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Nutri-Snack Bar Incorporated with Watermelon Seed Powder

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Abstract:
The Nutri snack bar is highly beneficial, made with natural ingredients like watermelon and pumpkin seeds as well as black raisins and figs. The major component, black raisins, is high in fiber and supports gut health. It also contains polyphenols, which lower the body's absorption of cholesterol. Figs are high in calories, proteins, calcium, iron and fiber. Protein, fiber, beneficial fats and antioxidants may all be found in abundance in seeds. This can be consumed by all age groups and especially children. A sensory and nutritional analysis was done as part of the research to create a nutri-snack bar enhanced with powdered watermelon seeds. Watermelon seed powder was added in increments of 0%, 10%, 20% and 30% to create four different treatments. The chemical composition of nutri-snack bar was analysed and recorded. The proximate analysis for energy, ash, protein and fat content has shown the incremental values by the addition of watermelon seed powder i.e., 230 to 407gms, 2.2 to 2.62%, 6.3 to 16.14 gms and 9.78 to 25.39 gms respectively. The minerals includes calcium and iron ranged from 88.9 to 94.9 mg and 4.14 to 6.06 mg. Thiamine and riboflavin content ranges from 0.086 to 0.125mg and 0.041 to 0.156. The sensory analysis showed variations in colour, flavour, texture, taste and overall acceptability. The treatment 2 was found to be the most preferable by the panellists.

Keyword: Nutri-Snack Bar, Quantitative Analysis, Sensory Evaluation, Meal Replacement

INTRODUCTION:

In recent times, the lifestyle of people changes and intake of nutrients were affected (Umme Habiba *et al*., 2021). In addition, people seek out items that are simple to make, such as cakes, popcorn, and chips, which can serve as healthy substitutes for fast foods. Thus, the greatest choice for supplying a sufficient amount of nutrients in a regular diet is nutri-snack bar (S Zubeda Sohan *et al*., 2021). The well-balanced nutritional properties of nutri-snack bar contribute to increased muscle growth and hemoglobin percentage. A nutri-snack bar is a meal replacement snack that is high in energy, iron, proteins and lipids (Humera Ansari et al., 2021). Additionally, it benefits people of all ages more (S.V.Ghodke *et al*., 2020).

A nutri-snack bar is made with natural components such as black raisins, figs, pumkin seeds and water melon seeds which are of high nutritional value (Effat Ansari *et al*., 2021). The high fiber content of black raisins supports gut health and the polyphenols in raisins lower the body's absorption of cholesterol (Margaret J. Schuster *et al*., 2017). The most nutrient-dense fruit, figs are heavy in calories,

proteins, calcium, iron and fiber (Gousia Gani *et al*., 2018). Protein, fiber, beneficial fats and antioxidants can all be found in abundant in seeds (Mridula Gupta *et al*., 2021).

Black raisins (Vitis vinifera) belong to the Vitaceae family. The significant phytochemicals found in grapes are called polyphenols and they support a wide range of biological processes as well as numerous health-promoting advantages (Kandasamy Sasikumar *et al*., 2020). Grape products include fresh fruit, raisins, juice and wine. More than 2,000 years ago, black raisins were utilized as a traditional herbal remedy for human health. "Ayurvedic" medication is recommended as a cardiotonic, which implies that it will improve cardiac functions (Prasad, Tyagi, 2015).

When compared to fresh grapes, consumers prefer to have dried grapes called raisins. Consuming the raisins three times a day reduces blood pressure. When grapes are harvested and produced at a commercial level, they begin to dry. The process of turning fresh grapes into dried grapes takes three steps. Pre-treatment, drying, and post-drying procedures are a few of these. The solar drying approach has taken the place of conventional heating methods (Salam and Kashif, 2021). One of the best processing methods for extending a product's shelf life is drying. Antioxidants are found in higher concentrations in dried fruits than in fresh fruits (Esra Capanoglu, 2014).

Fig (Ficus Carica) is one of the largest genera of angiosperm with more than 800 species worldwide. Because of its remarkable health advantages, figs are generally recognized by people worldwide (Qiuxia Yang *et al*., 2023). The eating of figs is beneficial for heart health, cholesterol reduction and breathing regulation. Figs contain about 100 bioactive substances, including xanthotoxol, arabinose, β-amyrins, β-carotenes, glycosides, and β-setosterols (Duke, 1992). The most significant bioactive substances are triterpenoids, which are found in latex, leaves and roots. A sulfur-containing protein called metallothionein is generated in modest amounts in both human and animal brains and is essential for appropriate brain function (Slatnar *et al*., 2011).

Figs offer several health advantages, such as improving vascular health by lowering blood fat levels and heart disease risk, as well as supporting digestive health through enough fiber consumption. Additionally, it supports healthy skin and has anticancer qualities (Aaron A Comeault *et al*., 2020).

Pumpkin (cucurbita) is a member of the Cucurbitaceae family and is often produced as a vegetable in many parts of the world. Vegetables and medicinal pumpkins are produced all over the world. Pumpkins have long been utilized as traditional medicines in China, Pakistan, India, Yugoslavia, Argentina, Mexico, America and Brazil (Asha Verma *et al*., 2022). Pumpkin seeds are used for therapeutic reasons all over the world because they are rich in nutritional and medicinal components (Sharma Megha *et al*., 2018).

Watermelon (Citrullus lanatus) seeds are a good source of fat and protein that may be substituted for fat in a variety of dishes (Tusneem Kausar *et al*., 2020). Low-molecular-weight polypeptides including globulin, glutenin, and albumin can be found in good amounts in watermelon seeds (Rameesa AM and Bushaira V, 2023).

Objectives:

- To standardize the nutri-snack bar by incorporating with watermelon seed powder.
- To determine the sensory properties of nutri-snack bar.
- To evaluate the nutritional composition of nutri-snack bar.

MATERIALS AND METHODS:

Raw Materials:

Fig (Ficus carica), Black Raisins (Vitis vinifera), Pumkin seeds (Cucurbita maximd) and Watermelon seeds (Citrullus lanatus) are purchased from the local market stores in Guntur.

Processing of Nutri-snack bar:

The ingredients were used in different ratios in three variations; the details of ingredients are mentioned in Table 1. The ingredients includes black raisins, fig and pumkin seeds and watermelon seeds are sorted and cleaned. The seeds are then roasted to develop good flavour and all ingredients are grinded into powder. All these ingredients are mixed in different proportions and then packed in air tight containers and stored at room temperature.

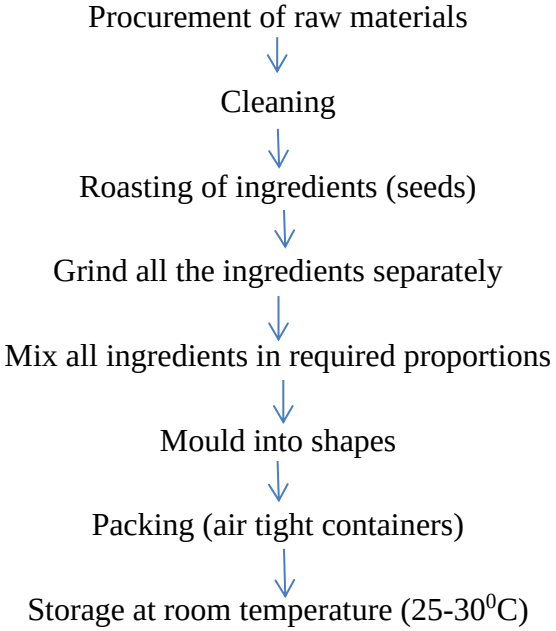

Figure 1: Flowchart of nutri-snack bar processing

Table 1: Proportions of nutri-snack bar

Ingredients	Constant	Treatment 1	Treatment 2	Treatment 3
Black Raisins paste	30	30	30	30
Pumpkin seed powder	20	20	20	20
Fig powder	50	40	30	20
Watermelon seed powder	0	10	20	30

Physico-chemical Analysis:

P^H Analysis:

One drop of sample was homogenized in one ml of distilled water and one ml of deionized water. An electric p^H meter was used to determine the nutri-snack bar P^H. The P^H meter was calibrated using buffer solutions (Lakshmi,M *et al*., 2022).

Estimation of moisture Analysis:

10 grams of the sample are collected in petri dish and dried for two hours at 60°C in a hot air oven. The weight reduction was expressed and reported as a percentage. Once the sample had cooled in the desiccators, it was weighed once again. Moisture content was expressed in g/100g of sample (AOAC in 1980).

$$\text{Moister content } \left[\frac{\text{g}}{100\text{g}}\right] = \frac{\text{Intial weight [g]} - \textit{Final weight [g]}}{\text{Weight of sample [g]}} \times 100$$

Estimation of total ash:

Three to five grams of nutri-snack bar samples were measured and placed onto ash plates. The samples were heated to 550°C in a muffle furnace. They were burned for seven hours, or until light grey ash or constant weight was achieved. The samples were weighed and the amount of ash within was determined once they cooled (AOAC in 1980).

Determination of Crude Fibre:

2g fat extracted sample was weighted and crude fiber was estimated (S.V.Ghodke *et al*., 2020).

$$\textit{Crude fiber}(\%) = \frac{\textit{Loss of weight noted } \times 100}{\text{Weight of sample taken}}$$

Determination of Carbohydrates:

Determination of carbohydrate is performed using Anthrone method (AOAC in 1980).

$$\text{Carbohydrates } \left[\frac{\text{g}}{100\text{g}}\right] = 100 - [\text{protein(g)} + \text{fat(g)} + \text{fiber(g)} + \text{ash(g)} + \text{moisture(g)}]$$

Determination of Protein:

The protein content of the sample was determined using Thimmaiah's (1999) approach. The micro-Kjeldal technique, which measures the quantity of reduced nitrogen in the sample, was used to evaluate the protein content.

$$\text{Protein } [\frac{\text{g}}{100\text{g}}] = \frac{\text{Titre value} \times \text{normality of HCL} \times 0.014 \times 6.25}{\text{Weight of sample (g)}} \times 100$$

Estimation of fat:

A sample that had been dried in the oven was fattened. The soxhlet device was used to quantify fat in accordance with Thimmaiah's (1999) approach. Fat was extracted with petroleum ether. Three hours were spent extracting on the heater. On a heater, the solvent was evaporated, cooled, and then weighed. The amount of fat taken will be determined by the weight differential.

$$\text{Fat content} = \frac{\text{Weight of ether extract}}{\text{Weight of sample}} \times 100$$

Energy Determination:

By calculating the quantity of fat, protein, and carbohydrates by their respective energy factors, the energy value of those nutrients was determined (AOAC in 1980).

$$\text{Energy [kcal]} = [\text{protein(g)} \times 4] + [\text{carbohydrate(g)} \times 4] + [\text{fat(g)} \times 9]$$

Calcium determination:

A sample's total mineral content was initially determined by heating it to 600°C for five to seven hours. As calcium oxalate, calcium was precipitated. After dissolving the precipitate in hot, diluted H2SO4, standard potassium permanganate was used to titrate the mixture (AOAC in 1980).

Estimation of iron:

The iron content of the sample was estimated by using atomic absorption spectrophotometer and the results were expressed in mg/100g of the sample (Shekhara Naik R *et al*., 2020).

Estimation of thiamine and riboflavin:

After the sample were acid hydrolysis, thiamine and riboflavin were extracted in an autoclave for 15 min at 120^{o}C. They were then independently measured using reverse-phase high performance liquid chromatography (HPLC) and enzymatically dephosphorylated with Take-Diastase for three hours at 45^{o}C. The findings were given in µ/100g dm. (Karin *et al*., 2022)

Sensory attributes:

A five-point hedonic scale was used by semi-trained judges to assess the sensory qualities of colour, flavour, texture, taste, and overall acceptability (Amerine et al., 1965). One of the most important aspects of any product development process is sensory acceptance. It takes a skilled worker to assess a product's colour, texture, flavour, taste, and general acceptability in order to determine customer acceptance.

RESULTS AND DISCUSSION:

The collected data were statistically analysed to determine the distinctions between the original and modified nutri-snack bar. For every parameter, the mean and standard deviation were determined. Using Excel Data Analysis 2007, an ANOVA was expressed to determine the differences between the various ingredient modifications.

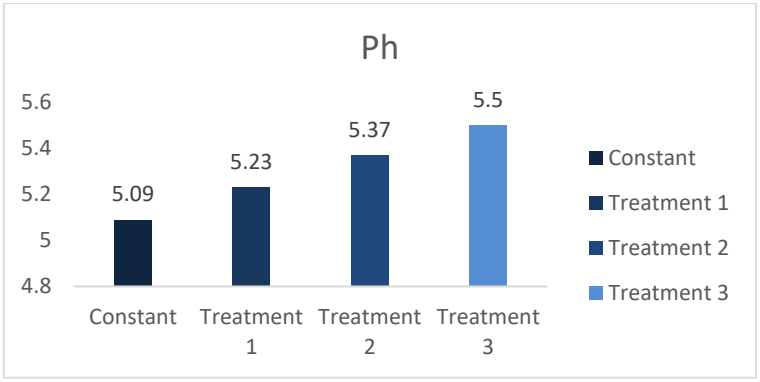

Figure 2: P^H of different nutri-snack bar

The analysis shows that the p^H of nutri-snack bar were increased slightly from constant to treatment 3 i.e., 5.09, 5.23, 5.37, 5.5. Is due the increase in watermelon seed powder which contains high p^H when compares to other ingredients. According to the study the p^H of watermelon seeds contains 4.0 to 5.5 (Aimin Liu *et al*., 1994).

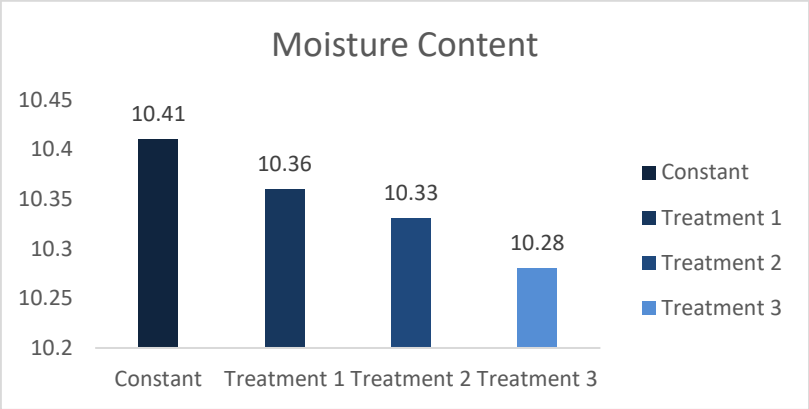

Figure 3: Moisture of different Nutri-snack bar

The moisture content of nutri-snack bar were decreased from constant to treatment 3 was found to be 10.41±0.04, 10.36±0.03, 10.33±0.03 and 10.28±0.02 respectively. The moisture content was high in constant due to presence of high amount of fig.

Nutrients composition g/100gm	**Constant**	**Treatment 1**	**Treatment 2**	**Treatment 3**
Moisture (gm)	10.41 ± 0.04	10.36 ± 0.03	10.33 ± 0.03	10.28 ± 0.02
Ash (gm)	2.2 ± 0.01	2.32 ± 0.02	2.5 ± 0.01	2.62 ± 0.02
Energy (kcal)	230 ± 0.15	288.9 ± 0.15	348 ± 0.15	407 ± 0.07
Protein (gm)	6.3 ± 0.01	9.57 ± 0.02	12.86 ± 0.01	16.14 ± 0.005
Carbohydrates (gm)	29.47 ± 0.01	29.16 ± 0.01	28.85 ± 0.01	28.54 ± 0.01
Fat (gm)	9.78 ± 0.01	14.91 ± 0.01	20.16 ± 0.01	25.39 ± 0.01
Crude fiber (gm)	1.43 ± 0.01	1.29 ± 0.01	1.15 ± 0.01	1.02 ± 0.01
Calcium (mg)	88.9 ± 0.1	90.9 ± 0.1	92.9 ± 0.1	94.9 ± 0.15
Iron (mg)	4.14 ± 0.01	4.78 ± 0.01	5.42 ± 0.01	6.06 ± 0.01
Thiamine (mg)	0.086 ± 0.001	0.1 ± 0.02	0.113 ± 0.01	0.125 ± 0.001

Riboflavin (mg)	0.041 ± 0.001	0.134 ± 0.001	0.147 ± 0.001	0.156 ± 0.001

Table 2: Nutritional value of nutri-snack bar

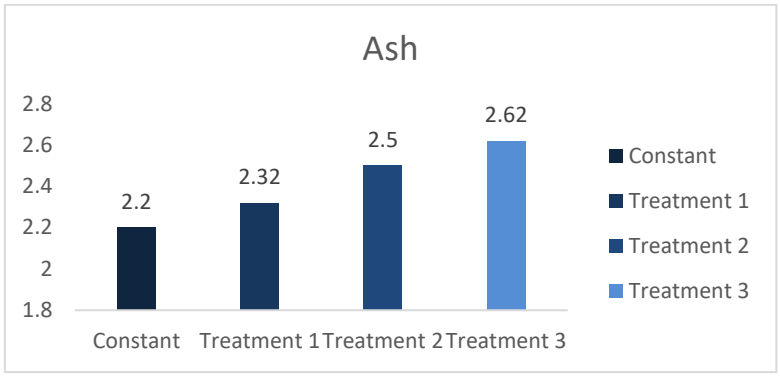

Figure 4: Ash content of different nutri-snack bar

The ash content of different nutri-snack bar showed in figure 3 which observes that there is a slight difference from constant to treatment 3 i.e., 2.2±0.01, 2.32±0.02, 2.5±0.01 and 2.62±0.02 respectively. The difference was less due the presence of same proportion of pumpkin seed where contains high amount of mineral content. According to the study (Gohari Ardabili et al., 2011) explains about ash content of pumpkin seeds were 2.49%.

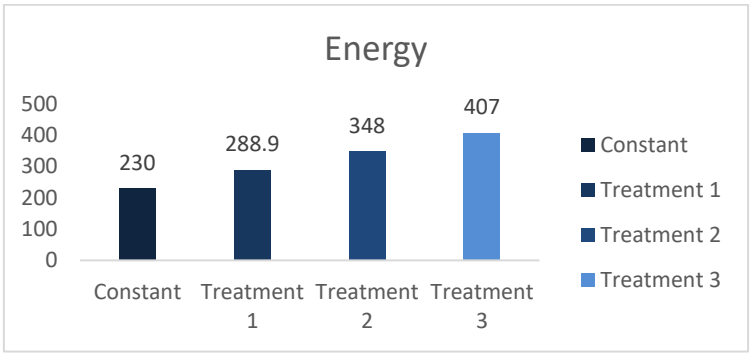

Figure 5: Energy content of nutri-snack bar

The energy content of nutri-snack bar has increased rapidly from constant to treatment 3 i.e., 230 ±0.15, 288.9±0.15, 348±0.15 and 407±0.07 respectively.

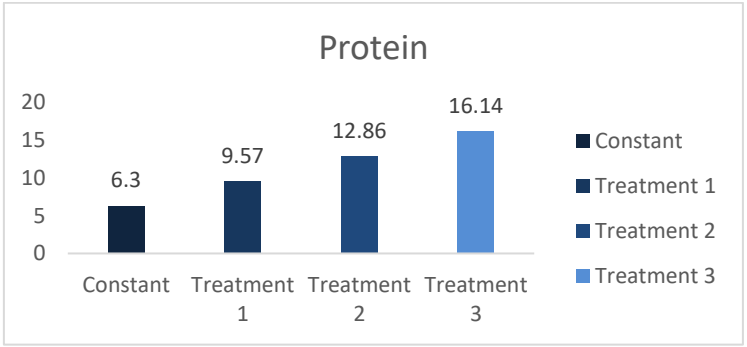

Figure 6: Protein content of different nutri-snack bar

The protein content of different nutri-snack bar are showed in figure 6 which observes that 6.3±0.01, 9.57±0.02, 12.86±0.01 and 16.14±0.005 respectively. Rapid increase in protein is due to the presence of watermelon seed powder in different proportions from constant to treatment 3.

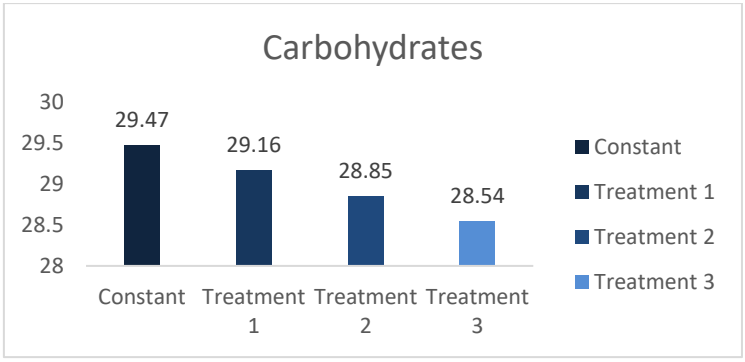

Figure 7: Carbohydrate content of nutri-snack bar

The carbohydrate content of nutri-snack bar were decreased from constant to treatment 3 i.e., 29.47±0.01, 29.16±0.01, 28.85±0.01 and 28.54±0.01 respectively. It is due to decreased ratio of black raisins in different variations.

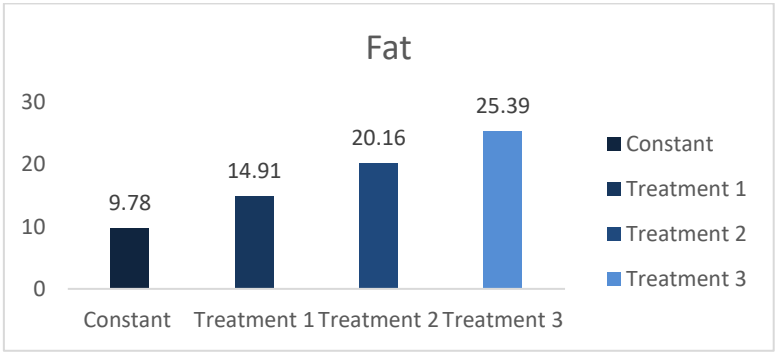

Figure 8: Fat content of nutri-snack bar

The fat content of different nutri-snack bar were increased from constant to treatment 3 i.e., 9.78±0.01, 14.91±0.01, 20.16±0.01 and 25.39±0.01 respectively.

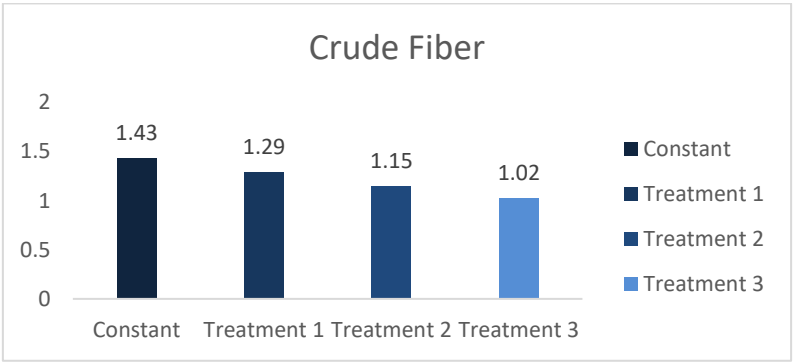

Figure 9: Crude fiber content of nutri-snack bar

The fiber content of nutri-snack bar were decreased slightly from constant to treatment 3 i.e., 1.43±0.01, 1.29±0.01, 1.15±0.01 and 1.02±0.01 respectively. Is due to the decrease of black raisins.

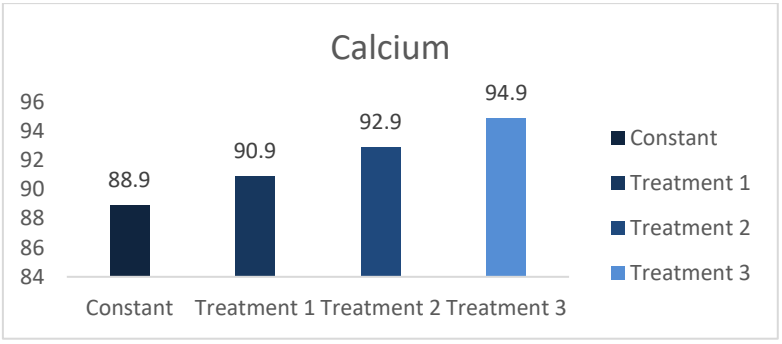

Figure 10: Calcium content of nutri-snack bar

The calcium content of nutri-snack bar are 88.9±0.1, 90.9±0.1, 92.9±0.1 and 94.9±0.15 respectively. The have a slight difference due to the presence of black raisins in same ratio.

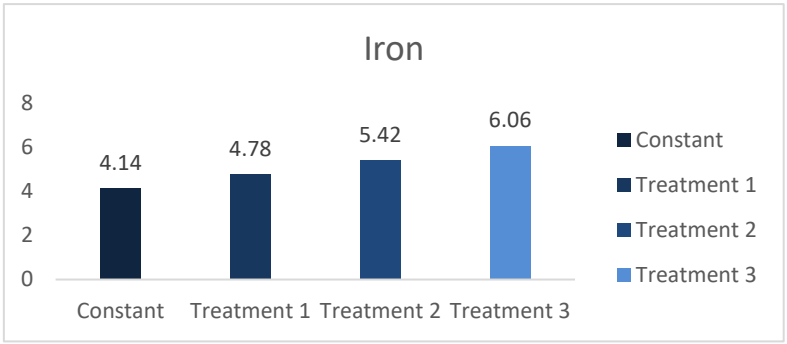

Figure 11: Iron content of nutri-snack bar

The iron content of nutri-snack bar were increased from constant to treatment 3 i.e., 4.14±0.01, 4.78±0.01, 5.42±0.01 and 6.06±0.01 respectively. It is due to the black raisins present in the ratio of 30gms.

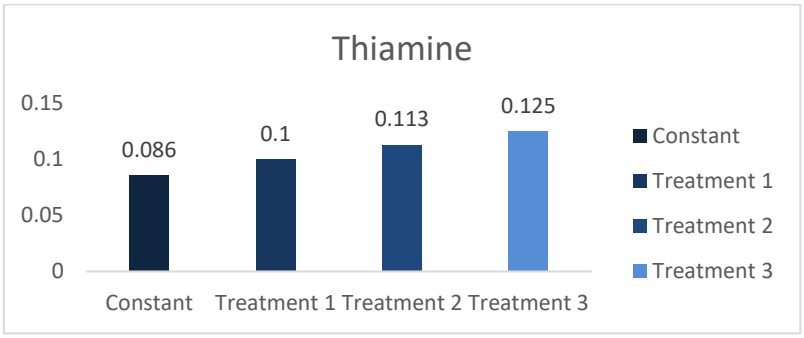

Figure 12: Thiamine content in nutri-snack bar

The thiamine content in nutri-snack bar were increased slightly from constant to treatment3 i.e., 0.086±0.001, 0.134±0.001, 0.147±0.001 and 0.156±0.001 respectively.

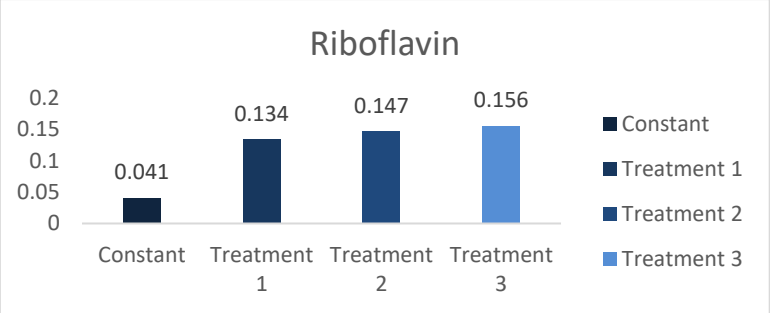

Figure 13: Riboflavin content of nutri-snack bar

The riboflavin content of nutri-snack bars are 0.041±0.001, 0.134±0.001, 0.147±0.001 and 0.156±0.001 respectively.

Sensory Analysis:

The table shows the average sensory score for each nutri-snack bar made with incorporation of watermelon seed powder in a ratio of 10g, 20g and 30g. The results of sensory evaluation examined by the semi-trained panellist showed that the prepared raisins roll ensures the equal score, while there were minor variations in texture, taste, and colour.

Sensory parameters	Constant	Treatment 1	Treatment 2	Treatment 3
Colour	4.86±0.34	4±0.74	4.16±0.59	3.8±0.66
Flavour	3.8±0.99	3.5±1.25	4.13±0.77	3.36±0.61
Texture	3.96±0.88	3.73±0.58	4.16±0.53	3.66±0.66
Taste	3.8±0.84	3.73±0.98	4.3±0.91	3.5±1.04
Overall acceptability	3.83±0.69	3.53±1.07	4.3±0.83	3.43±0.81

Table 3: Sensory evaluation of nutri-snack bar

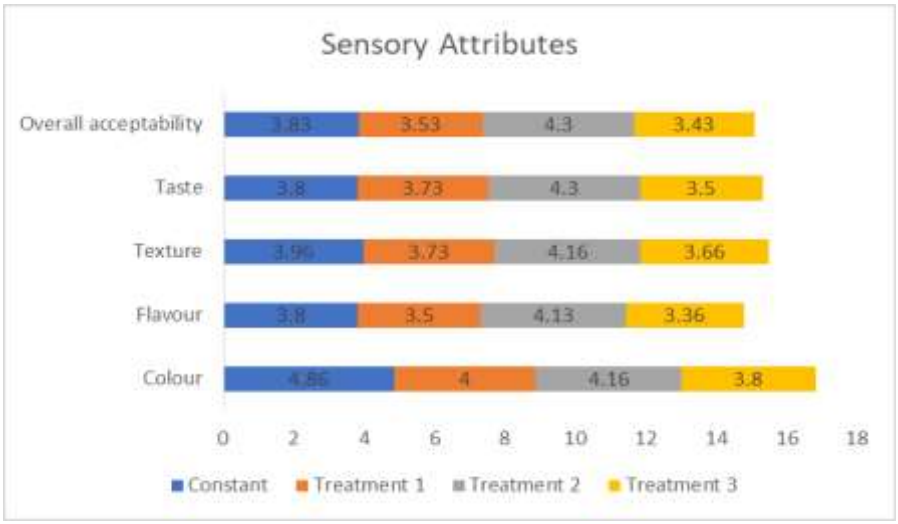

Figure 14: Sensory attributes of nutri-snack bar

Table 3 shows the average ratio obtained by semi-trained panellists who evaluated the sensory features of the prepared samples using a 5-point hedonic scale. Four different samples were evaluated, and the average results are shown in the table. From this the colour of prepared sample ranges 4.86±0.34 to 3.8±0.66. Flavour ranges 3.8±0.99 to 3.36±0.61, texture ranges 3.96±0.88 to 3.66±0.66, taste ranges

from 3.8±0.84 to 3.5±1.04 and the overall acceptability ranges 3.83±0.69 to 3.43±0.81. Among this Treatment 2 is acceptable by the panellist.

The sensory results reported with some modifications. The sensory evaluation of the nutri-snack bar showed a significant difference in the qualities of colour, texture, flavour and overall acceptability. Thirty panellists were used in the evaluation process. All of the modifications are acceptable based on this; however treatment 2 is the better option (Meilgaardetal., 2007).

CONCLUSION:

It can be concluded that all the variations contain different concentrations of fig and watermelon seeds. By incorporation of watermelon seed powder in different ratios can enhances the nutritional value. T2 was found to be more acceptable on the basis of sensory evaluation performed by panellist. Whereas it contains 10.33% moisture, 348 kcal of energy, 12.86 gms of protein, 92.9 mg of calcium and 5.42 mg of iron. The prepared nutri-snack bar contains maximum amount of energy, protein, calcium and iron. It helps to replace unhealthy foods. Moreover, this product is suitable for the people of all age group, especially children. The prepared nutri-snack bar provides energy to the people who have no time for a meal.

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