

Formulation of Bakery Products “Sweet Biscuits” by Utilizing Flax Seed Flour and Black Rice Flour to Improve the Public Health

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Abstract: The bakery product, “Sweet Biscuits” are most significant in food industry. These are an important food product used as snacks by every age group stage in India. Commercially available “Sweet Biscuits” are prepared from Refined Flour that is nutritionally inferior in the quality. The purpose of the present study was formulation of bakery products (Sweet Biscuits) by utilizing flax seed flour and black rice flour to improve the public health. It increased the Nutrient Content and improves sensory characteristics of value added “Sweet Biscuits”, Keeping in view the medicinal and nutritional benefits of the flaxseed flour and black rice flour to formulate and enriched “Sweet biscuits” by sensory attributes and cost estimation prevailing by the market price. Standard recipe “Sweet Biscuits” served as a control (T₀) with three treatment combinations, were prepared by replacing Refined Flour with different ratio of Black Rice Flour and Flax Seed Flour which were referred as T₁, T₂, and T₃ respectively. they were analyzed on Nine Point Hedonic Scale score card for different Sensory Attributes. The AOAC method was used for nutritional analysis. The result revealed that T₂ (9) was found to be the most acceptable regards to its overall acceptability followed by T₁(6.8), T₀(6.8) and T₃ (6.9) respectively. Nutrient content was significantly increased in Best Treatment T₂ as compared to control (T₀). So it was concluded from the result that the value addition of Black Rice Flour and Flax Seed Flour at different level, can improve the sensory attributes of enriched “Sweet Biscuits” there by enhancing the nutritive value and cost though acceptable and reasonable as compared to market price.

Keywords: Black rice flour, Flax seed flour, organoleptic characteristics, Sensory Attributes.

INTRODUCTION

The most important bakery items are sweet biscuits. These are a significant food item both kids and adults in India consume as snacks. However, school-age children, who require more protein per unit body weight, vitamins and minerals than adults, are more likely to like them. Due to their range of flavours, crispiness, and digestibility, sweet biscuits have a significant place in the field of convenience foods. All age groups, but especially kids, teenagers enjoy these. White flour, which is less nutritious than Black rice flour and Flax seed flour, is used to make commercially available while utilizing in preparation of Sweet Biscuits. The purpose of

utilizing flax seed flour and black rice flour is to improve the public health for the reason that both ingredients are richer in a good amount of Vitamin B6, B3 and E, Iron, potassium, copper, zinc, thiamine, magnesium, niacin and phosphorous which are essential to muscles building. Flaxseeds are richer in omega-3 fatty acids, called alpha-linolenic acid it contains a group of nutrients called lignans, which have powerful antioxidants which has the ability to improve mental health and immunity. Black rice is high in both soluble and insoluble fibre, and have anthocyanin pigment which is a good source of antioxidants that have the ability to inhibit the formation or to reduce the concentrations of reactive cell damaging free radicals which are helpful with cardiac health, cancer prevention, relieving inflammation, and with cognitive properties supplementation of black rice in humans improves LDL and HDL levels, which are beneficial for health and the prevention of heart disease.

OBJECTIVE OF THE STUDY

Keeping in view the medicinal and nutritional benefits of the flaxseed flour and black rice flour to formulate and enriched “*Sweet biscuits*” by sensory attributes and cost estimation prevailing by the market price.

MATERIALS AND METHODS

The Present Study was conducted in the Nutrition Research Laboratory, Department of Food Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences. The raw materials, Chakhao Forbidden Manipur Black Rice was purchased online from Amazon shopping website. Flax Seeds (Frutin’s), (Tata I Shakti) Food Grade Cooking Soda, (Weikfield) Baking Powder, Salted Butter (Amul Pasteurised butter), loose sugar (Tata Salt Vacuum Evaporated Iodised) Salt, these raw materials required for the preparation of value added bakery product Muffins, were purchased from the local market.

PROCUREMENT OF RAW MATERIALS

The raw materials, Chakhao Forbidden Manipur Black Rice was purchased online from Amazon shopping website. Flax Seeds (Frutin’s), (Tata I Shakti) Food Grade Cooking Soda, (Weikfield) Baking Powder, loose sugar (Tata Salt Vacuum Evaporated Iodised) Salt, these raw materials required for the preparation of value-added bakery product “*Muffins*”, were purchased from the local market of Prayagraj.

PROCESSING OF RAW MATERIALS

For processing, Black Rice and flax seeds was first cleaned from insects and diseases, then washed in running water for 1 min. They were then dried in Dehydrator at 140 F for 6 hours. The dried Black Rice and flax seeds were then roasted for 5 mins at 28-350 C, post which it was grounded into a powder. The grounded material was packed in an airtight container and stored at ambient temperature in a dry place for further use.

PRODUCT FORMULATION

Value added Bakery based product such as “*Sweet Biscuits*” was prepared by Incorporation of 30 Percent Refined Flour, 10 Percent Flax Seed Flour and 55 Percent Black Rice Flour, the experiment was prepared and replicated 3 times to get an average value, the control (T₀) was

prepared with 100 percent Refined Flour. Preheat oven at 120⁰c for 10 minutes. Weigh all the ingredients. Take 30 gm butter and 30 gm sugar and 5 ml vanilla essence mix it in bowl. In another bowl take Black Rice Flour, Flax Seed Flour, Refined Flour sieve it Properly, add 2 gm baking powder and 2gm salt together. Add 30 ml milk and knead it until it becomes smooth thicken dough and transfer into the biscuit tray, bake in pre-heated oven at 120⁰c for 20-25 minutes for uniform baking. Store and use within 28 days.

ORGANOLEPTIC EVALUATION

During preliminary trials, prepared value added “*Muffins*” were evaluated for sensory characteristics, based on 9-Point Hedonic Scale for colour, taste, texture, flavour and overall acceptability by 5 Panel members. The scores were based on the following criteria: Like extremely: 9; Like moderately: 7-8; like slightly: 5-6; dislike slightly: 3-4; and dislike extremely: 0-2.

STATISTICAL ANALYSIS

The data includes mean scores for each sample as tested by both un-trained and semi- trained panelists. The results of sensory evaluation were split by panellist type and each group was individually subjected to one way analysis of variance (ANOVA) test was used to determine the differences of the mean scores for appearance, smell, taste, consistency, and general acceptability at P <0.05.

RESULT AND DISCUSSION

Table 1: Sensory acceptability scores of “*Sweet Biscuits*” prepared by using Black Rice Flour and Flax Seeds Flour.

Control and Treatments	Colour and Appearance	Body and Texture	Taste and Flavour	Overall Acceptability
T ₀ Mean ± SE	7.2±0.10	7± 0	7± 0	7.0 ±0.05
T ₁ Mean ± SE	6.0±0.04	6.48±0.03	6.48±0.14	6.15±0.05
T ₂ Mean ± SE	8.54±0.14	8.70±0.12	8.86±0.04	8.62±0.07
T ₃ Mean ± SE	6±0	7±0	7±0	7±0
F cal (5%)	617.4	97.8	160.9	113.2
F tab (5%)	4.76	4.76	4.76	4.76
CD(P≤0.05)	0.044	0.516	0.044	0.029
S.A.	*S	*S	*S	*S

*S=Significant, **Non=Significant, S.A.=Statistical Analysis

The above table no: 1 show that the average Sensory Score of Value- added “Sweet Biscuits” on the basis of all parameters like Colour and Appearance, Body and Texture, Taste and Flavour and Overall Acceptability. The result was evaluated for sensory characteristics, based on 9-Point Hedonic Scale for colour, taste, texture, flavour and overall acceptability by 5 Panel members. The Colour and Appearance T₂ had the highest score (8.54) followed by T₁ (6.0), T₀ (7.2), and T₃ (6). Therefore, concluded that the average score of Colour and Appearance of “Sweet Biscuits” differ significantly which may be ascribed to different ratio of Black Rice Flour and Flax Seed Flour which affected the Colour and Appearance of “Sweet Biscuits” as it is became darker due the presence of anthocyanin pigment present in Black Rice Flour and flavonoid pigment Present in Flax Seed Flour.

The Body and Texture shows that T₂ had the highest score (8.70) followed by T₀ (7), T₁ (6.48) and T₃ (7), respectively. The addition of black rice flour and flax seed flour preparation of high fibre induced “Sweet Biscuits”, imparting a good appearance and increased texture quality which may help to absorbed the water, aid the consumer to feel full longer and keep their digestive system healthy, increase the bulk to stool and also reduces the cholesterol level from the arteries and decreases in the rise of blood sugar level.

The Taste and Flavour shows that T₂ had the highest score (8.86) followed by T₀ (7), T₁ (6.48) and T₃ (7), respectively. The incorporation of black rice flour and flax Seed Flour in “Sweet Biscuits” improved its taste and flavour as it has a slightly nutty flavour due to presence of flax seed flour and a little bit bitter taste due to presence of anthocyanin antioxidant polyphenol pigment present in Manipuri black rice respectively.

The sensory score of overall acceptability of value added “Sweet Biscuits” T₂ had the highest score (8.62) followed by T₀ (7), T₁ (6.15) and T₃ (7), respectively. The amount of the best treatment T₂ had 30 percent Refined Flour+50 percent Black Rice Flour+20 percent Flax Seed Flour.

The statistical analysis carried out on different sensory parameters have shown that the calculated value of ‘F’ on 4 and 8 degree of freedom at 5% probability level, so it was found significant difference between control and treatments, regarding all sensory attributes such as Colour and Appearance, Body and Texture, Taste and Flavour and Overall Acceptability of the value added “Sweet Biscuits”. In relation to Colour and Appearance of calculated value “F” (617) due to treatments was higher than tabulated value of F (4.76). Therefore it indicated that there was significant difference in Colour and Appearance between the three treatments of “Sweet Biscuits” It compared against Critical Difference in the mean value of (T₁, T₀), (T₂, T₀), (T₂, T₁), (T₃,T₀) (T₃,T₂) was greater than CD (0.044), therefore the difference was significant.

In relation to Body and Texture of calculated value “F” (97.8) due to treatments was higher than tabulated value of F (4.76). Therefore, it indicated that there was significant difference in Taste and Flavour between the three treatments of “Sweet Biscuits” It compared against Critical Difference in the mean value of (T₁, T₀), (T₂, T₀), (T₂, T₁), (T₃,T₀) (T₃,T₂) was greater than CD (0.516), therefore the difference was significant.

In relation to Taste and Flavour of calculated value “F” (160.9) due to treatments was higher than tabulated value of F (4.76). Therefore, it indicated that there was significant difference in Taste and Flavour between the three treatments of “Sweet Biscuits” It compared against

Critical Difference in the mean value of (T₁, T₀), (T₂, T₀), (T₂, T₁), (T₃,T₀) (T₃,T₂) was greater than CD (0.044), therefore the difference was significant.

In relation to Overall Acceptability of calculated value “F” (113.2) due to treatments was higher than tabulated value of F (4.76). Therefore, it indicated that there was significant difference in Overall Acceptability between the three treatments of “Sweet Biscuits” It compared against Critical Difference in the mean value of (T₁, T₀), (T₂, T₀), (T₂, T₁), (T₃,T₀) (T₃,T₂) was greater than CD (0.029), therefore the difference was significant. Therefore, it can be concluded that Black Rice Flour and Flax Seed Flour incorporation affects Overall Acceptability of the “Sweet Biscuits”. The overall acceptability became delicious in the ratio of 30 percent Refined Flour+50 percent Black Rice Flour+20 percent Flax Seed Flour. **Virginia Paul (2019)** reported that the research of “Sweet Biscuits” in overall acceptability varied from 8.6 to 6.4. This meant that it was decided that the recipes belonged in the "liked very much to like slightly" category. Numerous experimental trials have shown that the components present in flaxseeds and black rice have anti-disease and therapeutic properties; this has sparked the development of new, branded, nutritious meals derived from flaxseeds and black rice.

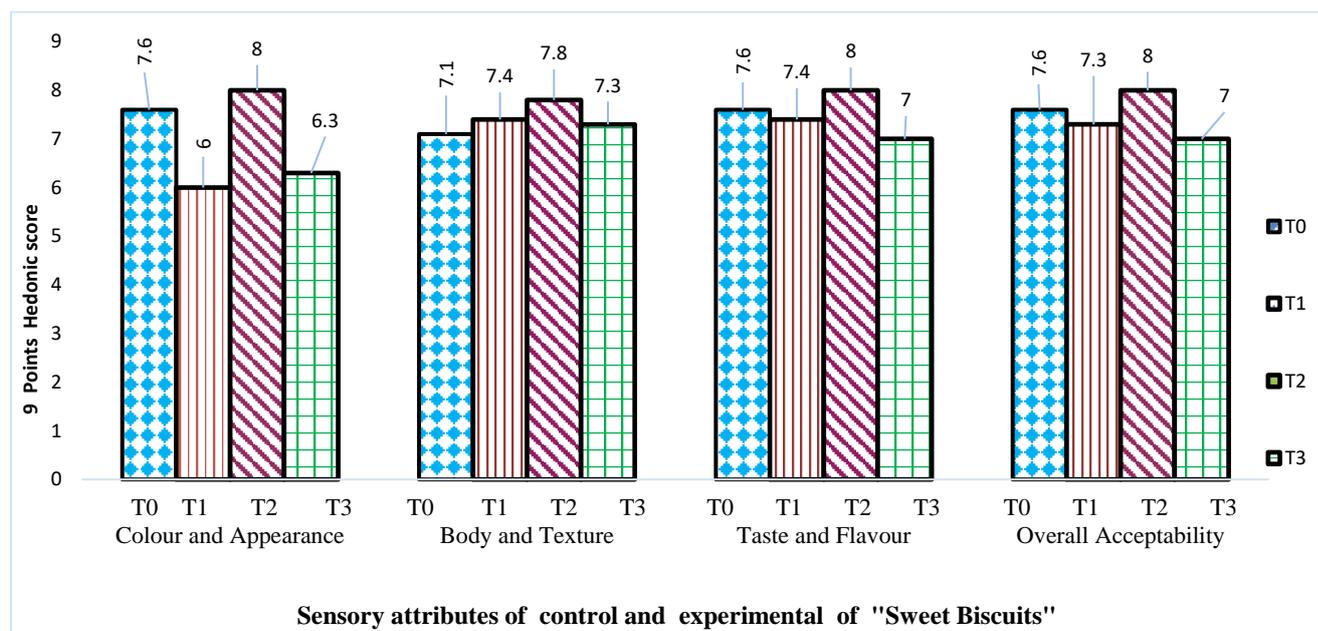


Figure no: 1 Average sensory score of Control and Best Treatment value added “Sweet Biscuits”

Table: 2 Comparative analysis of Proximate content, Mineral content, Anti-Nutritional Factor and Anti-Oxidant content /100gm of Control (T₀) with Best treatment (T₂) of “Sweet Biscuits” by using “t- test”.

Nutrients	T ₀ (Control)	T ₂ (Best Treatment)	(Difference) (T ₀ -T ₂)	't'cal.	't'tab. (5%)	S. A
Proximate Analysis						
Moisture (%)	11.76±0.01	2.54±0.00	9.22	978.63	2.44	*S
Ash (g)	1.13±0.01	4.22±0.01	3.09	350.75	2.44	*S
Protein (g)	3.92±0.01	13.97±0.01	10.05	953.11	2.44	*S
Fat (g)	9.13±0.01	10.53±0.01	1.4	158.36	2.44	*S
Crude Fibre (g)	1.22±0.01	4.98±0.01	3.76	563.5	2.44	*S
Carbohydrate(g)	71.98±0.0	63.15±0.01	8.83	491.90	2.44	*S
Energy (Kcal)	378.96±0.00	499.92±0.0	120.96	9072.25	2.44	*S
Mineral Content						
Iron (mg)	1.97±0.01	2.52±0.01	0.55	67.36	2.44	*S
Calcium (mg)	21.53±0.01	60.49±0.44	38.96	115.53	2.44	*S
Zinc (mg)	0.56±0.01	1.45±0.01	0.89	71.89	2.44	*S
Phosphorous(mg)	68.14±0.01	142.64±0.01	74.5	4562.17	2.44	*S
Potassium (mg)	74.14±0.01	210.14±0.02	136	8328.26	2.44	*S
Anti-Nutritional Factor						
Oxalate(mg)	0.03±0.01	0.04±0.01	0.01	0.18	2.44	*S
Tannin(mg)	0.67±0.34	1.40±0.13	0.73	2.56	2.44	*S
Phytate (mg)	0.36±0.01	0.68±0.01	0.32	1.99	2.44	*S
Anti-oxidant Content						
Total Phenolics (mg GAE/g)	18.96±4.31	482.64±56.34	463.68	12.92	2.44	*S
Total Flavonoids (mg QE/g)	1.32±0.68	62.06±12.29	60.74	7.82	2.44	*S
Radical Scavenging Activity (DPPH%)	0.99±0.61	40.69±11.03	39.7	5.10	2.44	*S

*S=Significant, **Non=Significant, S.A.=Statistical Analysis

The above table no: 2 shows that moisture content of control “Sweet biscuits” was 11.76 percent and it was gradually decreased in best treatment (T₂) 2.54 percent due to incorporation of Flax Seed Flour and Black Rice Flour which has lower Moisture absorption capacity due to its high fibre content lignans present in Flax Seed Flour which inhibit the moisture availability in “Sweet Biscuits”. (Esther Korkor Djidjor *et. al.* 2020), the increased in Moisture content has been associated with the increase in the Refined Flour which may contain some amount of

Moisture. The high moisture content has been associated with short shelf life of composite biscuit as they encourage microbial proliferation that leads to spoilage. The ash content of control “*Sweet Biscuits*” was 1.13 gm and it was gradually increased in best treatment (T₂) 4.22 gm due to the Ash content was higher in the best treatment (T₂), due to its high fibre content present in Flax Seed Flour and Black Rice Flour in “*Sweet Biscuits*”. **Lee-Hoon Ho and Nadratul Wahi dah binti Abdul Latif (2016)** who reported that the ash content of developed biscuits was the highest (12.64%) in control (T₀) and was significantly different from the best treatment T₂ (1.13g/100g). These results are in accordance that ash content of cookies increased from 2.17 to 3.11%. The highest value of ash content (3.11%) was observed in PPF (pitaya (*Hylocereus undatus*) peel flour) (15% PPF-substituted cookies) followed by PPF10 (2.73%), and PPF5 (2.39%), while lowest value for ash content (2.17%) was reported in PPF0 (control). The protein content of control “*Sweet Biscuits*” was 3.92 gm and it was gradually increased in best treatment (T₂) 13.97 gm due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of essential amino acids. **De Camargo et al., (2014)** who reported that mostly cookies are made with refined wheat flour which is deficient in some essential amino acids and other nutrients, therefore to enhance the nutritional value of cookies they can be fortified with flax seed flour. The fat content of control “*Sweet Biscuits*” 9.13 gm and it was gradually increased in best treatment (T₂) 10.53 gm due to incorporation of Black Rice Flour Flax Seed Flour which is the richest source of polyunsaturated fatty acids and alpha linolenic acids. **Kaur et., al (2018)** reported that Flax seed is an important source of a-linolenic acid and omega 3 fatty acids in the diet of vegetarian people. Therefore, it may serve as an alternate for supplying fatty acid to populations which do not have large access to seafoods. The crude fibre of control “*Sweet Biscuits*” 1.22 gm and it was gradually increased in best treatment (T₂) 4.98 gm due to incorporation of Black Rice Flour and Flax Seed Flour, which is the richest source of both soluble and insoluble fibre. **Kristensen et al., (2013)** reported that Effects of flax seed flour, crude fibre helps on gastrointestinal motility, constipation, glucose tolerance, hypocholesterolemic effect and fermentation. The carbohydrate of control “*Sweet Biscuits*” 71.98 gm and it was gradually decreased in best treatment (T₂) 63.15 gm due to incorporation of Black Rice Flour and Flax Seed Flour which are the lower source of Carbohydrates. **Kumar et., al (2020)** reported that it was concluded that addition of purple rice flour in cookies or biscuits could serve as a functional food for diabetic patients as it lowered the in the carbohydrate digestion rates and maintain the blood glucose levels. The Energy of control “*Sweet Biscuits*” 378.96 kcal and it was gradually increased in best treatment (T₂) 499.92 kcal due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Energy. **Paul Virginia et., al (2019)** reported that the Energy Content of “*Sweet Biscuits*” Control (T₀) 414.61 was Substantially lower than of its Best (T₂) 479.15 Kcal which indicate the Significant difference and its “T” calculated value was 9.66 respectively. The Iron of control “*Sweet Biscuits*” 1.97 mg and it was gradually increased in best treatment (T₂) 2.52 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Iron. **Chen et al., (2003)** reported that black rice contains minerals, including good amount of iron, which are beneficial for health and the prevention of heart disease. The Calcium of control “*Sweet Biscuits*” 21.53 mg and it was gradually increased in best treatment (T₂) 60.49 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Calcium. **Bhuyan et al., (2014)** reported that Minerals like Calcium play an important role in human health and are required to maintain a balanced diet, which is important for conserving all regular metabolic functions. The Zinc of

control "Sweet Biscuits" 0.56 mg and it was gradually increased in best treatment (T₂) 1.45 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Zinc. The Phosphorous of control "Sweet Biscuits" 68.14 mg and it was gradually increased in best treatment (T₂) 142.64 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Phosphorous. The Potassium of control "Sweet Biscuits" 74.14 mg and it was gradually increased in best treatment (T₂) 210.14 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Potassium. **Sood et al., (2015)** who reported that Flax seeds are the richest source of minerals and especially Zinc (Zn), Potassium(K), Phosphorus (P), Magnesium (Mg), Calcium (Ca), Iron (Fe), and low concentration of Sodium (Na), which helps in prevent many diseases such as chronic, cardiovascular, obesity disorders and cancer. The oxalic acid of control "Sweet Biscuits" 0.03 mg and it was gradually increased in best treatment (T₂) 0.04 mg due to incorporation of Black Rice Flour and Flax Seed Flour, Daily intake of Oxalate below the range of 60 mg/day is safe limit for consumption and do not cause any side effects. **Kennedy et al., (2000)** reported that the mean daily intake of oxalate by the five individuals tested was ranging from 44 to 352 mg/day is acceptable for human consumption. The Tannin content of control "Sweet Biscuits" 0.67 mg and it was gradually increased in best treatment (T₂) 1.40 mg due to incorporation of Black Rice Flour and Flax Seed Flour. **Kumar et al., (2019)** reported that daily intake of tannin below the range of 1.5–2.5 g is safe for consumption and do not cause any side effects but the consumption beyond this range is responsible for low absorption of iron from diet. The Phytate content of control "Sweet Biscuits" 0.36 mg and it was gradually increased in best treatment (T₂) 0.68 mg due to incorporation of Black Rice Flour and Flax Seed Flour. **Bedford et al., (2004)** reported that Phytic acid is the main organic form of phosphorus present in plant seeds and grains. It's presence reduces the protein digestibility and increases the excretion of endogenous nitrogen, amino acid and minerals such as iron, zinc, magnesium and calcium.

The Total Phenolics content of control "Sweet Biscuits" 18.96 mg and it was gradually increased in best treatment (T₂) 482.64 mg due to incorporation of Black Rice Flour which is rich in Anthocyanin pigment in a form of antioxidant. **Shabbir et al., (2008)** reported that dark purple grain has a greater iron content, polyphenol content, and antioxidant capacity than red brown grain. Pigmented rice, also known as coloured rice, is characterised by the presence of red brown or dark purple colour in the rice grain's covering layers. Pigments observed in the aleurone layer of rice grain have been identified as a variety of anthocyanin compounds from the phenolics and flavonoid family. The Total Flavonoid content of control "Sweet Biscuits" 1.32 mg and it was gradually increased in best treatment (T₂) 62.06 mg due to incorporation of both Black Rice Flour and Flax Seed Flour, which has higher percent of Anthocyanin pigment and P-coumaric acid in a form of Flavonoids. **Qin et al., (2009)** suggested that a recent report of anthocyanin supplementation in humans improves LDL and HDL levels. The anthocyanins in rice as total flavonoid content act as antioxidants and can inhibit inflammation in body and delay cancer development. The Radical Scavenging Activity of control "Sweet Biscuits" 0.99 percent and it was gradually increased in best treatment (T₂) 40.69 percent due to incorporation of Black Rice Flour and Flax Seed Flour which has higher percent of Anthocyanin pigment and P-coumaric acid. **Sampong et al., (2011)** reported the antioxidant activity of different rice varieties was significantly different. The DPPH radical scavenging activity was found higher in black rice varieties (59.02 to 75.52%) with the highest observed in aromatic black rice

Poireiton chakhao (75.52%) which showed highest antioxidant activity. These results in agreement with the results of three black rice varieties.

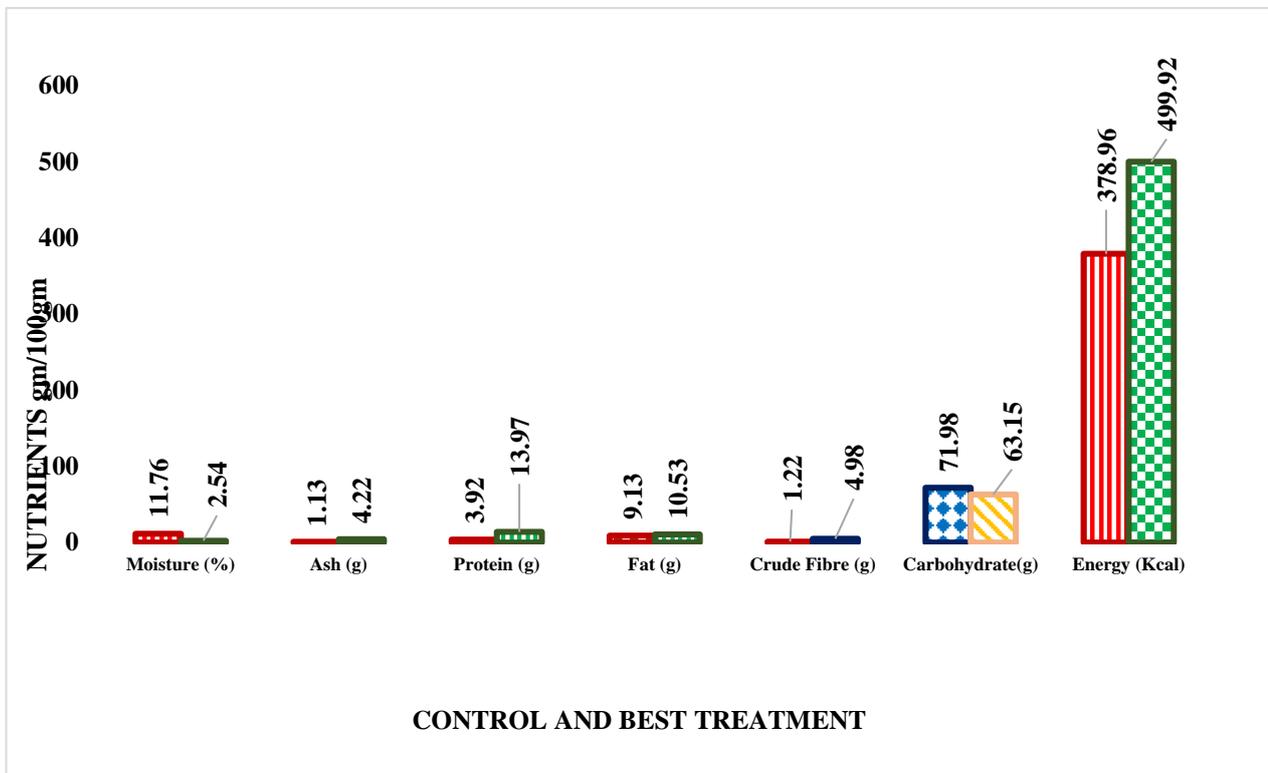


Figure no: 2 Proximate composition of Control and Best treatment of “Sweet Biscuits”

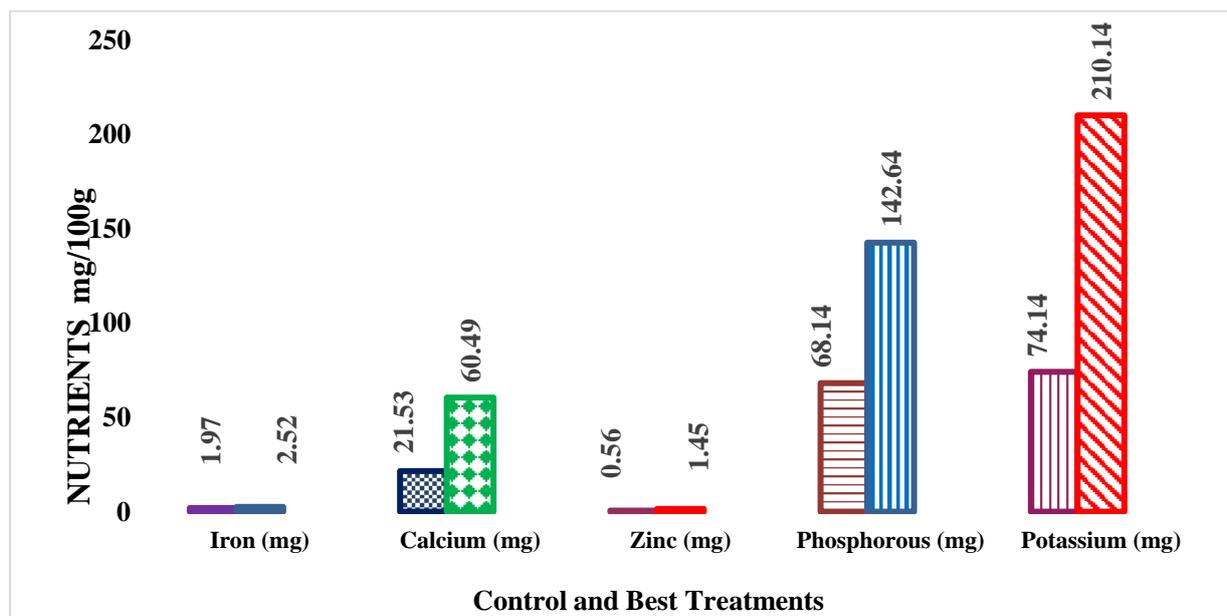


Figure no: 3 Mineral Content of Control and Best treatment of “Sweet Biscuits”

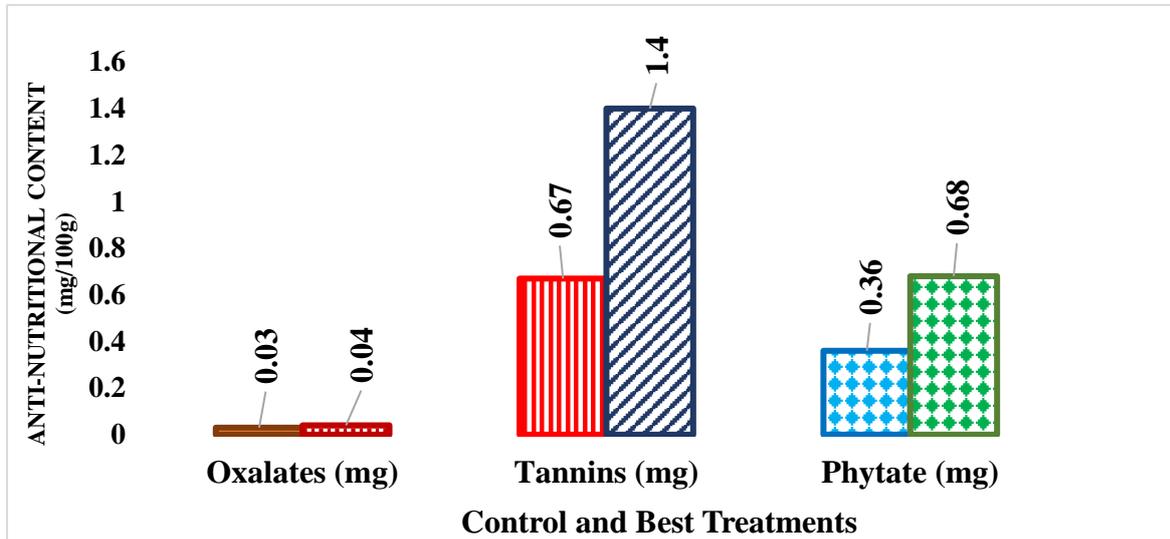


Figure no: 4 Anti-Nutritional content of Control and Best treatment of “Sweet Biscuits”

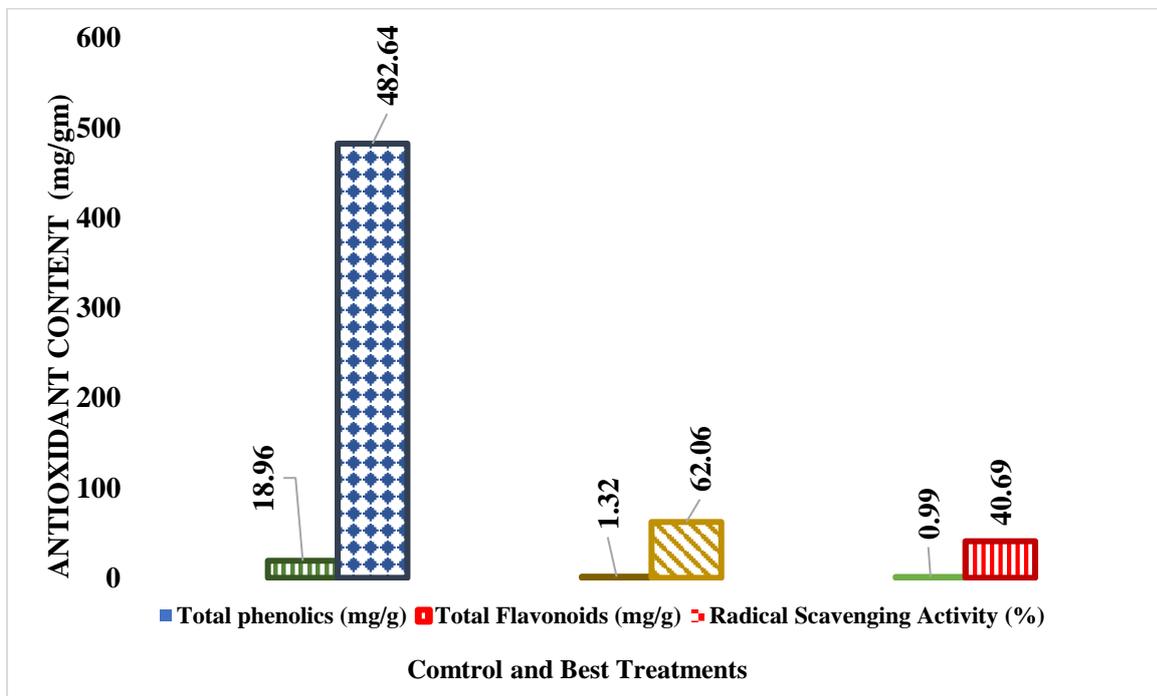


Figure no: 5 Anti-oxidant content of Control and Best treatment of “Sweet Biscuits”

4. Comparative analysis of Storage Period of Total Plate Count, Yeast and Mould and Coliform Count of Control (T₀) with Best treatment (T₂) of “Sweet Biscuits” by using “t-test”.

It was observed that Total Plate Count in “Sweet Biscuits” control at Day 7 i.e. 2.21×10^2 , Day 14 count i.e. 3.43×10^3 , Day 21 count i.e. 4.12×10^4 , Day 28 count i.e. 6.65×10^5 , whereas in best treatment Total Plate Count increased which was observed at day 7 onwards of storage period. Day 7 count i.e. 3.46×10^2 , Day 14 count i.e. 4.95×10^3 , Day 21 count i.e. 5.77×10^4 , Day 28 count i.e. 7.97×10^5 . It indicates the control was lesser total plate count than the best treatment of “Sweet Biscuits”. **K.A. et.,al (2002)** also reported that Biscuits are typically not maintained at consistent temperatures since they have a long shelf life; instead, they are typically kept at "room temperature," which can vary considerably depending on the weather (21-28 °C).

It was observed that that Yeast and Mould count in control at Day 14 count i.e. 0.57×10^2 Day 21 count i.e. 1.02×10^2 and Day 28 count i.e. 1.12×10^5 , whereas in Best treatment Yeast and Mould increased which was observed at day 7 onwards of storage period. Day 14 count i.e. 0.79×10^2 Day 21 count i.e. 1.08×10^2 and Day 28 count i.e. 1.16×10^5 . It indicates the control was lesser yeast and mould count than the best treatment of “Sweet Biscuits”. **Ballester et.,al (2019)** who also found that the most common culprits behind food contamination are microbes, moulds, and yeasts. Newly baked goods are sterile and free of living germs, but they quickly become contaminated when exposed to air and surfaces. Following the baking process, contamination also happens during the production processes of cooling, slicing (unhygienic handling), transport, packing, and storage.

It was observed that coliform count in control at Day 21 count i.e. 0.22×10^2 Day 28 Count i.e. 0.66×10^2 , whereas in best treatment coliform increased at day 21 onwards of storage period. Day 21 count i.e. 0.48×10^2 Day 28 count i.e. 0.72×10^2 . It indicates the control was lesser coliform count than the best treatment of “Sweet Biscuits”. **Gill et., al (2020)** who reported that the maximum coliform and faecal coliform bacterial count in biscuits was also 450 MPN g-1, which is more than twice the established permissible limit

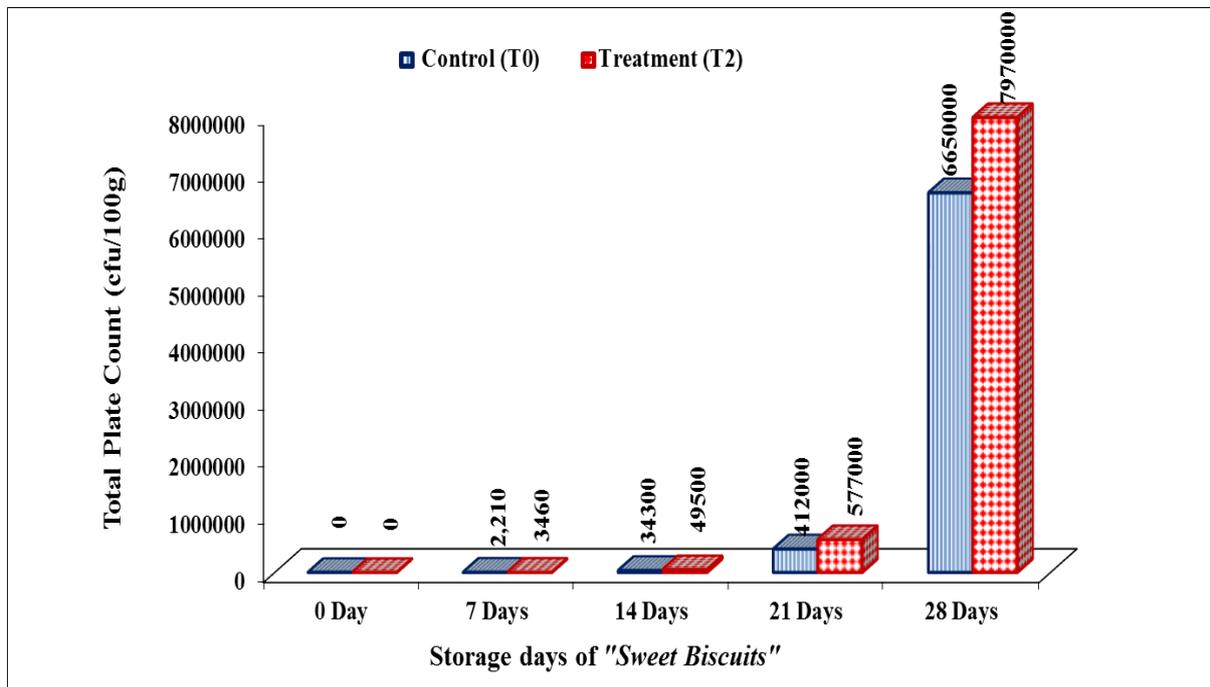


Figure no:6 Total Plate Count of Control and Best Treatment of "Sweet Biscuits"

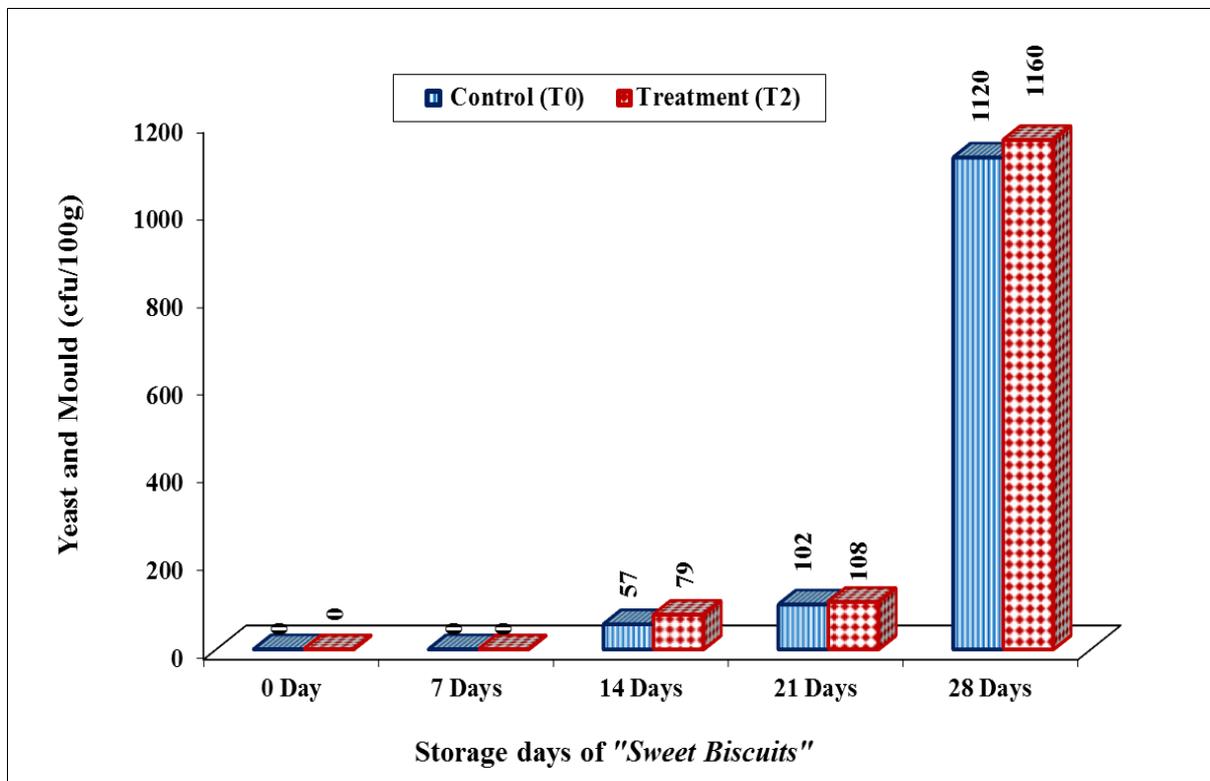


Figure no:7 Yeast and Mould Count of Control and Best Treatment of "Sweet Biscuits"

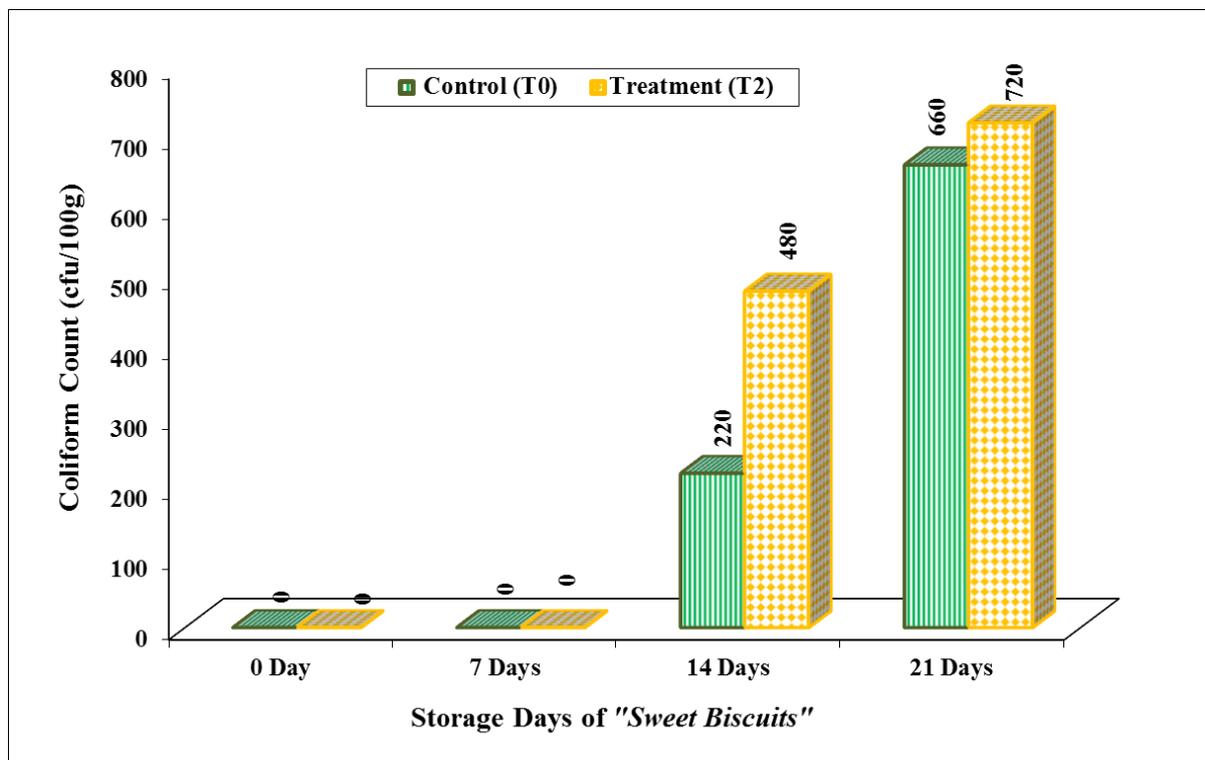


Figure no: 8 Coliform Count of Control and Best Treatments of “Sweet Biscuits”

Table no: 3 Cost of the prepared value-added food product namely “Sweet Biscuits”/100gm.

Ingredients	Actual Rate/Kg (Rs)	T ₀		T ₁		T ₂		T ₃	
		Amt (g)	Cost (Rs)						
Refined Flour	30	100	3	25	0.75	30	0.9	35	1.05
Black Rice Flour	170	-	-	45	7.65	50	8.5	55	9.35
Flax Seed Flour	115	-	-	30	3.45	20	2.3	10	1.15
Butter	480	30	14.4	30	14.4	30	14.4	30	14.4
Sugar	30	30	0.9	30	0.9	30	0.9	30	0.9
Salt	22	1	0.02	1	0.02	1	0.02	1	0.02
Baking Powder	65	1	0.06	1	0.06	1	0.06	1	0.06
Baking Soda	276	1	0.27	1	0.27	1	0.27	1	0.27
Vanilla Essence	50/50ml	5ml	0.25	5ml	0.25	5ml	0.25	5ml	0.25
Total Amount (Rs.)			18.9		27.75		27.6		27.45

Table no: 3 Shows that the cost of the raw materials of “Sweet Biscuits” was T₀ is Rs.18.9, T₁ is 27.75, T₂ is 27.6 and T₃ is 27.45 It was therefore concluded that the T₁ has the highest cost and T₀, T₂, T₃ has the lowest cost because the incorporation level of Black Rice Flour and Flax Seed Flour, which increased the cost of prepared products marginally.

CONCLUSION

Among all the experimented treatments T₂ has been scored high by the panel of judges on the basis of organoleptic properties followed by T₀, T₁, and T₃ respectively. The ratio of most acceptable treatments T₂ was 30 percent Refined Flour+50percent Black Rice Flour+20 percent Flax Seed Flour. The consumer’s demand has increased for the food products with taste, safety, convenience and nutrition. Thus nutrition has emerged an added dimension in the chain of food product development thus the, nutritional composition was increased significantly by the addition of Black Rice Flour and Flax Seed Flour in value added “Sweet Biscuits” Flaxseeds contain a good amount of Vitamin B₆, Iron, potassium, copper and zinc, regular consumption of anthocyanin rich Black Rice can reduce risk of cancer, its antioxidant content are able to prevent oxidative stress.

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