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Kritika Srivastava
Research Scholar Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Dr. Avinash Singh
Assistant Professor Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Dr. Shanker Suwan Singh
Assistant Professor Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh , India

Er. Anu Kumari
Assistant Professor Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Correspondence
Kritika Srivastava
Research Scholar Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh , India

Optimization of fiber rich sugar free biscuit prepared by using wheat flour, Ragi flour and stevia powder

Kritika Srivastava, Avinash Singh, Shanker Suwan Singh and Anu Kumari

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Abstract
Biscuits are convenient food products, becoming very popular among urban and rural populations of world wide. Some of the reasons for such vide popularity are low cost among other processed foods, varied taste, easy availability and longer shelf life. This paper presents review regarding several aspects of the quality and impact biscuits until packaging, mainly from food technologist point of view. During biscuits production, the optimization characteristics of dough, textural properties of biscuits and baking (heat and mass transfer) process may cause the optimization. Besides the major influence of this phenomenon on selection of ingredients, equipment usage and monitoring complete processing; it is the responsible for other relevant changes occurring in during biscuit baking. The biscuit prepared by wheat flour, Ragi flour and stevia powder in treatment T3 was best in terms of organoleptic characteristics and received highest score in (organoleptic) evaluation (color & appearance, body & texture, flavor & taste, overall acceptability). In view of the results obtained during the present investigation, it may be concluded that the optimized fiber rich sugar free biscuit is prepared by wheat flour, Ragi flour and stevia powder.

Keywords: Wheat flour Ragi Flour and Stevia powder, Optimization characters, Textural properties, Baking, Self-Life

Introduction
Wheat flour is a powder made from the grinding of wheat used for human consumption. More wheat flour is produced than any other flour. Wheat varieties are called "soft" or "weak" if gluten content is low, and are called "hard" or "strong" if they have high gluten content. Hard flour, or *bread flour*, is high in gluten, with 12% to 14% gluten content, and its dough has elastic toughness that holds its shape well once baked. Soft flour is comparatively low in gluten and thus results in a loaf with a finer, crumbly texture. Soft flour is usually divided into cake flour, which is the lowest in gluten, and pastry flour, which has slightly more gluten than cake flour. As human population continued to grow, there is a considerable worldwide interest in the utilization of wheat-based food products. Comparative analysis of several food products from wheat flour for both human and animal feed is of greater concern. Wheat is the principal cereal widely used for making bread than any other cereal. The protein called gluten makes bread dough stick together and gives it the ability to retain gas. Wheat supplies about 20 percent of the food calories for the world's people and is a national staple in many countries. Wheat is the major ingredient in most breads, rolls, crackers, cookies, biscuits, cakes, doughnuts, macaroni, spaghetti, puddings, pizza, and many prepared hot and cold breakfast foods. Much of the wheat used for livestock and poultry feed is a by- product of the flour milling industry. The nutritional value of wheat is extremely important as it takes an important place among the few crop species being extensively grown as staple food sources. The importance of wheat is mainly due to the fact that its seed can be ground into flour, semolina, etc., which form the basic ingredients of bread and other bakery products, as well as pastas, and thus it presents the main source of nutrients to the most of the world population. A huge increase in demand for cereals is predicted if the food needs for the estimated world population growth are to be met. But there is another potentially great benefit to these communities and that is the possibility to ensure such staple crops are nutritionally balanced and help remove the millions of cases of nutritionally-related deficiency disease that afflict them. It should be emphasised that in the past there has not been a single instance where plants have been bred to improve their nutritional content. If this has occurred it is purely by accident not design. Over three billion people are currently micronutrient (i.e. micronutrient elements and vitamins)

malnourished. This global crisis in nutritional health is the result of dysfunctional food systems that do not consistently supply enough of these essential nutrients to meet the nutritional requirements of high-risk groups. Wheat (Triticum aestivum-L) constitutes a major source of most of the diet containing moisture; 12.0, protein; 10.0, lipids, (fat); 1.6, carbohydrates; 72.6, fiber; 1.3, and ash; 1.4 g/100g respectively. Whole wheat flour contained 43 mg Ca, 284 mg P and 45 mg iron. Wheat is the major contributor of protein content of daily diet. Wheat is the principal cereal widely used for making bread than any other cereal. The protein called gluten makes bread dough stick together and gives it the ability to retain gas. The nutritional value of wheat is extremely important as it takes an important place among the few crop species being extensively grown as staple food sources. Wheat (*Triticum aestivum* L) constitutes a major source of most of the diet containing moisture 12.0, protein 10.0, lipids 1.6, carbohydrates 72.6, fiber 1.3 and ash 1.4 g/100g respectively. Whole wheat flour contained 43 mg Ca, 284 mg P and 45 mg iron. Wheat is the major contributor of protein content of daily diet.

Ragi and Mandua in India, grown extensively in various region of India which resembles as a food that supply a major portion of calories and proteins to large segment of population especially for people of low-income groups. In India, Karnataka is the leading producer of Finger millet accounting to 58% of its global production. The production area of Finger millet in India stands sixth after wheat, rice, maize, sorghum and bajra. It contains high levels of fiber, minerals and vitamins and has eight times more calcium than other cereals. It contains important amino acids *viz*., isoleucine, leucine, methionine and phenylalanine which are deficient in other starchy meals. It is comparable to rice with regards to protein (6-8%) and fat (1-2%) and is superior to rice and wheat with respect to minerals and micronutrient content. Ragi has gained importance because of its slowly digestible and resistant starch and has low glycemic index which makes it suitable for diabetic patients.

Table 1: Wheat flour Ashirvad Aatta from market, Ragi flour manna from Amazon

Flours	Protein%	Fat%	Ash%	Carbohydrates%	Dietary fiber%	Moisture%
Wheat	10.8	1.8	1.3	77.4	14.87	14
Ragi	7.3	1.2	3.0	77.1	19.1	16.7

Stevia (*Stevia rebaudiana* Bertoni) is a herb that is used extensively as a non-caloric sugar substitute. It is a natural sweetener plant having medicinal and commercial importance and is being use all over the world. Stevia is native to Paraguay and Brazil and it is often referred to as "The sweet herb of Paraguay" or "Honey leaf. It is having functional and sensory properties superior to those of many other high potency sweeteners. It is reported that steviosides have insulin tropic effect in pancreatic beta cells because it increases insulin secretion and thereby decreases blood sugar level. It is over 100-300 times sweeter than table sugar. In India it is majorly grown in Rajasthan, Maharastra, Kerela and Orissa. Stevia extract is white fine powder and is used in products for making suitable for weight watch people and diabetic people along with the antibacterial and antifungal actions. Stevia also contains substantial amounts of proteins, potassium, and other essential nutrients. Stevia can be taken in as a carbohydrate diet source without calories.

Table 2: Zevic powder from Amazon

Nutritive Sweetener	Protein	Fat	Carbohydrate	Ash	Dietary Fiber	Moisture
Stevia	0.9	0	99	0.3	0.6	0.04

Justification: The selective food habits of people raises the demand of value-added products and changing food habits are one of the signs of Indians becoming health conscious. Wheat being a highly preferred staple cereals, as it provides high level of energy and maintain metabolism of body. Finger millets (Ragi) is considered as Super food for under developed immune system of Children and provides various nutrients. It contains high levels of fiber, minerals and vitamins and has eight times more calcium than other cereals. Ragi also contains important amino acids *viz*., isoleucine, leucine, methionine and phenylalanine which are deficient in other starchy meals. Ragi is gluten free flour. Making this product sugar free by using a natural plant-based sweetener i.e. Stevia with bulking agent erythirol which makes the product suitable for diabetic and calorie conscious people.

Review of Literature

Goyle and Gujral (1992) [11] prepared sweet biscuits by incorporating simultaneously chick pea and two vegetable powder i.e. fenugreek (*Tirgonella foenum graccum*) and colocasia (*Colocasia antiquorum*). They also found that these biscuits were liked by the 6-year-old children studying in *balwadi* and also by 93 per cent of the mothers who were tested for acceptability of these biscuits.

Saha *et al.* (2011) [44] stated that biscuits prepared from flour composites containing 60:40 and 70:30 (w/w) finger millet: wheat flour were evaluated for its dough characteristics and biscuit quality. Hardness of biscuit dough measured by textural profile analysis was more in 60:40 combinations than in 70:30 levels. The dough became more adhesive with higher level of wheat flour and it varied across varieties. Extensograph data also showed that resistance of biscuit dough increased with the increasing levels of wheat flour. However, very little difference was observed between addition of 30 and 40 g/100 g wheat flour in terms of resistance to extension. Wheat composite flour (40 g/100 g) had higher water absorption capacity than in 30 g/100 g composite flour.

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Production of Biscuit

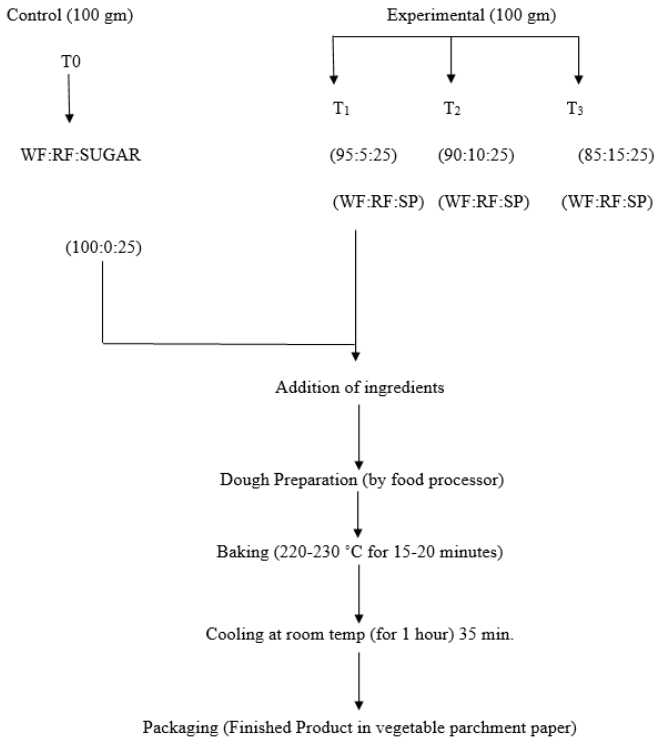
Mesh Sieved Ragi flour, wheat flour by sevieng 0.35, baking powder were mixed together. Stevia powder was mix with butter and then flour added together in desired quantities. The uniform mixture was obtained by adding milk to form dough. The dough was rolled and formed in to a uniform shape of

biscuit mould and baked to a temperature of 220-2300 °C for 12-15 minute for uniform baking in stone deck oven.

Materials and Methods

Ragi flour: Manna Ragi Flour via online (amazon)
Wheat flour: (Triticum) Aashirvad flour was collected local from market Prayagraj
Stevia powder: Via online (amazon)
Butter: Amul was collected from local market Prayagraj
Baking powder/baking soda: Sodium Bicarbonate
Milk was collected from local market Prayagraj

Plan of Work



Note: WF, RF, SP Wheat Flour, Ragi Flour, Stevia Powder stands for respectively

Result and Discussion

Table 3: The different parameters of control and experimental Sugar free Biscuit from using Wheat flour, Ragi Flour and Stevia Powder. Physio-chemical characteristics of control and experimental Sugar free Biscuit

Parameters	Treatment				
	T_0	T_1	T_2	T_3	S/Ns
Physico-chemical analysis					
Carbohydrate%	58.73	58.64	58.46	58.33	S
Protein%	8.95	9.12	9.03	8.94	S
Fat%	25.15	25.14	25.12	25.11	S
Ash%	1.45	1.45	1.44	1.51	S
Total Solids%	94.26	94.35	94.05	93.85	S
Moisture%	5.71	5.68	5.99	6.14	S
Dietary fiber	7.84	8.03	8.14	8.29	S
Organoleptic Score (9 Point hedonic scale)					
Color &Appearance	7.6	7.5	7.2	6.52	S
Body & Texture	7	7.4	7.1	7.9	S
Flavor & Taste	7	7.1	7.4	7.8	S
Overall acceptability	7.13	7.29	7.23	7.40	S
SPC (x10cfu/g)	14.8	14	12.2	11.6	S
Percentage Yield	6.4	5.4	5.4	4.4	S

Summary and Conclusion

Carbohydrate

The highest mean score for carbohydrates the sugar biscuit sample of T_0 (58.73) followed by T_1 (58.64), T_2 (58.46) and T_3 (58.33). The minimum (8.96) was obtained by T_0. As evident from the result of ANOVA the F (Cal) value (310.294) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on carbohydrates percentage.

Protein

The highest mean score for protein the sugar biscuit sample of T_1 (9.12) followed by T_2 (9.03), T_0 (8.96), T_3 (8.94). The minimum percentage (8.96) was obtained by T0 As evident from the result of ANOVA the F (Cal) value (0.246) was higher than the table value of F (3.49) at 5% level of non-significance. Therefore, the difference was significant, indicating non-significant effect of treatments on protein percentage.

Fat

The highest mean score for fat the sugar free biscuit recorded in sugar free biscuit sample of T_0 (25.16) followed by T_1 (25.15), T_2 (25.14) and T_3 (25.13). The minimum percentage of fat (25.16) was obtained in T0. As evident from the result of ANOVA the F (Cal) value (1.035) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was non-significant, indicating non-significant effect of treatments on fat percentage.

Ash

The highest mean score for ash of the sugar free biscuit in sugar free biscuit sample of T_3 (1.53) followed by T_0 (1.45), T_1 (1.45) and T_2 (1.44). The minimum percentage of ash (1.45) was obtained by T0. As evident from the result of ANOVA the F (Cal) value (17.287) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on ash percentage.

Moisture

The highest mean score for moisture of the sugar free biscuit was recorded in sugar free biscuit sample of T_2 (5.95) followed by T_3 (5.94), T_0 (5.75) and T_1 (5.65). The minimum percentage of moisture was obtained by T0 (5.72). As evident from the result of the F (Cal) value (2.318) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on moisture percentage.

Dietary Fiber

The highest mean score for dietary fiber of the sugar free biscuit was recorded in sugar free biscuit sample of T_3 (8.25) followed by T_2 (8.14) T_1 (8.03) and T_0 (8.84). The minimum percentage of dietary fiber was obtained by T0 (7.84). As evident from the result of ANOVA the F (Cal) value (327.500) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the differences were significant, indicating significant effect of treatments on dietary fiber.

Total Solids

The highest mean score for total solid of the sugar free biscuit

was recorded in sugar free biscuit sample of T_1 (94.35) followed by T_0 (94.26), T_2 (94.05) and T_3 (93.85). The minimum percentage of total solid was followed by T0 (94.26). As evident from the result of ANOVA the F (Cal) value (312.573) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the differences were significant, indicating significant effect of treatments on total solids.

Color & Appearance

The highest mean score for color and appearance score of sugar free biscuit was recorded in sugar free biscuit sample of T_0 (8.20) followed by T_1 (7.80), T_2 (7.20) and T_3 (7.00). The minimum percentage of color and appearance was obtained by T0 (20.950). As evident from the result of ANOVA the F (Cal) value (3.500) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on color and appearance.

Body and Texture

The highest mean score for body and texture of sugar free biscuit was recorded in sugar free biscuit sample of T_0 (8.20) followed by T_1 (7.80), T_2 (7.60) and T_3 (6.20). The minimum percentage of body and texture was obtained by T0 (22.950). As evident from the result of ANOVA the F (Cal) value (3.808) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on body and texture.

Flavor and Taste

The highest mean score for taste and flavor of sugar free biscuit was recorded in sugar free biscuit sample of T_0 (8.20) followed by T_1 (7.80), T_2 (7.60) and T_3 (6.20). The minimum percentage of flavor and taste was obtained by T0 (17.000). As evident from the result of ANOVA the F (Cal) value (8.00) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the differences were significant, indicating significant effect of treatments on body and texture.

Overall Acceptability

The highest mean score of overall acceptability in sugar free biscuit was recorded in sugar free biscuit sample of T_0 (8.27) followed by T_1 (7.73), T_2 (7.33) and T_3 (7.00). The minimum percentage of overall acceptability was obtained by T0 (8.27). As evident from the result of ANOVA the F (Cal) value (7.743) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the difference was significant, indicating significant effect of treatments on overall acceptability.

Microbial Analysis

The highest mean score of microbial analysis for sugar free biscuit was recorded in sugar free biscuit sample of T_1 (33.80) followed by T_2 (31.40), T_0 (18.40) and T_3 (15.80). The minimum percentage of microbial analysis in sugar free biscuit was obtained by T0 (18.34) As evident from the result of ANOVA the F (Cal) value (286.640) was higher than the table value of F (3.49) at 5% level of significance. Therefore, the differences were significant, indicating significant effect of treatments on microbial analysis.

Percentage of Yield

The highest mean score of Percentage of Yield for sugar free biscuit was recorded in the sample of T0 (6.4) followed by T1 (5.4), T2 (5.4), T3 (4.4). As evident from the result of ANOVA the F (Cal) value (4.44) was greater than the table value of F Tab (3.49) at 5% level of significance. Therefore; the difference was significant, indicating significant effect of treatments on Yeast and mould average. The significant difference thus obtained was further analyzed statistically to find out the C.D between and within the different treatment combinations.

Conclusion

In view of the experimental results obtained during the present investigation that the biscuit prepared by wheat flour, ragi flour and stevia powder can be successfully prepared. The biscuit prepared by Wheat flour Ragi flour and Stevia powder in Treatment T3 was best in terms of organoleptic characteristics and received highest score in organoleptic evaluation (color& appearance, body & texture, flavor and taste, overall acceptability.

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