Development of sorghum biscuits incorporated with spices. *International Journal of Food Science and Nutrition*, 3(2), 120-128.
- Shakya, S. R. 2015. Medicinal uses of ginger (*Zingiber officinale* Roscoe) improves growth and enhances immunity in aquaculture. *International Journal of chemical studies*, 3(2), 83-87.
- Singh, A.K. 2014. A Study on Development Trends of Food Processing Sector in India. *Shodh Sanchayan*, 5(1), 2-7.



© The Author(s)

This is an  Open Access article licensed under a Creative Commons license: Attribution 4.0 International (CC-BY).