

Quality Analysis of Millet Incorporated Brownie

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Abstract: *Life can be sustained only with adequate nourishment. Human beings need growth and development to lead an active and healthy life. Whenever a new product is formulated it's important to Analyse its quality in all aspects. In this study physical, chemical and nutritional analysis for the already standardized millet brownie prepared kodo and pearl millet is assessed and presented in detail. The quality assessment for all its sensory aspects is also done every day during shelf - life testing, to determine the products' exact shelf life. The outcome of the results was compared with commercially available products. The quality of the millet brownie in all aspects was good. It's highly nutritious and very rich in fiber content. Through the assessment of the quality of brownies we may know that products made with millets are highly acceptable by their nutritional content which is very high compared to commercial products with Maida as major ingredient.*

Keywords: Millet, Brownie, Kodo, Pearl, Quality and nutrient analysis

1. Introduction

In the 21st century, climate changes, water scarcity, increasing world population, rising food prices, and other socioeconomic impacts are expected to generate a great threat to agriculture and food security worldwide, especially for the poorest people who live in arid and subarid regions. These impacts present a challenge to scientists and nutritionists to investigate the possibilities of producing, processing, and utilizing other potential food sources to end hunger and poverty. Cereal grains are the most important source of the world's food and have a significant role in the human diet throughout the world. As one of the most important drought - resistant crops, millet is widely grown in the semiarid tropics of Africa and Asia and constitutes a major source of carbohydrates and proteins for people living in these areas. In addition, because of their important contribution to national food security and potential health benefits, millet grain is now receiving increasing interest from food scientists, technologists, and nutritionists. (Ahmed. S. M. Saleh., *et al.*)

Taking Food safety and security into consideration and adopting to the trend of Millet processing, Millet is incorporated in various food products now a days. Bakery fields are blooming these days. There are very few bakery products in the market which are available with millet as a major ingredient. According to the consumer preference brownies are loved by all but they are not available with millet as major ingredients. Considering the nutritional benefits of millet, it is incorporated into the brownie and assessed for its quality attributes and shelf life under this study.

The project aims at formulating Millet Brownie, Considering the nutritive value and health benefits of Millet. It is significant since not many Brownies include Millet as its ingredients.

Objectives:

The objective of the project of this study discussed is,

- 1) To Analyse the Nutrient content for standardized Millet incorporated Brownie

- 2) To determine its shelf life.

2. Review of Literature

The review of literature pertaining to the present study of “Quality Analysis of Millet incorporated Brownie” is discussed in the following headings.

- 2.1 Benefits of Millet (Kodo and Pearl)
- 2.2 Role of ingredients

2.1 Benefits of Millet (Kodo and Pearl)

Kodo millet can be used for traditional as well as novel foods. Un processed or processed grain can be cooked whole and if necessary, ground to flour by traditional or industrial method. Kodo millets are rich in B Vitamins especially niacin, B6 and folic acid, as well as minerals such as calcium, iron, potassium, magnesium and zinc. Kodo millets contain no gluten and are good for people who are gluten intolerant. Regular consumption of kodo millet is very beneficial for postmenopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels. The highest lecithin content in kodo millet is an excellent source for strengthening the nervous system. Kodo millet is very easy to digest. Pearl millet is gaining importance as a climate resilient and health promoting nutritious crop. Large variability found in pearl millet germplasm has been conserved in several gene banks (Santhosh K. Pattanashetti, Kothapally Narishima Reddy, 2016). Pearl millet is quantitatively the most important millet, with world annual production of 14 million tons (Mt). It is cultivated mainly in the semiarid tropics, almost exclusively by subsistence and small - scale commercial farmers. (J. R. N Taylor, in Encyclopedia of Grain Science, 2004).

2.2 Role of ingredients

2.2.1 Whole Wheat flour

Whole wheat is basically flour made from unrefined wheat. Using wheat in this form is more nutritious. Often the flour is made after the husk is removed. This kind of wheat is usually used, and it is called refined flour or ‘white’ flour.

Volume 12 Issue 1, January 2023

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Understanding the information & facts about whole wheat will help you realize that it is in fact better for your body. Whole wheat is richest in dietary fiber. It provides over 30 percent of your daily required intake of fiber. Whole wheat is rich in manganese, magnesium and tryptophan, which is a form of protein.

Carbohydrates:	71.2 gm
Protein:	11.8 gm
Phosphorous:	306 mg
Magnesium:	138 mg
Niacin:	5.5 mg
Iron:	5.3 mg
Calcium	41 mg
Dietary fiber:	12.5 gm
Essential AminoAcids :	1.89 gm

Plate I – Nutrients in Wheat

Pearl millet

Up to 30% pearl millet was used successfully in making bread in Senegal. The nutritional advantages of pearl millet are its high fat content and a relatively high lysine content, comparable with that of high - lysine corn in some varieties. Anti nutritional factors, however, have been reported in several studies. A thionamide like substance has been identified that interferes with the formation of thyroid hormones, which in turn leads to undesirable goitrogenic effects (M. I. Gomez, S. C. Gupta, in Encyclopaedia of Food Sciences and Nutrition (Second Edition), 2003).

Kodo millet

Apart from being a rich source of nutrients, kodo millets also contain high amounts of polyphenols, antioxidants, tannins, phosphorous and phytic acids. These antinutrients form complexes with micronutrients such as iron, calcium and zinc, and reduce their solubility and bioavailability. Tannin also adversely affects utilization of proteins and carbohydrates by forming complexes, thus resulting in reduced growth, feeding efficiency, metabolizable energy and bioavailability of amino acids (Balasubramanian, 2013).

Milk

Milk is an essential component of the diet of ~6 billion people. The world production of milk reaches 730 million tons/y. Even though mammals produce milk to feed their offspring, in many areas of the world humans continue to consume milk throughout their life. Milk, that is, cow's milk, is composed of about 87% water; it also contains, on average, 3%–4% fat, 3.5% protein, about 5% lactose, and 1.2% minerals, with some variation depending on the breed considered (Muehlhoff E, Bennett A, McMahon D 2013).

Butter

Butter is a water - in - oil emulsion with a minimum fat content of 80%, in which water content should not exceed 16% and non - fat milk solids generally constitute 2%. There is a substantial annual consumption of butter worldwide and world production of butter is as high as 4.1 million tons per annum (Mortensen, 2011).

Cocoa powder and Dark chocolate

Within the frame of the Austrian National action plan for

nutrition, chocolate ranges among the sweets together with bakery products and candies, because it contains significant amounts of sugar. This group of food contributes about 10% to the daily energy intake. Sweets supply about half of total sugar intake for all age groups and may reach 90% in the group of too heavy children and teenagers. Despite a broad offer of food in the industrialized countries, children have a certain risk of malnutrition in trace elements and vitamins, if they keep too much on sweets and chips. Too high sugar consumption can lead to diabetes mellitus and adiposities. A reasonable food mix is therefore recommended to meet all requirements (Manfred Sager).

Baking powder

Baking powder contains baking soda, one or more leavening acids, and a filler. The leavening acids are added in their powdered form as salts which do not react until they dissolve in water. The filler stabilizes the product by keeping the baking soda and leavening acid separate and standardizes it to the desired strength. Double - acting baking powders contain a mixture of a fast - acting leavening acid like MCP (monocalcium phosphate monohydrate) and a slow - acting leavening acid like SAPP (sodium acid pyrophosphate). They react partially at low temperatures and partially at high temperatures to provide uniform leavening throughout processing (Brodie, 2006).

3. Methodology

The research design pertaining to the study Entitled “Quality Analysis of Millet Incorporated Brownie” has been discussed under the following headings.

- 3.1 Quality Testing of Standardized Millet Brownie
- 3.2 Shelf - life estimation of Standardized Brownie.

3.1 Quality testing of the millet incorporated brownie

3.1.1 Physical analysis

- 3.1.1.1 Determination of length, breadth and thickness.
- 3.1.1.2 Determination of moisture content.

3.1.2 Nutritional analysis

- 3.1.2.1 Determination of energy.
- 3.1.2.2 Determination of Carbohydrates.
- 3.1.2.3 Determination of Fat.
- 3.1.2.4 Determination of Protein.
- 3.1.2.5 Determination of total Ash.
- 3.1.2.6 Determination of Fiber.

3.1.3 Microbial analysis

- 3.1.3.1 Determination of total plate count.

3.1.1 Physical analysis

3.1.1.1 Determination of length, breadth and thickness

The tests include measurement of length, breadth, thickness of the prepared and formulated product. The sample is taken, and length, breadth and thickness are measured by Vernier caliper. The readings are noted, and the average size of prepared product is found.

3.1.1.2 Determination of moisture content

The moisture of the formulated product was estimated.5g of

sample was weighed and placed in a dish and kept in oven maintained at 130 - 1330C for 2 hours. Remove the dish after 2 hours, cool in desiccators and weigh.

3.1.2 Nutritional analysis

3.1.2.1 Energy

Energy refers to the calories available in the food. The energy was determined using the Atwater method. Energy from factors like protein, carbohydrates, fat, and alcohol was used for the determination of energy.

3.1.2.2 Carbohydrates

The carbohydrate content of the formulated product was determined by Anthrone method. Weigh 100mg of the sample and hydrolysed for 3hours with 5ml N - HCL and cooled to room temperature. Neutralised with solid sodium carbonate and makeup the volume into 100ml and centrifuge. Collect the supernatant & take 0.5 and 1ml aliquots. Prepare the standards and 1ml of the working standard.0 serves as blank. Make the volume up to 1ml by adding distilled water and add 4ml of Anthrone reagent. Heated for 8minutes and read the green to dark green colour at 630nm. Draw a graph and calculate the amount of carbohydrate present in the sample tube.

3.1.2.3 Fat

Fat was measured by the Soxhlet method. A known quantity of sample was taken in flask and refluxed with petroleum ether for 10 - 12 hours in Soxhlet extractor apparatus. The solvent evaporated from the extraction flask completely on steam bath. After evaporation of solution, residual fat was obtained.

3.1.2.4 Protein

Protein was estimated by microkjeldal method. Food is heated and catalytically digested, and protein is decomposed into ammonium, which on reaction with acids gives protein. Protein is determined by titration of acid with a sodium carbonate solution by way of a methyl orange pH indicator.

3.1.2.5 Total Ash

Total ash was estimated for the formulated product. A fresh sample was taken and was estimated by igniting the oven dried material in the dish left after the determination of moisture with the flame of a burner till charred. Transfer to muffle furnace and ignite till grey ash is obtained. Repeat the process and weigh.

3.1.2.6 Fiber Content

The term crude fiber originally meant as an organic residue consisting of largely cellulose that is left after the other carbohydrates and proteins have been removed by successful treatments with boiled acids and Alkalies. The crude fiber obtained is not cellulose alone but also contains hemicellulose, dextrin and other nitrogenous compounds, however they are not enough to prevent the results from being reasonably accurate and comparable.

3.1.3 Microbial analysis

3.1.3.1 Total plate count

Using sterile pipette, prepare decimal dilutions of 10⁻², 10

- 3, 10⁻⁴ and others of food homogenate by transferring 10ml of previous dilution to 90ml diluents. Add 12 - 15ml plate count agar to each plate and mix the sample solutions and agar thoroughly by alternate rotation. Let agar solidify. Invert solidified Petri dishes and incubate for 48±2h at 350C. The colonies were counted after the period of incubation.

3.2 Shelf - life testing

The Millet incorporated brownie was kept at room temperature and in refrigeration temperature and monitored for first sign of deterioration, which is fungal growth on the surface. The sensory characteristic of the product was analyzed during the shelf - life testing period. The shelf - life testing of the product was evaluated using the scorecard to analyze the changes in sensory characteristic of the product.

4. Results and Discussion

Results and discussion pertaining to the study of “Quality analysis of Millet incorporated Brownie” has been discussed under the following headings.

4.1 Quality Testing of Millet incorporated Brownie.

4.2 Shelf - life testing of Millet incorporated Brownie.

4.1 Quality testing of Millet incorporated Brownie

4.1.1 Physical parameters

4.1.1.1 Length, breadth and thickness

Table 1: Physical Parameters of Millet Brownie

	Piece No.1	Piece No.2	Piece No.3	Average
Length	4.8 cm	5.4 cm	4.7 cm	4.9 cm
Breadth	4.1 cm	4.9 cm	4.6 cm	4.5 cm
Thickness	3.1 cm	2.7 cm	3.3 cm	3.1 cm

4.1.2.1 Moisture

The Moisture content of Millet incorporated brownie is 19.82g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet brownie has lower Moisture content compared with sweet potato flour incorporated brownie as it is only 24.25g. So, the shelf life of millet brownie can be higher because of low moisture than sweet potato flour incorporated brownie.

4.1.2.2 Energy

The energy content of Millet incorporated brownie is 386.33 Kcal. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. Millet brownies have higher energy content compared with sweet potato flour incorporated brownies.

4.1.2.3 Carbohydrate

The CHO content of Millet incorporated brownie is 61g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet

brownie has higher CHO content compared with sweet potato flour incorporated brownie as it is only 55.35g.

4.1.2.4 Fat

The Fat content of Millet incorporated brownie is 14g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet brownie has lower Moisture content compared 0 50 100 150 200 250 300 350 400 450 Chart Title quantity Column1 Column2 44 with sweet potato flour incorporated brownie as it is only 36.4g. So, the millet brownie can be taken in adequate level by obese people because of lower fat than sweet potato flour incorporated brownie.

4.1.2.5 Fibre

The Fibre content of Millet incorporated brownie is 3.62g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet brownie has fibre where as sweet potato flour incorporated brownie is absent in fibre content.

4.1.2.6 Protein

The protein content of Millet incorporated brownie is 3.52g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet brownie has lower protein content compared with sweet potato flour incorporated brownie as it is 7.3g.

4.1.2.7 Total Ash

The Total Ash content of Millet incorporated brownie is 1.66g. It is compared with research article on Physical, Chemical and Sensory Properties of brownies substituted with sweet potato flour with addition of milk and cumin oil by I P Lingarnsaari, C Anam* and A P Sanjaya. The Millet brownie has higher Moisture content compared with sweet potato flour incorporated brownie as it is only 1.16g.

4.1.2.8 Total Plate count

The total plate count of the prepared Millet incorporated brownie was estimated and found to be 12cfu/g for the first day, 21cfu/g for the second day, 29cfu/g for the third day and 38cfu/g for the fourth day.

4.2 Shelf - life testing

Table 2: Shelf - life testing of Millet incorporated Brownie both refrigerated and room temperature condition

	Color and Appearance	Texture	Flavor	Taste	Overall Acceptability
Day 2	5	5	5	5	5
Day 4	5	5	5	5	5
Day 6	5	5	5	5	5
Day 8	4	3	4	4	4
Day 10	4	3	4	4	4
Day 12	3	2	3	2	3.5
Day 14	2	2	3	2	2.5

Day 2

The sensory evaluation of the shelf - life test for day 2 at both refrigerated and room temperature condition was analysed by colour and appearance, Texture, Flavour, Taste and overall acceptability scored 5 for all.

Day 4

The sensory evaluation of the shelf - life test for day 4 at both refrigerated and room temperature condition was analysed by colour and appearance, Texture, Flavour, Taste and overall acceptability scored 5 for all.

Day 6

The sensory evaluation of the shelf - life test for day 6 at both refrigerated and room temperature condition was analysed by colour and appearance, Texture, Flavour, Taste and overall acceptability scored 5 for all.

Day 8

The sensory evaluation of the shelf - life test for day 8 at both refrigerated and room temperature condition was analyzed by color and appearance, Texture, Flavor, Taste and overall acceptability and the score reduced to 4 in all criteria and Scored 3 for texture on eighth day.

Day 10

The sensory evaluation of the shelf - life test for day 10 at both refrigerated and room temperature condition was analyzed by color and appearance, Texture, Flavour, Taste and overall acceptability score was reduced to 4 same as the eighth day.

Day 12

The sensory evaluation of the shelf - life test for day 12 at both refrigerated and room temperature condition was analyzed by color and appearance, Texture, Favour, Taste and overall acceptability score was reduced to 3 for color and appearance and flavor, scored 2 for texture and taste. Hence the average score was 3.5 overall on twelfth day.

Day 14

The sensory evaluation of the shelf - life test for day 14 at both refrigerated and room temperature condition was analyzed by color and appearance, Texture, Favour, Taste and overall acceptability score was reduced further as 2 for all the criteria except flavor as it scored 3, average score was 2.5 overall on the fourteenth day.

5. Conclusion

Millet incorporated brownie is assessed for its quality parameters. Most of the bakery products are made with Maida which is rich in its gluten content and may be allergic to most of the people, it is also not very easy to get digested whereas millet is gluten free rich in fiber and can also be taken by people who are suffering from constipation. The best one, which is prepared with 50% millet and 50% wheat flour, is selected for assessing its quality. The nutritional value of the product is calculated with the help of a nutritional chart and the product was also assessed by proper testing methods for analyzing its major nutrients, microbial assessment is also done to find its total plate count. The shelf of the product in both refrigerated and room temperature

conditions is analyzed as 7 days. The sensory parameters were assessed for each day and the scores are listed. It is concluded that the Brownie prepared with millet is highly nutritious and high in its fiber content.

Finding of the Study pertaining to Nutritional Analysis are,

- 1) The product has an average length of 4.9cm (about 1.93 in), breadth of 4.5 cm (about 1.77 in) and thickness is 3.1cm (about 1.22 in).
- 2) The moisture content of the product is 19.82g per 100g.3)
- 3) The millet incorporated brownie is rich in
 - Energy – 386.33kcal/100g
 - Carbohydrate – 619/100g
 - Fat – 14g/100g
 - Protein – 3.52g/100g
 - Fiber – 3.62g/100g
 - Total ash – 1.66g/100g

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