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# Formulation and quality characterization of supplementary food- Panjeri

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## Abstract

The Panjeri (or Panjiri) is a traditional supplementary food made from different dry fruits and cereals. This supplementary food was formulated with locally available ingredients. It has ingredients such as wheat, almond, pistachios, raisins, dried fig, dates, walnut, cashew nut, makhana (fox nuts), plant-based seeds ghee, coconut, khareti seeds, sugar. However, the ingredients vary from a place to another place. The present study was aimed towards investigation the nutritional analysis of 100 gm of Panjeri sample. The results were carbohydrates- 59.5g/100 g, proteins- 7.1 g/100 g, fats- 23.2 g/100 g, fibre- 6.2 g/100 g, moisture content- 9.2 g/100 g, ash- 1 g/100. Mineral analysis showed different contents such as calcium- 78.2 mg/ 100 g, potassium- 286.4 mg/100 g, iron- 4.8 mg/100 g, magnesium- 4.8 mg/100 g, vitamin c- 1.2 mg/ 100 g, vitamin d- 3.1 mg/100 g. The antioxidant activity by DPPH was 1276 ppm and by FRAP it was 9.796 µmol. The microbial activity showed a total viable count of 100 CFU/ml, yeast & mould- <10 and *coliform, E.coli, staphylococcus* and *salmonella* were absent in the sample. The sensory analysis was done and the shelf life study showed no changes till one month showing a higher shelf life. The high nutritional content of panjeri is very beneficial for post partum and lactating mothers.

**Keywords:** Panjeri; Nutritional Analysis; Antioxidant activity; Microbial Activity; Sensory Analysis

## 1. Introduction

Panjeri is a traditional food which is used as a supplementary food for post-partum women. Panjeri can be commonly seen in most Hyderabadi households and most commonly used in many parts of Telangana. It is made from a combination of different dry fruits and various cereals, seeds, ghee and sugar. It is loaded with energy and helps new mothers to recover after giving birth. Dry fruits are rich in healthy fats and calories which provide adequate calories and also by being appetizing.

Whole wheat flour provides fibre and essential nutrients, ghee offers healthy fats that aid in the absorption of vitamins and provide energy, nuts and seeds are rich in proteins, healthy fats, and essential minerals, edible gum is known for its strengthening properties, beneficial for postpartum recovery.

Almonds are an incredible dense package of nutrients. They are concentrated source of energy as they have 60 per cent fat. Almonds have 20 per cent protein like pulses. Like other nuts, carbohydrate content is low. They are fairly good source of b-vitamins and contribute to vitamin-E content. (SriLakshmi, Food Science; Seventh Edition). Walnuts are rich in polyunsaturated fat, protein, fibre, manganese, copper, melatonin, ellagic acid and omega 3 fatty acids have been linked to reduced inflammation, decreased risk of heart disease. Walnuts are heart healthy due to polyunsaturated fatty acids. Walnuts are rich in antioxidants like melatonin. (SriLakshmi, Food Science; Seventh Edition)

Panjiri is a nutritious food product formed from the locally available flours of cereal grains and legumes such as wheat flour, soya flour, chickpea flour using household technologies like blending and roasting. (Salve et al;2011).

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Traditionally, panjiri can be modified so as to increase its micronutrient quality and to reduce the fat content with the aim of reducing the risk of obesity in mothers but benefitting the growth of infant (Kajale et al;2014). Substituting panjiri with millet, which are nutritionally rich as compared to cereals and provides minerals, fibers, vitamins and are gluten free as well, can play an important role in enhancing the overall nutritional quality of panjiri, (Kaur et al., 2021). Hence present study framed to formulate supplementary food panjiri and to know nutritional importance.

## 2. Materials and methods

The raw materials were purchased from a local store named- 'Friends Unani Ayurvedic and General Store' in Site 3 locality, Borabanda, Hyderabad.

**Figure 1** Ingredients used for the preparation of panjeri

**Figure 2** Roasted dry fruits and other ingredients

### 2.1. Formulation of panjeri

Three combinations of panjeri were formulated by incorporating the flour mixed at various proportions (Table 1)

**Table 1** Formulation for the preparation of panjeri

| Samples | Combinations |
|---|---|
| T- 1 | 50% WF + 35% DF+ 15% OI |
| T- 2 | 70% WF + 15% DF + 15% OI |
| T-3 | 60% WF + 25% DF+ 15% OI |

**Note: WF-** Wheat Flour, **DF-** Dry Fruits (almond, pistachios, raisins, dried fig, dates, walnut, cashew nut, makhana), **OI-** Other Ingredients (ghee, coconut, khareti seeds, sugar)

### 2.2. Preparation of Panjeri

The supplementary food Panjeri was prepared by this process- All the dry fruits were roasted in ghee in a pan separately, they were placed in a plate and wheat powder was roasted separately and the dry fruits and other ingredients were grinded in a mixer grinder. Wheat and dry fruits were mixed according to their quantities. Sugar was powdered and used in the recipe (flowchart 1).

### 2.3. Method of Preparation of Panjeri

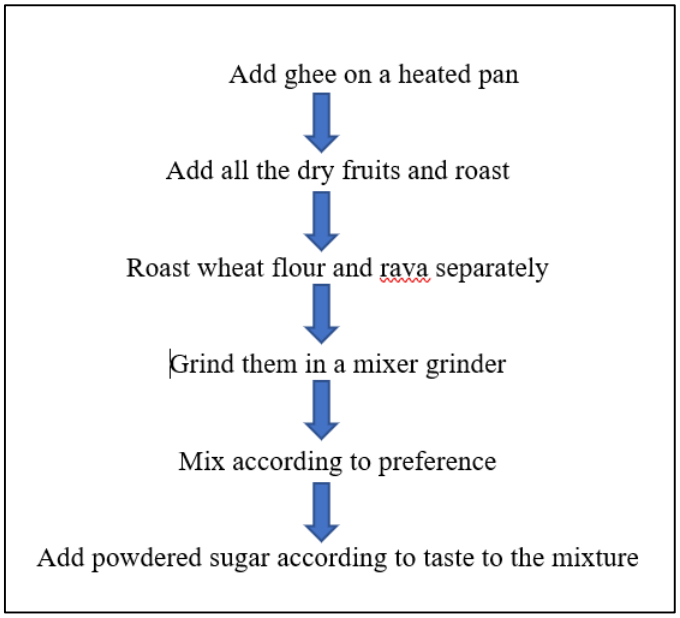



**Figure 3** Preparation process of panjeri


**Figure 4** The Panjeri samples prepared for the sensory evaluation

### 2.4. Organoleptic Evaluation

The sensory evaluation was carried out three samples of Panjeri prepared Sample $T_1$, $T_2$ and $T_3$ by using a 7-point hedonic scale with panel of 20 judges considering 6 parameters such as colour, texture, aroma, taste, appearance, overall acceptability and identified best scores sample, the best score identified sample carried out for further analysis.

#### *2.4.1. Nutritional Evaluation*

Proximate analysis is a set of methods used to determine the nutritional composition of a food sample. It involves the measurement of various components such as energy, moisture, protein, fat, carbohydrates, ash and fiber (Table 2).

*2.4.2. Protein Determination*

The AOAC 2001 by using Kjeldahl method, which is used for the determination of protein in the selected food sample. (AOAC International, 2001)

Protein (%) = (N x 6.25) / Sample weight (g)

*2.4.3. Carbohydrates Determination*

The carbohydrate content carried out by differentiation method by (100 – (moisture + Fat +Protein +ash + fibre)) (AOAC International, 2022).

*2.4.4. Moisture Determination*

The AOAC 925.10 21st Edition is a method for determining the moisture content in the selected food sample by air oven dry method. (AOAC International, 2022)

Moisture content (%) = [(Initial weight (W1) – Final weight (W2))/ Initial weight (W1)] x 100.

*2.4.5. Ash Determination*

The AOAC 942.05 is a method for determination of ash content in the selected food sample by gravimetric method. (AOAC International, 2022)

Ash content (%) = (Weight of ash/ Weight of the sample) x 100.

*2.4.6. Fat Determination*

The AOAC (Association of Official Agricultural Chemists) 20th Edition 2016 method (920.39) by gravimetric determination, which is used for the determination of fat in selected food sample. (AOAC International, 2019)

Fat (%) = (Weight of extracted fat/ Weight of the sample) x 100.

*2.4.7. Fiber Content*

The AOAC 991.43 is a method for determination of total fiber content in the selected food sample by enzymatic-gravimetric method. (AOAC International, 2022)

Total Dietary Fiber % (TDF) = [Initial weight of the sample (W1) – Weight of the protein residue (W2) – Weight of the ash residue(W3) + Weight of the filtered fiber residue (W4)] / Initial weight of the sample (W1) x 100

**Table 2** The Nutritional Evaluation of the Panjeri

| Test parameters | Units | Methods |
|---|---|---|
| Protein | g/100 g | AOAC 2001 |
| Carbohydrate | g/100 g | AOAC:985.29 |
| Moisture | g/100 g | AOAC:925.10 |
| Ash | g/100 g | AOAC:942.05 |
| Total fat | g/100 g | AOAC:920.39 |
| Fiber | g/100 g | AOAC:991.43 |

**2.5. Mineral analysis of Panjeri**

The assessment of calcium and iron concentrations in the samples was conducted (Table 3). Calcium levels were quantified using the AOAC method 984.27, Similarly, iron content was analyzed employing AOAC method 985.35.

- **Calcium (Ca)-** The AOAC 984.27 is a method for determination of calcium content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022)

Calcium content (%) = [ Absorbance of sample solution (A) x Volume of the sample solution (V) x Dilution factor (DF) x 40.08)] / Weight of the sample (W) x 1000.

- **Iron (Fe)-** The AOAC 985.35 is a method for determination of iron content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022)

Iron content (%) = [ Absorbance of sample solution (A) x Volume of the sample solution (V) x Dilution factor (DF) x 55.85)] / Weight of the sample (W) x 1000.

- **Magnesium:** The AOAC 968.08 is a method for determination of Magnesium content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022)

Magnesium content (mg/100 g) =
Absorbance of sample solution (A)×Volume of the sample solution (V)×Dilution factor (DF)×Magnesium Atomic Weigh t/ weight of sample X 100.

- **Potassium:** The AOAC 985.35 is a method for determination of Magnesium content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022)

Potassium content (mg/100 g) =
[Weight of the sample (W)×100Absorbance of sample solution (A)×Volume of the sample solution (V)×Dilution factor (DF)×Potassium Atomic Weight (39.1).

**Table 3** Mineral analysis of the Panjeri

| Test parameters | Units | Methods |
|---|---|---|
| Calcium | mg/100 g | AOAC 984.27 |
| Iron | mg/100 g | AOAC 985.35 |
| Potassium | mg/100 g | AOAC 985.35 |
| Magnesium | mg/100 g | AOAC 968.08 |

### 2.6. Vitamin Analysis of Panjeri

*2.6.1. Vitamin C Analysis (AOAC 985.33)*

To determine vitamin C (ascorbic acid) content, the AOAC 985.33 method is employed, which involves the 2,6-dichlorophenolindophenol (DCPIP) titration. First, the sample is homogenized and then extracted with an appropriate solvent, typically a metaphosphoric acid solution. The extract is filtered and titrated with a standard DCPIP solution. The endpoint is reached when the blue color of the DCPIP solution turns colorless, indicating the presence of ascorbic acid. The vitamin C content is calculated based on the volume of DCPIP used, compared to a standard curve. This method is widely recognized for its accuracy in quantifying vitamin C in food and beverage samples (AOAC International, 2022).

*2.6.2. Vitamin D Analysis (AOAC 982.29)*

Vitamin D content is analyzed using the AOAC 982.29 method, which involves high-performance liquid chromatography (HPLC). Initially, the sample is saponified to release vitamin D from its esters. After saponification, the sample is extracted with an organic solvent such as hexane or chloroform. The extract is then evaporated and reconstituted in a mobile phase suitable for HPLC analysis. The vitamin D compounds are separated using a chromatographic column and detected by a UV or fluorescence detector. The vitamin D content is determined by comparing the peak areas of the sample with those of vitamin D standards. This method provides precise measurement of both vitamin D2 and D3 (AOAC International, 2022) (Table 4).

**Table 4** Vitamin content analysis methods

| Vitamin content | Methods |
|---|---|
| Vitamin C | AOAC 985.33 |
| Vitamin D | AOAC 982.29 |

### 2.7. Antioxidant analysis of Panjeri

The antioxidant activity of food samples was evaluated using assays: DPPH (2,2-diphenyl-1-picrylhydrazyl), FRAP (Ferric Reducing Antioxidant Power), and ABTS (2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)) assays. Each assay was conducted following standardized procedures (Table 5).

**Table 5** Antioxidant activity of the Panjeri

| Antioxidant activity | Units | Method |
|---|---|---|
| DPPH | ppm | Brand-Williams et al., 1995 |
| FRAP | µmol Fe +2 /g | Benzie & Strain (1996) |

- **DPPH Method-** (2,2-Diphenyl-1-picryhydrazyl) is a method for determination of antioxidant activity in the selected food sample. (Brand-Williams et al., 1995)

Antioxidant activity (%) = [(Absorbance of the DPPH solution without sample – Absorbance of the DPPH solution with sample) / Absorbance of the DPPH solution without sample control] x 100

- **FRAP Method–** (Ferric Reducing Antioxidant Power) is a method for determination of antioxidant activity in the selected food sample. (Benzie and Strain, 1996)

FRAP value (µmol TE/g) = (Absorbance of the sample- Absorbance of the blank) / (Absorbance of the Trolox standard – Absorbance of the blank) x Concentration of Trolox standard (µmol/ml) x Dilution factor

### 2.8. Microbiological Analysis

Microbial analysis such as aerobic plate count, yeast & molds and *Enterobacteriaceae* was carried out for 30 days of study by procedure followed by Indian standard method. (FSSAI Manual, 2nd Edn.2022)

### 2.9. Statistical Analysis

Data obtained from sensory analysis is subjected to mean and standard deviation and it was statistically calculated by ANOVA using a significance of P value 0.05.

## 3. Results and discussion

### 3.1. Sensory Evaluation of Panjeri

The sensory evaluation was carried out at Shapur Nagar, Jeedimetla; shown in (Table 7). The data in the table shows the average and the standard deviation of the sensory scores. In evaluation of aroma T1 sample has a mean value of 7.0 and a standard deviation of 0.1, T2 has a mean value of 6.7 and a standard deviation of 0.459 and T3 has the highest mean of value of 7.3 and standard deviation of 0.83. In terms of taste T1 got the mean value of 6.45 and a standard deviation of 0.505, T2 got a mean of 6.675 and a standard deviation of 0.454 and T3 got a mean of 6.725 and a standard deviation of 0.373. Regarding flavour, the T1 got the highest mean value 6.825 and a standard deviation of 0.287, T2 got a mean of 6.475 and a standard deviation of 0.49 and T3 got a mean of 6.75 and a standard deviation of 0.403. In evaluation of the appearance T2 got the highest mean value of 7 and a standard deviation of 0.574, T3 got the second highest mean of 6.75 and a standard deviation of 0.403 and T1 got mean of 6.075 and a standard deviation of 0.849. In the category of overall acceptability, T2 got the highest mean value of 7.0 and a standard deviation of 0.11 and T3 got the second highest mean value of 6.725 and a standard deviation of 0.370 and T1 got a mean of 6.1 and a standard

deviation of 0.849. All the samples were similar to each other in the overall sensory scores. But T3 got the highest value which was selected for final analysis.

**Table 6** Sensory parameters of Treated samples (T 1, T 2 and T 3) of Panjeri

| Sample | Aroma | Taste | Flavour | Appearance | Overall Acceptability |
|---|---|---|---|---|---|
| T1 | 7.125±0.547 | 6.45±0.505 | 6.825±0.287 | 6.075±0.869 | 6.1±0.849 |
| T2 | 6.7±0.459 | 6.675±0.454 | 6.475±0.49 | 7.±0.11 | 7.0±0.1 |
| T3 | 7.3±0.83 | 6.725±0.373 | 6.75±0.335 | 6.75±0.403 | 6.725±0.370 |

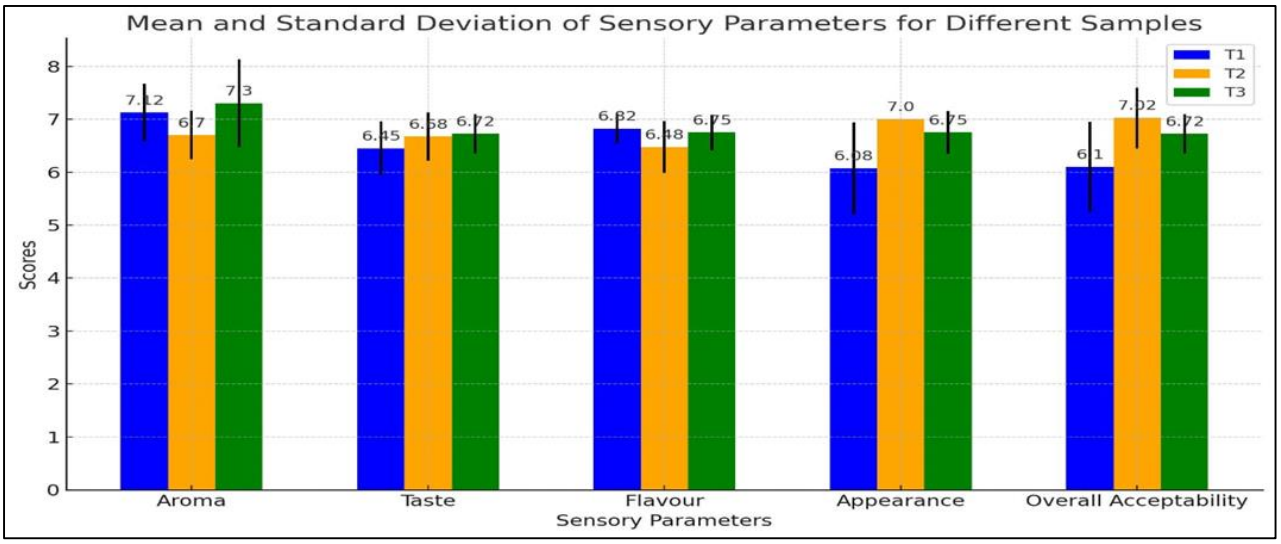



**Figure 5** Graph showing mean of samples T1, T2, T3

### 3.2. Nutritional Analysis of Panjeri

The nutritional analysis of the best sample selected after sensory evaluation was analysed and the results are as follows (Table 7)

**Table 7** Nutritional analysis of Panjieri (Sample T-2)

| Test Parameter | Result | Unit |
|---|---|---|
| Carbohydrates | 59.5 | g/100g |
| Protein | 7.1 | g/100g |
| Fat | 23.2 | g/100g |
| Fibre | 6.2 | g/100g |
| Moisture | 9.2 | g/100g |
| Ash | 1.0 | g/100g |

The Carbohydrate content in my sample is 59.5 g/100 g, Protein content is 7.1 g/100 g, Fat is 23.2 g/100 g, Fibre is 6.2 g/100 g, Moisture is 9.2 g/ 100g, Ash is 1 g/100 g. The moisture content in pearl millet panjiri varied from 9.37±0.91 to 9.61±1.74% The protein and ash content was 7.02±0.58% and 1.95±0.13%.The fat content was 23.64% . The carbohydrate content was 62.57±1.03%. (Saxena et al;2024)

### 3.3. Mineral Analysis of Panjeri

The content of calcium is 78.3 mg/100 g, potassium is 286.4/mg/100 g, iron is 4.8 mg/100 g and magnesium is 139.8 mg/ 100 g. (Table 8).

**Table 8** Mineral Content of Panjeri (Sample T-2)

| Test Parameter | Result | Unit |
|---|---|---|
| Calcium | 78.2 | mg/100g |
| Potassium | 286.4 | mg/100g |
| Iron | 4.8 | mg/100g |
| Magnesium | 139.8 | mg/100g |

Highest content of iron, calcium and phosphorus was seen in S1, which was formulated with 100% pearl millet flour and no wheat flour, the values being, 11.24 mg/100 g, 40.38 mg/100 g, and 279.15 mg/100 g, respectively. (Saxena et al;2024)

### 3.4. Vitamin Analysis of Panjeri

The vitamin C content, measured at 1.2 mg/100g, indicates a relatively low concentration of this essential nutrient. Vitamin D**,** measured at 3.1 µg/100g, is present in a more relevant concentration (Table 9). Vitamin D is critical for calcium absorption and bone health, and it also supports immune system function. The reported value indicates a moderate amount of vitamin D in Panjeri.

**Table 9** Vitamin Content of Panjeri

| Test Parameter | Unit | Result |
|---|---|---|
| Vitamin C | mg/100g | 1.2 |
| Vitamin D | µg/100g | 3.1 |

### 3.5. Antioxidant Activity of Panjeri

The antioxidant activity of Panjeri was evaluated using two methods: DPPH radical scavenging assay and FRAP assay. (Table 10).

**Table 10** Antioxidant Activity of Panjeri

| Test Parameter | Result | Unit |
|---|---|---|
| DPPH | 1276 | ppm |
| FRAP | 9.796 | µmol |

The antioxidant activity by DPPH was 1276 ppm and FRAP was 9.796. The antioxidant activity results for Panjeri reflect its potential to neutralize free radicals and reduce oxidative stress. The DPPH scavenging activity measured at 1276 ppm indicates the concentration at which Panjeri can effectively quench DPPH radicals. The FRAP value of 9.796 µmol represents the ferric reducing antioxidant power of Panjeri. FRAP measures the ability of the sample to reduce ferric ion (Fe 3+) to ferrous ion (Fe 2+), reflecting its antioxidant capacity. other study found values as the antioxidant activity in pearl millet panjeri was 30.8±1.24%. (Saxena et al;2024).

### 3.6. Microbial Activity of Panjeri

The microbial activity showed a total viable count of 100 CFU/ml, yeast & mould- <10 and *coliform, E.coli, staphylococcus* and *salmonella* were absent in the sample (Table 11).

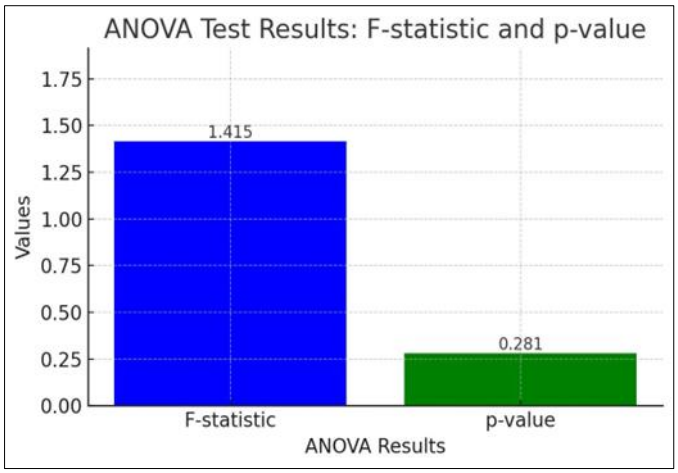
**Table 11** Microbial Activity of Panjeri

| S. No | Test Parameter | Unit | Result |
|---|---|---|---|
| 1. | Total Viable Count | CFU/ml | 100 |
| 2. | *Coliform* | CFU/ml | Absent |
| 3. | *E.coil* | CFU/ml | Absent |
| 4. | *Staphylococcus* | CFU/ml | Absent |
| 5. | *Yeast & Mould* | CFU/ml | <10 |
| 6. | *Salmonella* | CFU/ml | Absent |

### 3.7. Statistical Analysis

*3.7.1. ANOVA*

The one-way ANOVA was conducted to assess whether there are significant differences between the means of the three groups (T1, T2, T3). The analysis yielded an F-statistic of 1.415 and a p-value of 0.281. Since the p-value is greater than the conventional significance level of 0.05. This result indicates that there is no statistically significant difference between the means of the three groups. The F-statistic of 1.415 suggests that the variance between the groups is only slightly larger than the variance within the groups. The p-value of 0.281 implies a 28.1% probability that the observed differences are due to random variation rather than reflecting a true difference between the groups. based on the data available, T1, T2, and T3 do not exhibit significant differences in their means at the 0.05 significance level.




Value: A p-value of 0.281 means there is a 28.1% chance that the observed differences in means are due to random variation rather than a true difference; F-Statistic: An F-statistic of 1.415 indicates that the between-group variance is only slightly larger than the within-group variance.

**Figure 6** Analysis of variance

## 4. Conclusion

This study evaluated the formulation of Panjeri and found that the version with 60% wheat flour, 25% dry fruits, and 15% other ingredients (T2) was highly acceptable based on its organoleptic properties, including aroma, appearance, texture, taste, mouthfeel, and overall acceptability. The formulated Panjeri demonstrated strong nutritional value, with a nutrient profile of 59.5g carbohydrates, 7.1g proteins, 23.2g fats, 6.2g fiber, 9.2g moisture, 1g ash, and significant levels of calcium (78.2 mg), potassium (286.4 mg), iron (4.8 mg), magnesium (4.8 mg), and vitamins C (1.2 mg) and D (3.1 µg) per 100g serving. The antioxidant activity was also notable, with a DPPH scavenging activity of 1276 ppm and a FRAP value of 9.796 µmol. Microbial analysis indicated a safe product with a total viable count of 100 CFU/ml, negligible yeast and mould (<10), and absence of *coliforms, E. coli, Staphylococcus,* and *Salmonella*. These results confirm that the T2 formulation not only offers excellent sensory and nutritional attributes but also maintains high safety standards.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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