



QUALITY CHARACTERISTICS ASSESSMENT OF VALUE ADDED PALMYRA SPROUT POWDER

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ABSTRACT

Cookies are ready to eat, sweet and crispy snack. “Gluten free cookies” were developed by using green gram and with the incorporation of Palmyra sprout. Gluten- free food products can be consumed by celiac disease patients. The Palmyra sprouts are the good sources of vitamin – E and it has a negligible amount of fat. Palmyra sprout is a traditional as well as seasonal food so it is incorporated in the cookie. The green gram has 32% of egg protein and is low in fat. The cookies were formulated in three different proportions: T1 (50% Green gram, 35% Palmyra sprout); T2 (50% Green gram, 30% Palmyra sprout); and T3 (50% Green gram, 20% Palmyra sprout). The three different proportions of the cookies were subjected to sensory evaluation. The Palmyra sprout incorporated cookie was subjected to various examinations like Nutrient analysis, Microbial analysis and Sensory analysis. The sensory attributes of Formulated and Standardized cookies were carried out by using 9 point hedonic scale and the T2 treatment had a high acceptability score when compared to T1 and T3. Protein, Energy, Carbohydrate, Fat, Dietary fiber, Ash, Moisture, Calcium and Iron were abundant in the T2 treatment. The shelf life of the cookies was analyzed for T2 treatment for 30days. The microbial analysis of T2 treatments, such as yeast and mould count, total bacterial count, were evaluated and the results were obtained on the 1st day (65cfu/gram), 5th day (95cfu/gram), 10th day (120cfu/gram) and 15th day (145cfu/gram). The cost analysis was evaluated in the study. The developed cookies are low - cost, nutritious and affordable to people of all socioeconomic groups.

Keywords: Palmyra sprout, Green gram, Gluten-Free, Cookies, Celiac disease.

1. INTRODUCTION:



In this current scenario consumer's expectancy is to consume favorite and tasty food with existence of nutrients. The foods are not only intended to satisfy the consumer's hunger; they must also provide the essential nutrients to ensure the consumer's physical and mental health by preventing nutrient deficiency and nutrient – related diseases. The cost of health care has been steadily rising, while life expectancy has been steadily increasing

Cookies can be purchased at an affordable price. The word cookie describes, specifically, thick and soft baked products. The cookies will contain a very small amount of water, ranging from 1% to 5%. The cookies differed from one another based on the ingredients used in the cookie flour. The cookies contain nutrients such as fat, carbohydrates, and energy. The common ingredients included in the cookies are: flour, butter, sugar, salt, cardamom powder and milk. (*Devi, 2017*).

The Palmyra palm is referred to as the “miracle tree” because Palmyra tree has many health benefits. (*Khatri et al., 2020*). It belongs to the “Arecaceae” family. Each part of the Palmyra tree has a high monetary value. *Borassus flabellifer* is used for multiple purposes as a folk medicine, such as a diuretic, an antiphlogistic stimulant and an anti-laprotic. (*Sahni et al., 2014*).

Legumes and pulses varieties like green grams, chick peas, lentils, peas, cowpeas, kidney beans and soybeans contain at least 20% protein on a dry basis. Legumes and pulses provide lysine which is deficient in many cereals.

Celiac disease was first described by Samuel Gee in the year 1888, but only in 1953 did it became clear the importance of the gluten in the origin of this pathology. Celiac disease is a chronic inflammatory disorder which occurs in the small intestine, that is produced by the ingestion of gluten products in susceptible people.

People with celiac disease can't consume gluten because celiac disease is an immune disease that will damage the small intestine. Gluten is a protein which is found in food products like wheat, barley and rye. (*Parzanese, et.al, 2017*).

The gluten-free diet first appeared in a report on the dietary treatment of celiac disease by paediatrician and scientist Willem Karl Dicke in 1941. For many varieties of additional purposes this gluten free diet is applied including management of NCGS (Non – celiac gluten sensitivity), Irritable bowel syndrome (IBS), Diabetes, DH, inflammation and obesity. The gluten – free diet is gaining popularity, and consumers, health professionals and food manufacturers are all influencing it. (*El Khoury et al., 2018*)

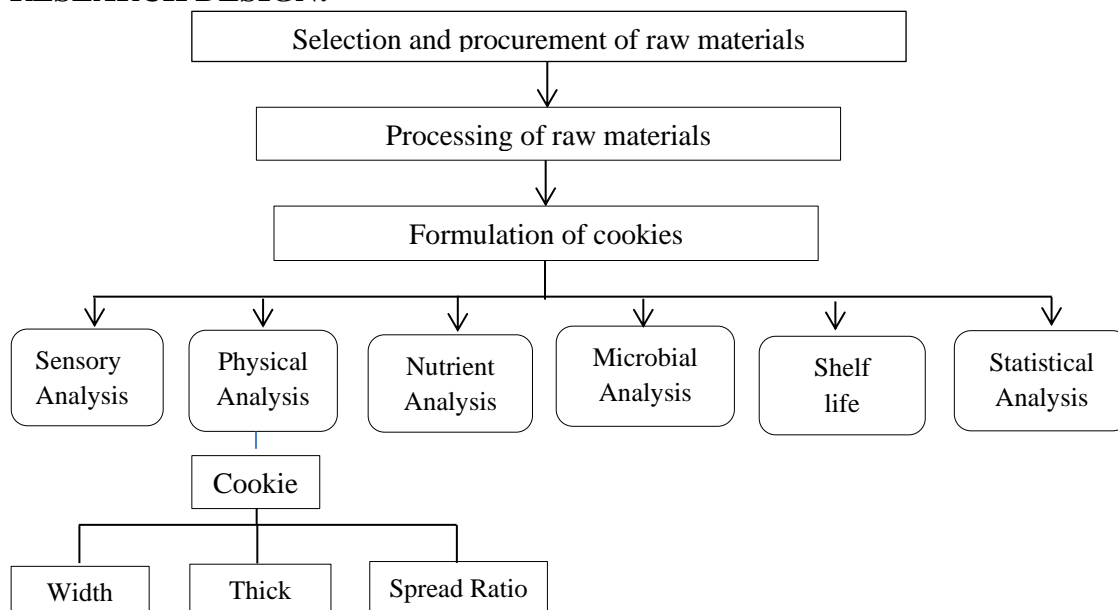
Objectives of the study “**Quality characteristics assessment of value added Palmyra sprout powder**”.



- To formulate and standardise gluten free Palmyra sprouts incorporated cookies.
- To evaluate nutrient composition and the shelf life of the cookies
- To study physical properties and the organoleptic characteristics of formulated cookies.

2. METHODOLOGY

RESEARCH DESIGN:



2.1 PURCHASING OF RAW INGREDIENTS:

This is an experimental design. The Palmyra sprout was incorporated into the cookies to increase the nutrient quality of the cookies. All of the ingredients were purchased at a local market in Chennai.

2.2 PROCESSING OF RAW MATERIALS:

The green gram dhal or mung bean was cleaned by removing dust particles and roasting the green gram at 80°C for 5 minutes, ground it into fine powders and sieved. The preparation of the Palmyra sprout flour was prepared by selecting the fresh Palmyra sprout, removing the skin and stem of the Palmyra sprout, washed, cleaned,



boiled for 15 minutes and cut into small pieces and kept under the sunlight for 3 days. Then, ground it into a powder and sieved it into fine powder.

FORMULATION AND STANDARDIZATION OF COOKIE:

The formulation and standardization of the cookies was prepared in three different proportions and subjected to sensory evaluation.

T1 50:35, T2 - 50:30 and T3 - 50: 20 of green gram flour and Palmyra sprout flour were used to make the cookies. The best proportion of the cookie was selected by the non-trained panellists. This is then standardised and subjected to various examinations. Standardization of the recipe helps in quantifying the right proportion of ingredients in a recipe and increases the quality of the product. Wheat flour is used as control group. Wheat flour was replaced in the cookie recipe by green gram flour and Palmyra sprout flour.

2.3 PHYSICAL PROPERTIES OF COOKIES:

The physical properties of the cookies were analysed as follows:

- 2.3.1 Weight:** An electronic weighing machine is used to determine the weight of the cookies.
- 2.3.2 Width or Diameter:** The width of the cookie was determined using the vernier calliper. (*Ajay,singh 2019*).
- 2.3.3 Thickness:** Thickness of the cookies was determined using the vernier calliper. (*Chauhan, et al., (2016)*).
- 2.3.4 Spread Ratio:** The spread ratio of the cookies was calculated by using the formula by dividing the average value of diameter by the average value of the thickness of the cookies. (*Ajay,Singh 2019*)

$$\text{Spread ratio} = \frac{\text{Average diameter (mm)}}{\text{Average thickness (mm)}}$$

2.5 PREPARATION OF COOKIES:

The cookies were prepared with slight modification, according to the author. (*Adriana Paucean, 2016*).

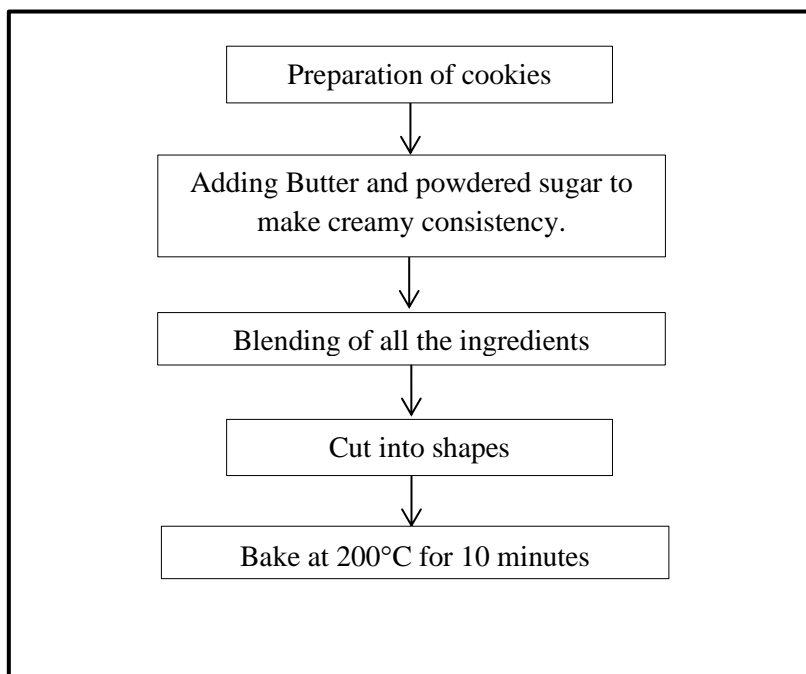


Figure 1: Flow chart: preparation of cookies.

TABLE1: PROPORTION OF INGREDIENTS USED IN T0, T1, T2 AND T3

| Sample | Wheat flour | Green gram flour | Palmyra sprout flour | Sugar | Butter | Milk |
|--------------|-------------|------------------|----------------------|-------|--------|------|
| T0 (control) | 80gm | - | - | 10gm | 5gm | 5ml |
| T1 | - | 50gm | 35gm | 10gm | 5gm | 2ml |
| T2 | - | 50gm | 30gm | 10gm | 10gm | 2ml |
| T3 | - | 50gm | 20gm | 25gm | 10gm | 2ml |

2.6 ANALYSIS OF SENSORY QUALITIES OF COOKIES:

T0, T1 T2 and T3 treatments were used for sensory analysis. The sensory analysis was done by using the 9 – point hedonic scale with the non - trained panelist.

2.7 DETERMINATION OF NUTRIENT ANALYSIS:

The best cookie selected for nutrient analysis for Energy, Carbohydrate, protein, fat, Dietary fiber, Ash, moisture, Iron and calcium was analyzed according to the AOAC, 2000.

2.8 COLOUR ANALYSIS:



Colour measurement of cookies was done by using the Hunter lab colour spectrophotometer. The results were expressed in terms of L^* , lightness [from 0 (black) to 100 (white)], a^* , greenness/redness [from a^* (green) to βa^* (red)] and b^* , blueness/yellowness [from b^* (blue) to βb^* (yellow)]. The measurements were carried out under constant lighting conditions in reflectance mode at room temperature (25°C), with white tile serving as a control ($L^*98.76$, $a^*0.04$, $b^*2.01$). (Ayyappan *et al.*, 2015).

2.9 MICROBIAL ANALYSIS:

The Microbial analysis of the cookie was analysed by using AOAC, 2000.

2.10 SHELF LIFE ANALYSIS OF THE COOKIES:

For 30 days, the cookie was kept in an airtight container. And the product was evaluated using the total plate count. The shelf life of the formulated product will be evaluated using the total plate count method on the 0th, 5th, 10th, 15th and 30th days by keeping it at the room temperature.

2.11 COST ANALYSIS:

The costs of the prepared cookies were calculated by using the cost of individual raw ingredients used in the preparation of food products as the prevailing market price.

3. RESULT AND DISCUSSION

3.1 ORGANOLEPTIC CHARACTERISTICS OF THE COOKIES:

TABLE: 2 ORGANOLEPTIC CHARACTERISTICS OF THE COOKIES:

| Treatment | Colour | Appearance | Taste | Aroma | Texture | Overall Acceptance |
|-----------|----------|------------|-----------|-----------|---------|--------------------|
| T0 | 7.6±0.8 | 7.6±0.48 | 7.2±0.4 | 7.6±0.48 | 7.2±0.4 | 7.44±0.149 |
| T1 | 6.6±0.48 | 7.2±0.4 | 6.4±0.489 | 6.2±0.4 | 6.2±0.4 | 6.52±0.24 |
| T2 | 8.8±0.4 | 9±0 | 8±0 | 8.4±0.489 | 8±0 | 8.44±0.08 |
| T3 | 8±0.632 | 7±0.632 | 7.6±0.48 | 7.4±0.48 | 6.6±0.4 | 7.32±0.20 |

From the above table, it shows that Treatment T2 has the best acceptable score compared to T1 and T3.

COLOUR:



Colour is the major 'characteristics' and it serves as a hint of the quality of the food product. The colour of the cookies was examined in the given table. The colour for the Palmyra sprout incorporated cookies have a T0 of 7.6 ± 0.8 , T1 is 6.6 ± 0.48 followed by T2 at 8.8 ± 0.4 and T3 at 8 ± 0.632 . Whereas the T2 has highest score and T1 has the lowest score.

APPEARANCE:

Appearance of the food is an important factor in increasing its acceptance. The appearance of the cookies was examined in the given table. The appearance of the cookies is that T0 is 7.6 ± 0.48 , T1 is 7.2 ± 0.4 , T2 is 9 ± 0 and T3 is 7 ± 0.632 . The T3 has the lowest value and the T2 has the highest value

TASTE:

Taste is the most important aspect of any food product. If the taste is not good, the food product can be rejected. The taste of the cookies was carried out by the sensory analysis. T0 is 7.2 ± 0.4 , followed by T1 at 6.4 ± 0.489 , T2 at 8 ± 0 and T3 at 7.6 ± 0.48 . As a result, T2 has the highest taste score and T1 has the lowest.

AROMA:

Aroma also plays an important role. The good aroma of the food will induce eating habits. The Aroma of the cookies was determined as follows: T0 is 7.6 ± 0.48 , followed by T1 is 6.2 ± 0.4 , T2 is 8.4 ± 0.489 and T3 is 7.4 ± 0.48 . The T2 have the highest value, while the T1 has the lowest.

TEXTURE:

Crispiness and breakable is present in the texture of the cookies. T0 has the texture score of 7.2 ± 0.4 , T1 has a score of 6.2 ± 0.4 , T2 has a score of 8 ± 0 and T3 has a score of 6.6 ± 0.4 . Even with the texture, T1 has the lowest score, whereas T2 has the highest score.

OVERALL ACCEPTANCE:

The overall acceptance of the 5 non - trained panelists is as follows: T0 has 7.44 ± 0.149 followed by T1 has 6.52 ± 0.24 , T2 has 8.44 ± 0.08 and T3 has 7.32 ± 0.20 . Hence, the T2 has the highest acceptability score in the Palmyra sprout incorporated cookies.

FIGURE: 2 TREATMENTS OF THE COOKIES:



3.2 PHYSICAL PROPERTIES OF COOKIES:

TABLE 3: PHYSICAL PROPERTIES OF COOKIES:

| Sample | Weight (mm) | Width (mm) | Thickness (mm) | Spread Ratio (mm) |
|--------|-------------|------------|----------------|-------------------|
| Cookie | 5.8 ±0.08 | 3.4±0.2 | 1.7±0.14 | 2.63±0.1 |

WEIGHT OF THE COOKIES:

After baked, the weight of the cookies has been increased. The author reported that there is an increase in the weight of the cookies after it was baked. The weight varies from 6.0 to 6.18gram after baking. (*Shankar and Mamta, 2013*). The weight of the cookie was 5.8 ± 0.08 .

WIDTH OF THE COOKIES:

The width of the cookie will proportionally increase due to the porosity of the cookies. When rice flour, maize flour, and soy bean flour are combined, the width of the biscuit decreases from 1.95 to 1.85, according to the author. (*Simona Man et al., 2014*).

The width of the cookies was increased after baking it. The width of the cookies was analysed at 3.4 ± 0.2 .

THICKNESS OF THE COOKIES:



After baking, the thickness of the cookies was increased. The author reported that there was an increase in the thickness of biscuit prepared from the makhana flour incorporated biscuits it ranged from 5.26 to 5.96. (*Shankar and Mamta 2013*).

Thickness of the cookies was analysed as 1.7 ± 0.14 mm.

SPREAD RATIO OF THE COOKIES:

The increased spread ratio of the cookies was more desirable. (*Chauhan, Saxena and singh, 2016*). The author reported that there is a gradual decrease with increase in the spread ratio of the biscuit with the incorporation of makhana flour into the wheat. (*Shankar and Mamta 2013*). The spread ratio of the cookies was analysed at 2.63 ± 0.32 mm.

3.3 PROXIMATE COMPOSITION:

The proximate composition of Treatment (T2) Palmyra sprout incorporated cookies was analyzed.

TABLE 4: PROXIMATE COMPOSITION

| Nutrients Composition | Palmyra Incorporated Cookies Per 100gm |
|-----------------------|--|
| MACRONUTRIENTS | |
| Energy | 231.2 calories |
| Protein | 30.02 gm |
| Carbohydrate | 18.66 gm |
| Fat | 8.53 gm |
| Dietary fiber | 4.03 gm |
| Ash | 2.97 gm |
| Moisture | 5.667 gm |
| MICRONUTRIENTS | |
| Calcium | 202.67 mg |
| Iron | 5.19 mg |

ENERGY:



The energy analysed in the Palmyra sprout incorporated cookies was found to be 231.2 calories. The researcher reported that the calories of the biscuits prepared from the refined wheat flour and quinoa biscuits were found to be 482 and 465 kcals per 100 gram. The higher calories in the cookies were due to the higher in fat and carbohydrate content in the refined wheat flour. (*Anam 2018*).

PROTEIN:

The protein content in the Palmyra sprout incorporated cookies was found at 30.02 grams. The researcher reported that the protein content in the mixed millet whey isolated biscuit was found to be 16.63% (*Narmada M, et al., 2020*). When compared to the referenced study, the protein content in the Palmyra sprout cookies was higher value.

CARBOHYDRATE:

The carbohydrate content in the Palmyra sprout incorporated cookies was founded to be 18.66 grams. According to the researchers, the carbohydrate content in the quinoa biscuits was reported as 63.1 grams. (*Brito et al., 2015*). The carbohydrate content in cookies was less than in the quoted study.

FAT:

The fat content in the Palmyra sprout incorporated cookies was found to be 8.53 grams. The author explained that the fat content in the wheat fortified biscuit with citrus peel powder was 11.98 grams (*Hanan et al., 2012*). The fat content in the Palmyra sprout cookies was less value than the study mentioned.

FIBRE:

The fibre content in the Palmyra sprout incorporated cookies was found to be 4.03 grams. The author reported that the cookies, which are made with finger millet flour, contain 4.72% of fibre. (*Radhika, et al., 2019*).

MOISTURE:

The moisture content in the Palmyra sprout incorporated cookies was 5.667 grams. The cookies with the low moisture content and with the proper packaging of the cookies will have the longer shelf life. (*Bertagnolli et al., 2014*). According to the author, it states that the moisture content of the salty refined wheat cookies was 4.75 grams. (*Kaur et al., 2017*).

While compared to the referenced study, the moisture content in the cookies was slightly higher value.



ASH:

The ash content of the cookies was 2.97grams. The author reported that the total ash content of the quinoa biscuits and the wheat biscuits was found to be 2.33 and 1.24 grams. (*Anam 2018*). The ash content in the cookies was similar to those in the quoted study.

IRON:

The iron content in the cookies was 5.19 mg. The author reported that the iron content in the soymeal fortified cookies was analysed as 5.5 – 7.7 mg. However, in the current study, the iron content was slightly similar to the quoted study. (*Ghoshal Gargi and Kaushik Prerna, 2020*).

CALCIUM:

The calcium content in the cookies was 202.67 mg. The author states that the soymeal fortified cookies were analysed at 99.4 – 116.2 mg. The calcium content in the current study was higher value than the mentioned study. (*Ghoshal Gargi and Kaushik Prerna, 2019*).

3.4 COLOUR ANALYSIS:

TABLE 5: COLOUR ANALYSIS

| NAME OF THE SAMPLE | PARAMETERS | | | |
|--------------------|------------|----------|-------|-------|
| | L* | a* | b* | dE* |
| White Tile | 94.28 | 4.34 | 7.96 | |
| Cookies(T2) | 43.72 | 13.01 | 29.84 | 58.72 |
| Cookies(T2) | 45.89 | 13.02 | 31.33 | 57.58 |
| Cookies | 47.82 | 11.82 | 31.62 | 55.81 |
| Average | 45.81 | 12.6.667 | 30.93 | 57.37 |

Treatment T2 was carried out for the colour analysis. The above values are the triplicate values of T2 cookies. The Author states that the darkening of the cookies was verified due to the incorporation of okara. However, when comparing L^* values, statistically significant differences were found between samples: Control and 15-O in



comparison with 30-O and 50-O. When comparing a^* and b^* , there is an increase in the values with the replacement of okara which was observed as ($p < 0.05$). (Ostermann-Porcel *et al.*, 2017).

3.5 MICROBIAL ANALYSIS:

The T2 proportion was carried out for the total bacterial count. It is 0.65×10^2 on the 0th day, 0.95×10^2 on the 5th day, 1.20×10^2 on the 10th day and 1.45×10^2 on the 15th day. This was the value noted for the total bacterial count for the first 15 days. On the 0th day, the yeast and mould count for the cookies was 0.10×10^2 cfu/ml.

According to the author, on the 0th day, the total bacterial count for the rice bran cookies was 0.90×10^2 cfu/ml. The bacterial count was 2.50×10^2 cfu/ml on the 15th day. (Nagi *et al.*, 2012).

The total bacterial count in the study had a lower value than in the above quoted study.

3.6 SHELF LIFE:

The overall acceptance of the cookies was higher in the Treatment T2, so Treatment T2 was selected for the shelf life for the cookies.

The taste, texture, color, crispiness and flavor of the cookies were all acceptable on 0th day. And the acceptable level of the cookies was 8.02 on the hedonic scale.

The taste, texture, color, crispiness and flavor of the cookies remained the same after 5 days. There is no difference in the cookies.

On the 15th day, there was no change in the flavor and the taste of the cookies.

Mould and fungi did not appear on the cookies on the 30th day, but the crispiness had decreased and the flavor had changed slightly, but it still tasted good.

The Palmyra incorporated cookies were kept at 35°C in the room temperature. The parameters of the experimental cookies, such as colour, taste, appearance and aroma, were the same on the 20th day as it were on the 1st day. However, the texture of the cookies was slightly altered. After the 25th day, there is a slight difference in the flavor and taste. And there was no visible growth of microorganisms that was observed until the 30th day of the storage period. And there is a slight change in weight of the cookies. That is, after the 25th day, there is a decrease in



the weight of the cookies. According to the author, during the shelf life, there was a reduction in the biscuit on the 15th day and a mild rancid flavour on the 30th day. (*vinitha 2020*).

3.7 COST ESTIMATION:

The cost of the samples includes green gram, Palmyra sprout, sugar, butter, and Cardamom powder, milk, processing costs for preparing the cookies, labor cost, and electricity charge. The cost analysis of the cookies was conducted for 100g of cookies; the cost was Rs. 107 per Kg. The developed cookies are inexpensive and accessible to people of all socioeconomic groups.

4. CONCLUSION:

The developed Palmyra sprout incorporated gluten free cookies has high acceptance score. It is also nutritionally dense and it does not contain any artificial colours or preservatives. It have a high protein content of 30.02 grams in developed cookies, which is different from other developed cookies. It contains 4.03 grams of fiber, 231.2 k calories of energy, 18.66 grams of carbohydrate, 202.67 milligrams of calcium and 5.19 mg of Iron content in the cookies. The cost of the cookies was Re 1.0 per cookie. It is affordable and very low in price. The developed cookies were gluten free and nutritious, like other products which are available in the market, in both terms of quality and quantity. Hence, it can be consumed by all age groups. This product enables celiac patients to consume the gluten - free snack.

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