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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 nutrionally 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. The desired outcome of the present study was assessed the sensory attributes of value-added bakery product "Sweet Biscuits" prepared by incorporation of Black Rice Flour and Flax Seed Flour, nutritional analysis and microbial load of value added "Sweet Biscuits" done by AOAC method followed by statistical analysis of variance (ANOVA), (C.D) techniques and "t-test" and cost estimation. Standard recipe "Sweet Biscuits" served as a control (T_0) 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 T_1, 25:45:30gm T_2, 30:50:20gm and T_3 35:55:10 gm respectively. Value added "Sweet Biscuits" are distinguished by the crunchy and crispy texture and improved organoleptic characteristics. They were analyzed on Nine Point Hedonic Scale score card for different Sensory Attributes. The result revealed that T_2 (8.62) was found to be the most acceptable regards to its overall proportion followed by T_1(6.15), T_0 (7.0) and T_3 (7) were liked moderately by the Sensory Panel Members respectively. Nutrient content was significantly increased in Best Treatment T_2 as compared to control (T_0) and Microbial load i.e., Total Plate Count, Yeast and Mould count and Coliform count was found safe to consume till 21 days. 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, nutrient content and microbial load of enriched "Sweet Biscuits" Through this, the costs are decreased while remaining acceptable and reasonable in comparison to the marketplace price.*

Keywords: *Black Rice Flour, Flax Seed Flour, Organoleptic Characteristics and 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. Refined Flour, which is less nutritious than Black Rice Flour and Flax Seed Flour, is

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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 Flax Seed Flour and Black Rice Flour to formulate and enriched *"Sweet biscuits"* by sensory attributes, nutritional analysis, microbial load 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 Prayagraj (U.P)

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 *"Sweet Biscuits"*, 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 (T_0) was prepared with 100 percent Refined Flour. Preheat oven at 120^0c 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

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thicken dough and transfer into the biscuit tray, bake in pre-heated oven at 120^0c for 20-25 minutes for uniform baking. Store and use within 21 days.

ORGANOLEPTIC EVALUATION

During preliminary trials, prepared value added *"Sweet Biscuits"* were evaluated for sensory characteristics, based on Nine Point Hedonic Scale for colour, taste, texture, flavour and overall acceptability by 5 Sensory 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. **(Srilakshmi B. 2007)**

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 analysis of variance two-way (ANOVA) test, 't-test' was used to determine the significant differences of the mean scores for appearance, smell, taste, consistency, and general acceptability at P <0.05. **Gacula, Jr. and Singh (2008)**

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%) **F tab (5%)** **CD(P≤0.05)** **S.A.**	617.4 4.76 0.044 **S***	97.8 4.76 0.516 **S***	160.9 4.76 0.044 **S***	113.2 4.76 0.029 **S***

S*=Significant, NS**=Non-Significant, S.A.**=Statistical Analysis (P≤0.05)

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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 Nine Point Hedonic Scale for colour and appearance, taste and flavour, body and texture and overall acceptability by 5 Sensory Panel members**.** T_2 had the highest Colour and Appearance score (8.54) followed by T_1 (6.0), T_0 (7.2), and T_3 (6). Due to its golden brown colour, which ascribed it more acceptable and delicious by the 5 sensory panel members due to balance proportion of Refined Flour 30 gm+ Black Rice Flour 50 gm + Flax Seed Flour 20 gm.

Body and Texture indicates that T_2 had the highest score (8.70) followed by T_0 (7.2), T_1 (6.48) and T_3 (7), which provided crunchy, crispy texture when sensory panel member cracked at the time of testing, which was found most acceptable and delicious by the 5 sensory panel members due to balance proportion of Refined Flour 30 gm+ Black Rice Flour 50 gm + Flax Seed Flour 20 gm.

Taste and Flavour indicates that T_2 had the highest score (8.86) followed by T_0 (7), T_1 (6.48) and T_3 (7), which seems slightly nutty and little bitter, crunchy and buttery flavour in mouthfeel which was more acceptable by sensory panel member due to balance proportion of Refined Flour 30 gm+ Black Rice Flour 50 gm + Flax Seed Flour 20 gm.

Sensory Score of overall acceptability indicates that T_2 had highest Overall Acceptability in Colour and Appearance due to its golden brown colour, Body and Texture which provided crunchy and crispy texture, Taste and Flavour provided slightly nutty and little bit bitter flavour, which ascribed it more acceptable and delicious in the ratio of Refined Flour 30gm + Black Rice Flour 50 gm + Flax Seed Flour 20 gm by the Sensory Panel Members.

The sensory score of overall acceptability of value added *"Sweet Biscuits*" T_2 had the highest score (8.62) followed by T_0 (7.0), T_1 (6.15) and T_3 (7), respectively. The amount of the best treatment T_2 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

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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" (617.4) 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 (T_1, T_0), (T_2, T_0), (T_2, T_1), (T_3,T_0) (T_3,T_2) 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 (T_1, T_0), (T_2, T_0), (T_2, T_1), (T_3,T_0) (T_3,T_2) 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 (T_1, T_0), (T_2, T_0), (T_2, T_1), (T_3,T_0) (T_3,T_2) was greater than CD (0.044), therefore the difference was significant.

In relation to Overall Acceptability calculated value of "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 (T_1, T_0), (T_2, T_0), (T_2, T_1), (T_3,T_0) (T_3,T_2) was greater than CD (0.29) therefore, the difference was significant. It can be concluded that the average score for all parameters of sensory attributes of value added *"Sweet Biscuits"* differ significantly, which may be ascribed to different ratio of 30 percent Refined Flour+50 percent Black Rice Flour+20 percent Flax Seed Flour in value added *"Sweet Biscuits"*. **Paul Virginia (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

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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.

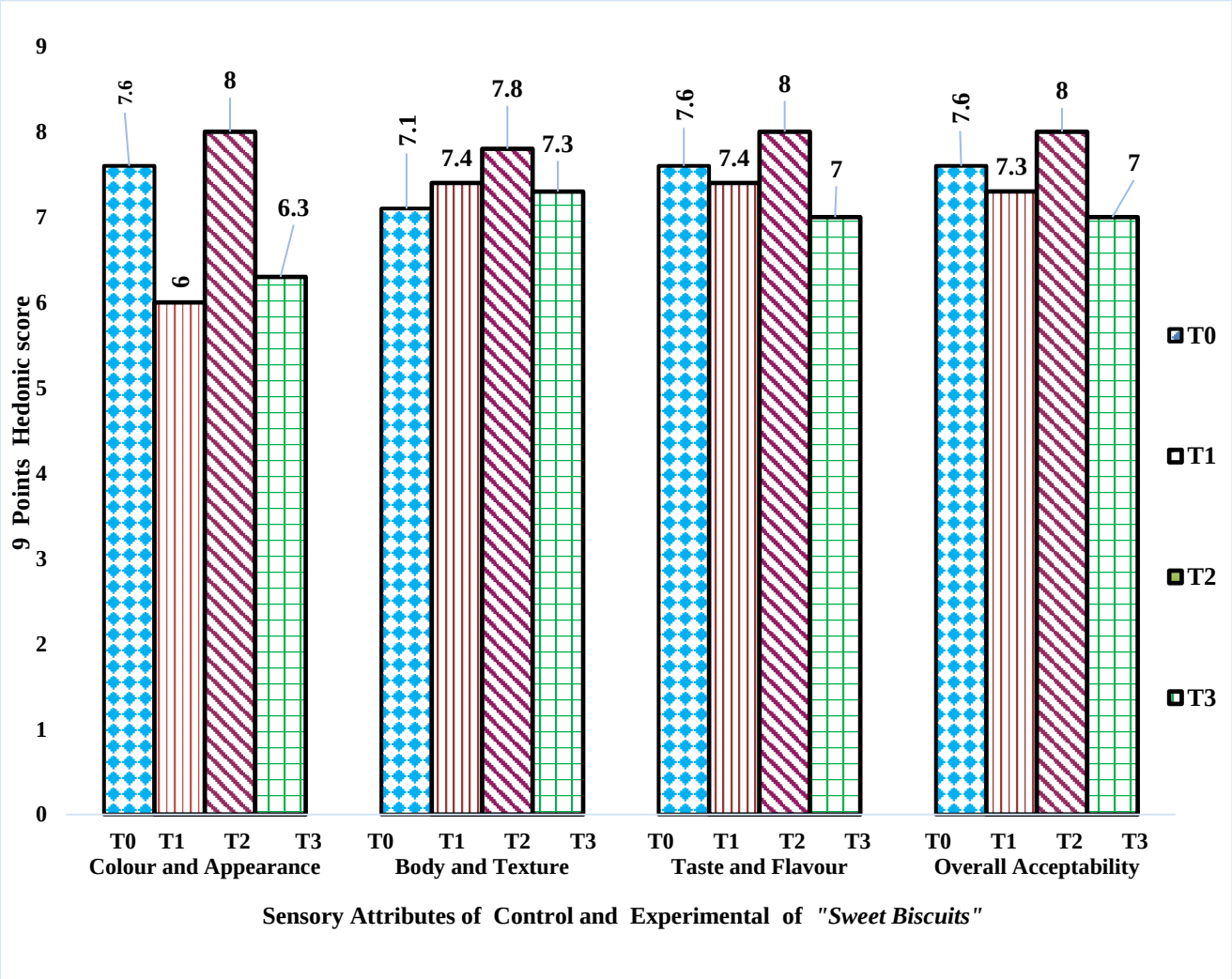

Fig no:1 Average Sensory scores of Control and Experimental Treatment of value added *"Sweet Biscuits"*

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Table: 2 Comparative analysis of Proximate content, Mineral content, Anti-Nutritional Factor and Anti-Oxidant content /100gm of Control (T_0) with Best treatment (T_2) 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. (P<0.05)
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, Ns**=Non-Significant, S.A*=Statistical Analysis (P<0.05)

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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 (T_2) 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.

Ash content of control *"Sweet Biscuits"* was 1.13 gm and it was gradually increased in best treatment (T_2) 4.22 gm due to ash content was higher in the best treatment (T_2), 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 (T_0) and was significantly different from the best treatment T_2 (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).

Protein content of control *"Sweet Biscuits"* was 3.92 gm and it was gradually increased in best treatment (T_2) 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.

Fat content of control *"Sweet Biscuits"* 9.13 gm and it was gradually increased in best treatment (T_2) 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.

Crude Fibre of control *"Sweet Biscuits"* 1.22 gm and it was gradually increased in best treatment (T_2) 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.

Carbohydrate of control *"Sweet Biscuits"* 71.98 gm and it was gradually decreased in best treatment (T_2) 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.

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Energy of control *"Sweet Biscuits"* 378.96 kcal and it was gradually increased in best treatment (T_2) 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 (T_0) 414.61 was Substantially lower than of its Best (T_2) 479.15 Kcal which indicate the Significant difference and its "T" calculated value was 9.66 respectively**.**

Iron of control *"Sweet Biscuits"* 1.97 mg and it was gradually increased in best treatment (T_2) 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.

Calcium of control *"Sweet Biscuits"* 21.53 mg and it was gradually increased in best treatment (T_2) 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.

Zinc of control *"Sweet Biscuits"* 0.56 mg and it was gradually increased in best treatment (T_2) 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 (T_2) 142.64 mg due to incorporation of Black Rice Flour and Flax Seed Flour which are the richest source of Phosphorous.

Potassium of control *"Sweet Biscuits"* 74.14 mg and it was gradually increased in best treatment (T_2) 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.

Oxalate Content of control *"Sweet Biscuits"* 0.03 mg and it was gradually increased in best treatment (T_2) 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 *etal.*, (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.

Tannin content of control *"Sweet Biscuits"* 0.67 mg and it was gradually increased in best treatment (T_2) 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.

Phytate content of control *"Sweet Biscuits"* 0.36 mg and it was gradually increased in best treatment (T_2) 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

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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.

Total Phenolics content of control *"Sweet Biscuits"*18.96 mg and it was gradually increased in best treatment (T_2) 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.

Total Flavonoid content of control *"Sweet Biscuits"* 1.32 mg and it was gradually increased in best treatment (T_2) 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.

Radical Scavenging Activity (DPPH)% of control *"Sweet Biscuits"* 0.99 percent and it was gradually increased in best treatment (T_2) 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.

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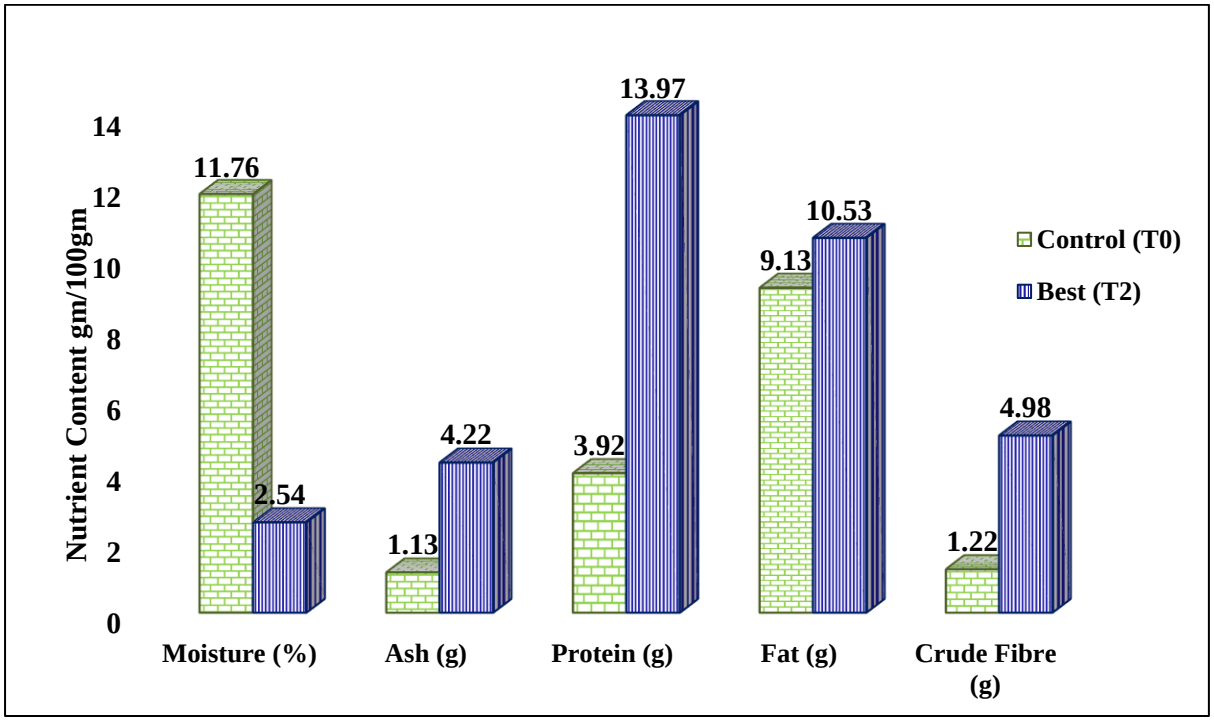

Figure no: 2 Proximate Content of Control and Best treatment of *"Sweet Biscuits"*

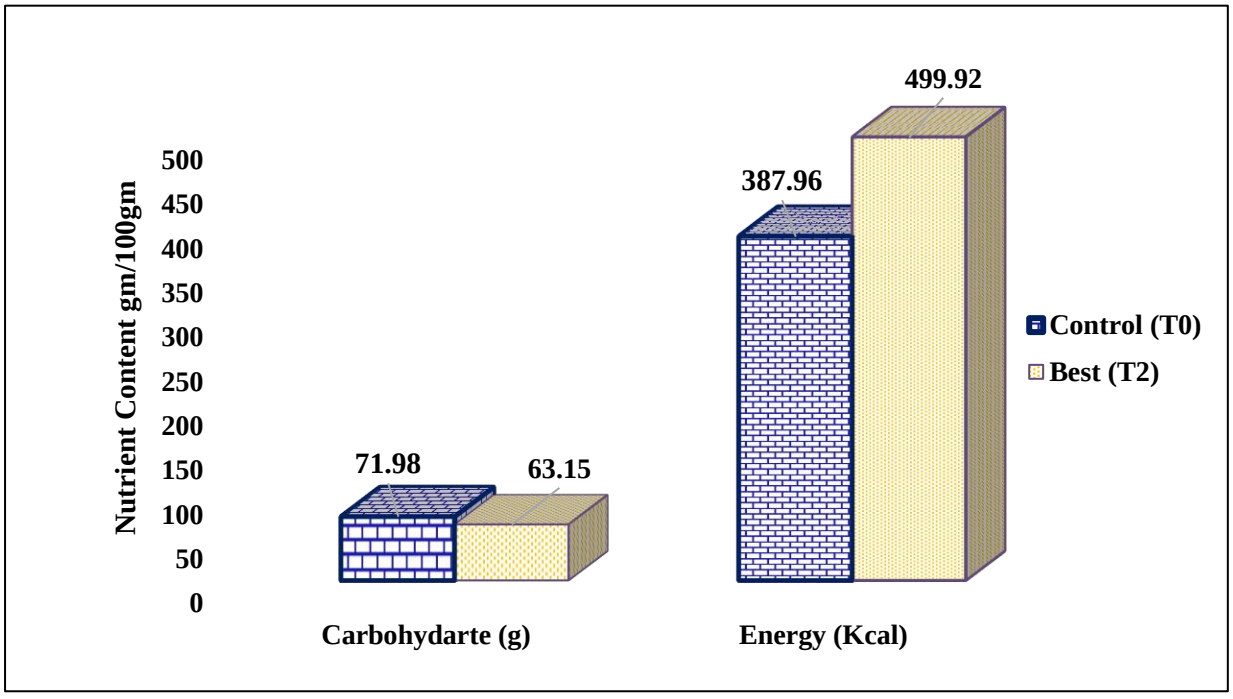

Figure no: 3 Proximate Content of Control and Best treatment of *"Sweet Biscuits"*

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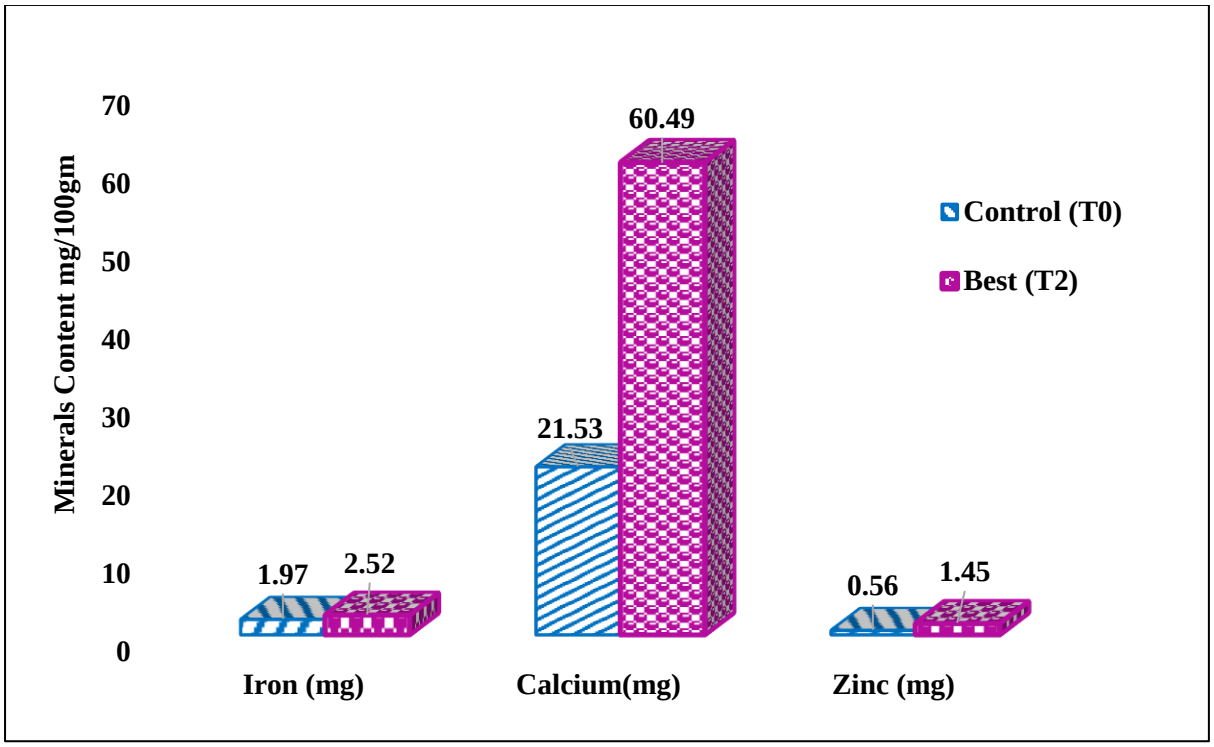

Figure no: 4 Mineral Content of Control and Best treatment of *"Sweet Biscuits"*

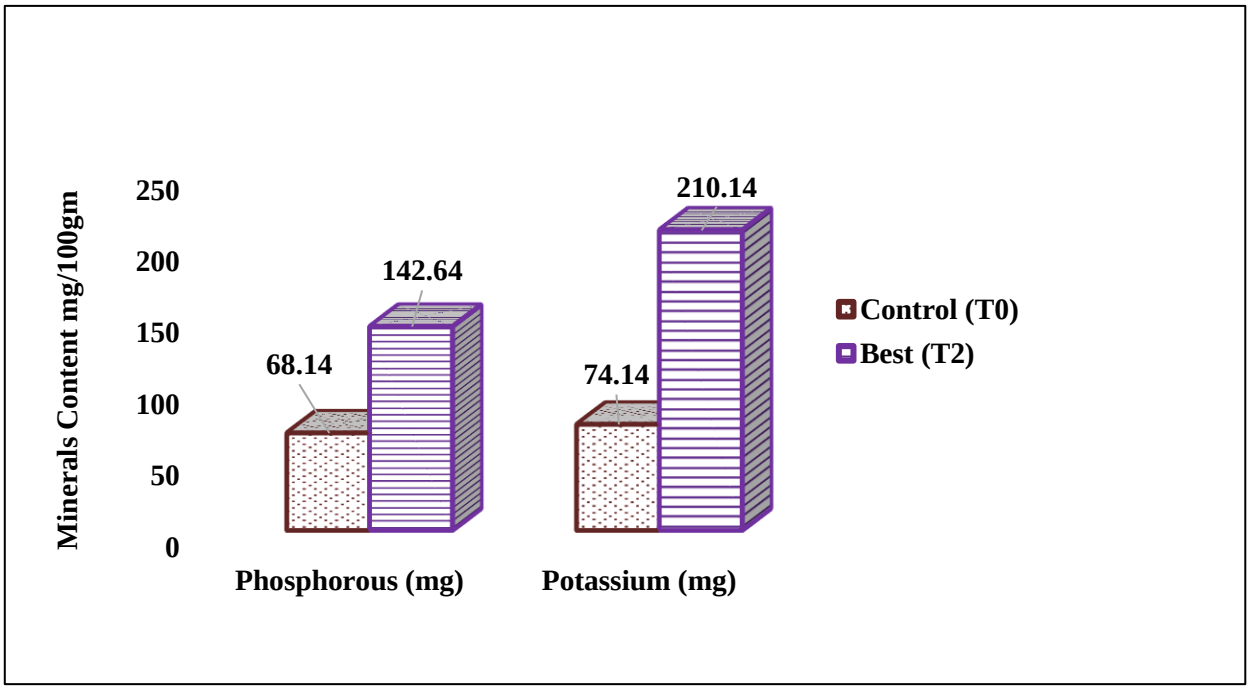

Figure no: 5 Mineral Content of Control and Best treatment of *"Sweet Biscuits"*

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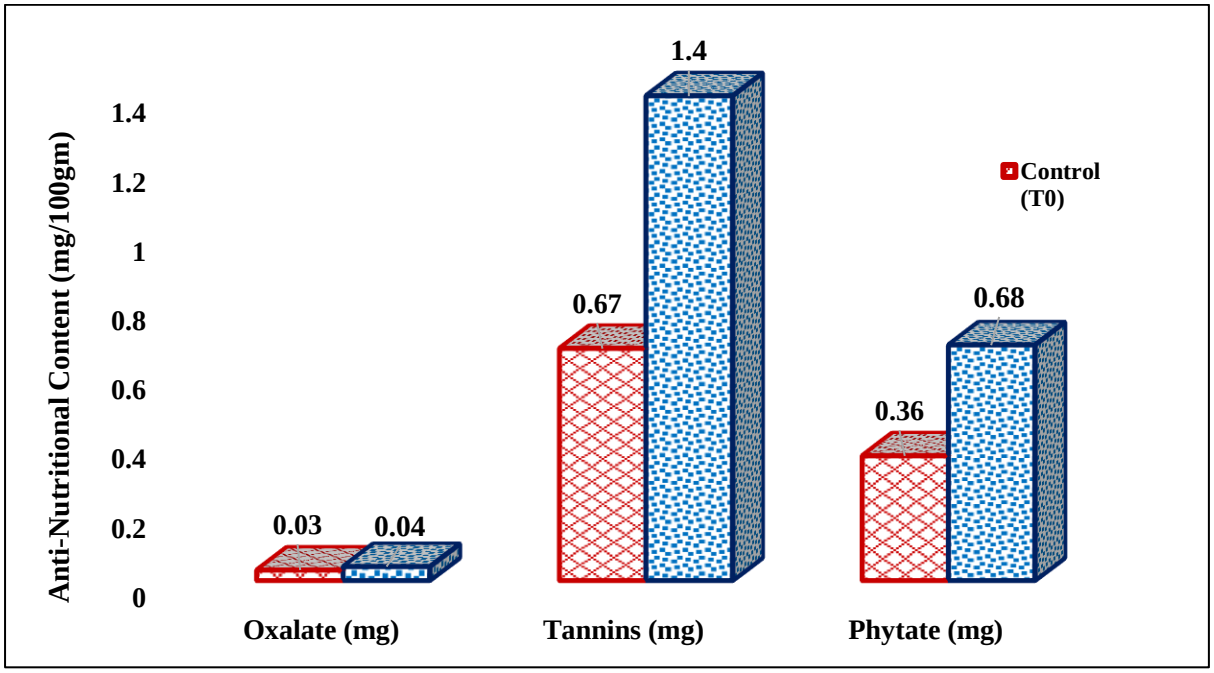

Figure no: 6 Anti-nutritional Content of Control and Best treatment of *"Sweet Biscuits"*

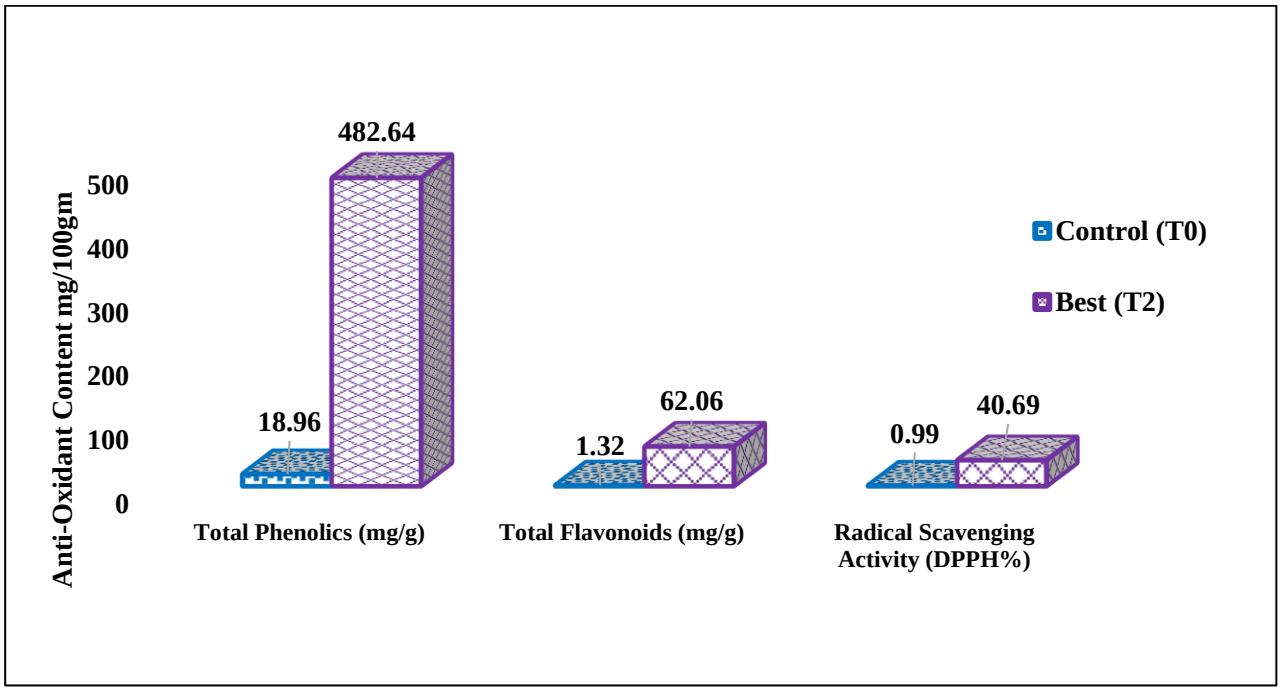

Figure no: 7 Anti-oxidant Content of Control and Best treatment of *"Sweet Biscuits"*

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Comparative analysis of Storage Period of Total Plate Count, Yeast and Mould and Coliform Count of Control (T_0) with Best treatment (T_2) 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

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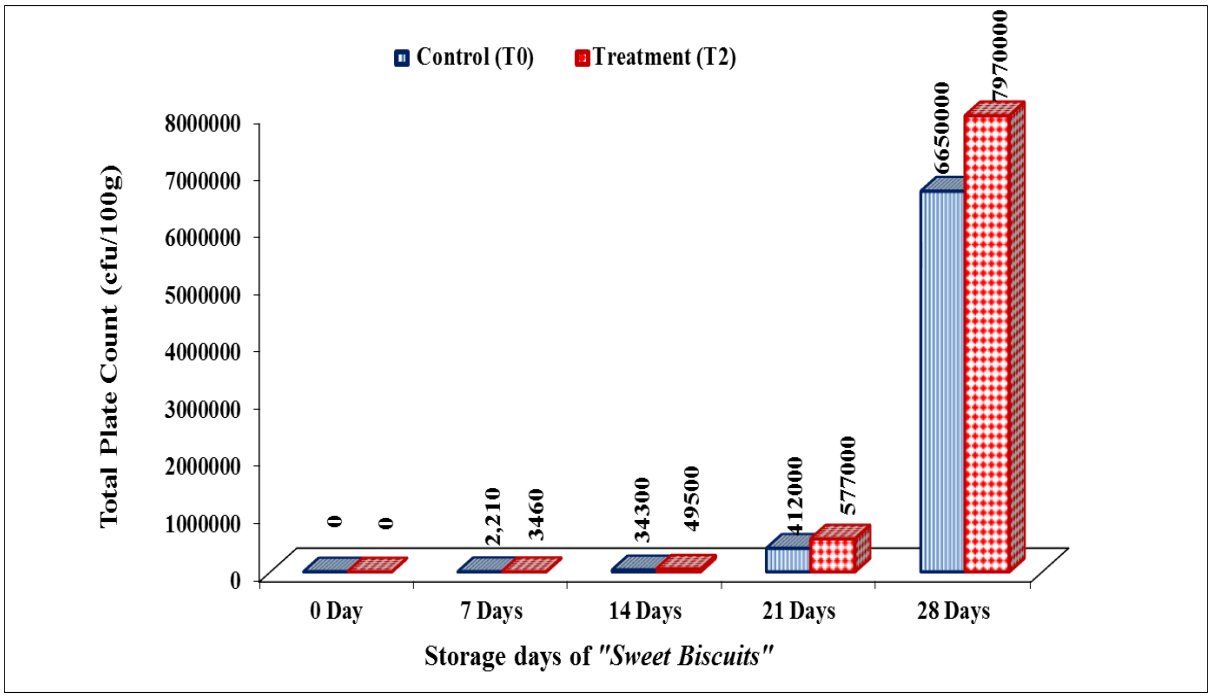

Figure no: 8 Total Plate Count of Control and Best Treatment of *"Sweet Biscuits"*

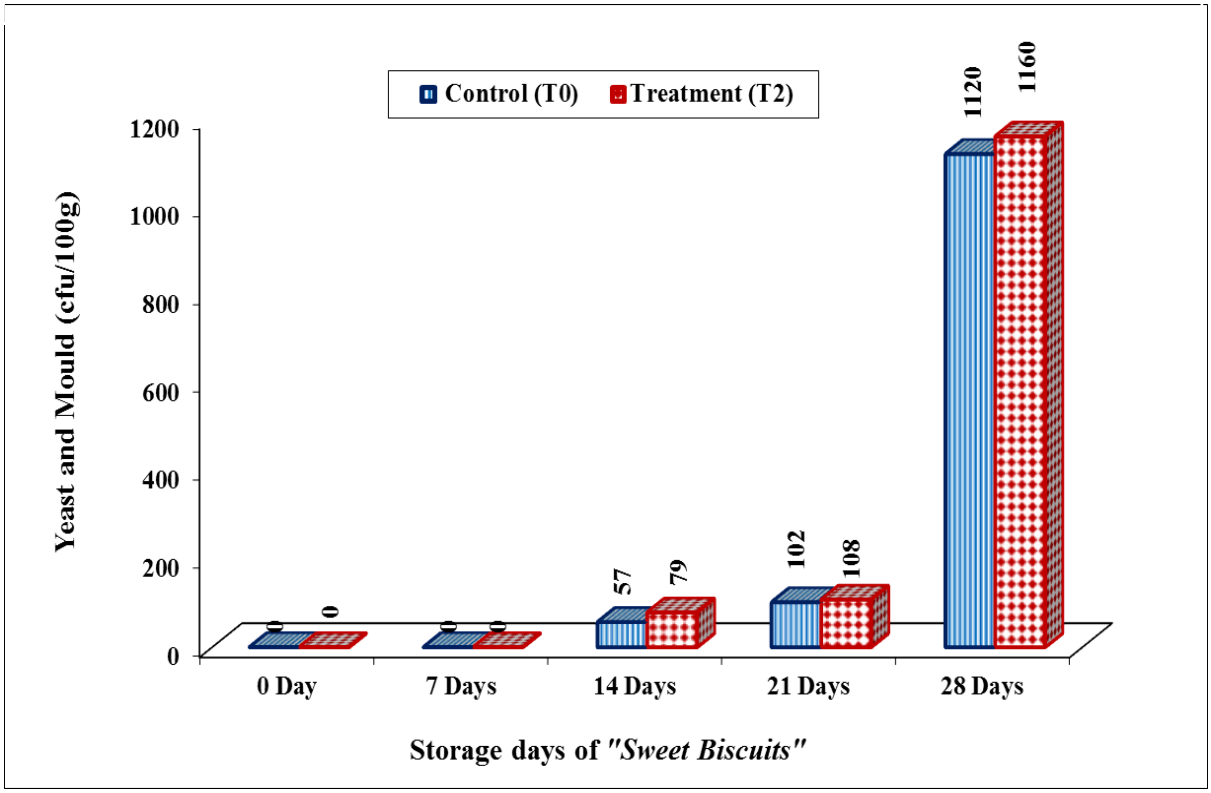

Figure no:9 Yeast and Mould Count of Control and Best Treatment of *"Sweet Biscuits"*

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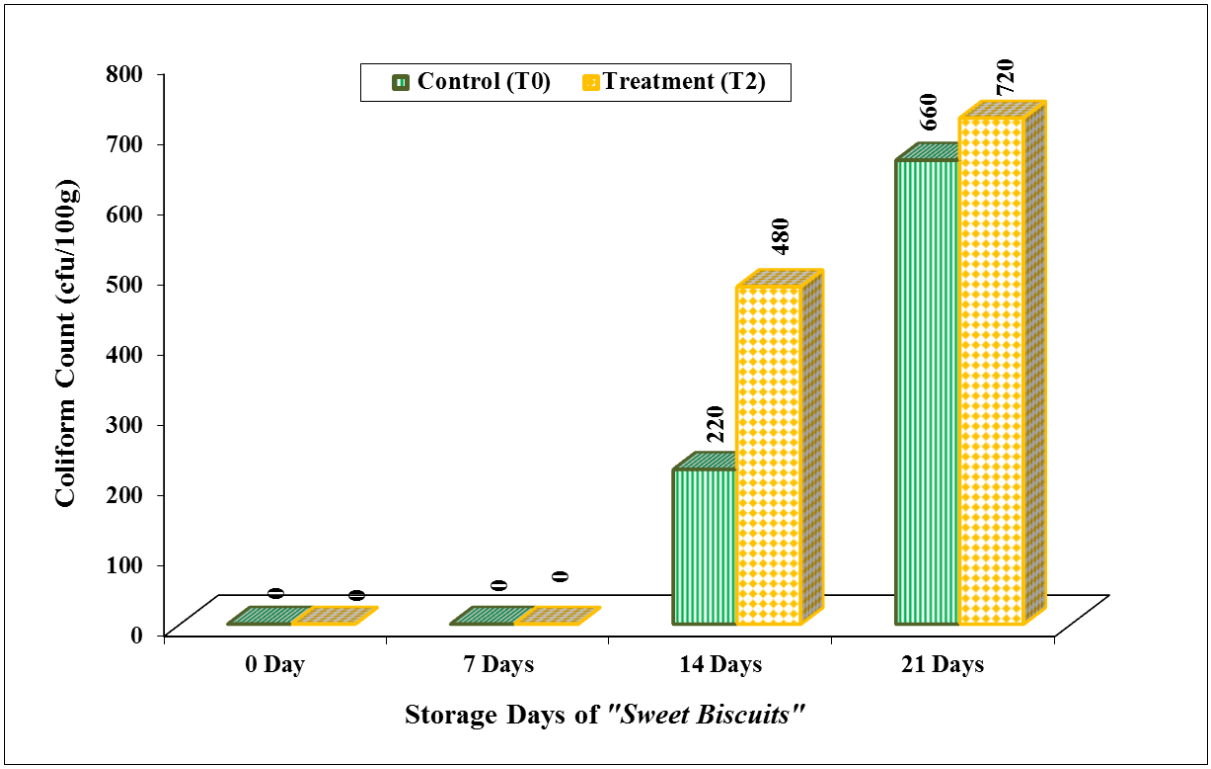

Figure no: 10 Coliform Count of Control and Best Treatments of *"Sweet Biscuits"*

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)	Amt (g)	Cost (Rs)	Amt (g)	Cost (Rs)	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

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Table no: 3 Shows that the cost of the raw materials of *"Sweet Biscuits"* was T_0 is Rs.18.9, T_1 is 27.75, T_2 is 27.6 and T_3 is 27.45 It was therefore concluded that the T_1 has the highest cost and T_0, T_2, T_3 has the lowest cost because the incorporation level of Black Rice Flour and Flax Seed Flour, which decreased the cost of prepared products marginally.

CONCLUSION

Among all the experimented treatments T_2 has been highly scored (8.62) by the panel of judges on the basis of organoleptic properties followed by T_0, T_1, and T_3 respectively. The ratio of most acceptable treatments T_2 was 30 percent Refined Flour+50percent Black Rice Flour+20 percent Flax Seed Flour. Thus, nutrition has emerged an added dimension in the chain of value-added 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"* and the access microbial load i.e., Total Plate Count, Yeast and Mould and Coliform Count at different interval of time in the value added *"Sweet Biscuits"* was found to be acceptable up to day 21 at room temperature. The cost had found lowest cost because the incorporation level of Black Rice Flour and Flax Seed Flour. The consumer's demand has increased for the food products with taste, safety, convenience and nutrition.

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