

# Acceptability Studies Of A Gluten Free DRINK Developed From Amaranthus Viridis And Sesamum Indicum

Dr Luxita Sharma

**Abstract:** Cereal is the staple crop in India. It is also makes the major source of carbohydrate and vitamin B complex in the diet. Cereals contain gluten and some people are allergic to gluten. Pseudocereals are starchy grains and do not contain gluten. In this category amaranth, quinoa and buckwheat are most popular. The product contains amaranth, milk, sesame, cardamom and pineapple. This product was prepared to bring an option of gluten free, nutritious and less fatty milk drink. The purpose of this experiment was to analyse the nutritional and sensory properties of the ingredients. The product was prepared by using a number of methods keeping in mind their effect on nutrients. The methods used were sprouting, roasting, baking and boiling. The results obtained from the experiment showed that the product contains calories 110.53 kcal, 4.16 g of protein, 14.72 g of carbohydrates and 3.89 g of fat. This present research work studies the aspects of milk, amaranth, sesame and cardamom nutritional contribution and establishes their role in nutrition, health and disease prevention.

**Index Terms:** Amaranthus viridis, gluten free, Nutrient profile, polyphenols, protein, pseudocereal, Sesamum indicum.

## 1 INTRODUCTION

THIS amaranth high protein beverage is a milk based drink made with the combination of amaranth, milk, sesame seeds, cardamom and pineapple sugar. The process of manufacturing includes boiling, grinding, straining and extraction. This drink is full of nutrition. It is high in protein as it contains amaranth and cow's milk. The method used in its production is very cost effective. Cereals are the most popular crop in the world. It is the most important food to the mankind. When compared with legumes and pulses crop, cereals are exceeding total annual grain production with 2000 million tonnes while pulses with less than 250 million tonnes [1]. Cereals are widely used in food preparation as flour, seeds, flakes or thickeners [2]. They are rich sources of starch, protein (except lysine), essential fatty acids, vitamins(B complex), fibres and minerals. Protein present in cereals is of great value especially for vegetarians. Around 16-45% of the protein in the diet is obtained from cereals. Though the protein content is not considered of good quality because of limiting amino acid, lysine. But it is used to complement protein intake with other plant sources [3]. Cereals also contain gluten. Some people have sensitivity to this protein and some may not have. Due to lack of knowledge about the term gluten and its disorders people are increasing their interest in gluten-free products. According to recent survey, gluten-free products have been a boom to the food industry in the last 5 years [4]. This change in demand has lead to the discovery of pseudocereals. The term pseudocereal is given to the class of plants that are grown to yield starchy grains which are suitable for human consumption and are not a part of cereal and legumes group. Generally the grains of pseudocereal are very small in size. Many of them can grow in poor soil

conditions unlike cereal grains. Botanically these are classified as dicotyledons and monocotyledons. Most popular pseudocereals are quinoa, amaranth and buckwheat. There are many other grain which are classified as pseudocereal such as Bixaceae (Annatto seeds), Hemp, Trapaceae (Water Caltrop), Araceae (Arrow Arum, Tuckahoe), etc [5]. Amaranth and quinoa are the major pseudocereal crops that are popular among the consumers. Few years ago buckwheat had showed a sudden decline in the market but is again gaining popularity in the recent years [13]. There are over 60 species of amaranth that are known. The commonly consumed species are Amaranthus caudatus, Amaranthus cruentus and Amaranthus hypochondriacus. Nutrition profile of these pseudocereals has given them such acceptance. Pseudocereals unlike other cereals contain high amount protein. Amaranth contains the highest amount of protein then buckwheat and quinoa. They contains good amount of lysine and tryptophan which other cereal grains lack into. Particularly they are high in methionine, cysteine, homocysteine, and taurine when compared to true cereals. They also contain high amount of essential fatty acids. They are rich in minerals like iron, magnesium, phosphorus. Folic acid is also found in abundance in this group of cereals. The folic acid content of amaranth and quinoa is, 4 times and 10 times respectively, higher than true cereals [13]. They also contain significant amount of phytochemicals like phenolic compounds that has antioxidant properties [4]

The scientific name of sesame is Sesamum indicum L. It belongs to the Pedaliaceae family. It is an annual plant. Sesame has white coloured bell shaped flower with branches of yellow, blue or red colour. Sesame plant has both branched and unbranched growing pattern [6]. It usually takes 3-4 to grow. The flowering usually starts 30-40 days after sowing the seeds. After attaining maturity seeds enclosed in the capsule suddenly scatter from it. This scattering makes harvesting difficult. Harvesting from a mechanical harvester cannot be done. It requires manual harvesting. This increases the cost. There is new variety which has been developed to save energy and money. This new variety does not scatter seeds from the capsule and is also disease resistant. It can also resist drought [22].

• Dr Luxita Sharma, Associate Professor, HOD, Department of Dietetics and Applied Nutrition, Amity University Haryana, India. +91-97172-96338. E-mail: Ishrama@ggn.amity.edu

Sesame seeds are commonly used for its oil. It is also called as "Queen of oils". It has a very pleasant aroma. It is very popular in the world [12]. It is very commonly in India during winter season. In India it is from salad dressings, making sweets like laddoo, chutney, cakes and breads. Around the world it is has been used to make biscuits, cakes, paste, crackers and oil is used for salad dressings. Roasted seeds are used in chocolates, breads, breadsticks and cookies. Whereas mechanically hulled seeds are used for Tahini and candies [7]. Sesame seeds are widely used because of its high nutritive value as well. They are very rich in good fats, proteins, carbohydrates, calcium and other minerals. Their application is based on the type of cuisine and requirement. They used as a food as well as for its oil.

## 2. REVIEW OF LITERATURE

### 2.1 Amaranth (*Amaranthus cruentus*)

Consumption of amaranth is increasing at a fast pace. In recent years it has gained a lot of popularity. This increase is due to the latest craze of consuming gluten-free and protein rich cereals with or without any additional physiological requirement. Besides being high in protein and gluten-free, amaranth has many other functional and physiological properties as well. These properties are due to presence of biologically active compounds like flavonoids, protease inhibitors lignans, betalains, lectins, bioactive peptides, squalene, etc. This literature will focus on the health promoting effects of amaranth. According to the score given by FAO/WHO amaranth protein gets a score of 75 with respect to the ideal score 100. Grains of amaranth contain higher amount albumins and globulins. This means that better distribution of essential amino acids than true cereals. Amaranth seeds are said to be rich in amino acid lysine. It is proved by the amount of lysine (3.3–9.2 mg/g) and leucine (3.6–7.9 mg/g protein) which was obtained from the seeds. The amount of other essential amino acids found are methionine (1.7–2.3 mg/g protein), cystine (2.9–4.2 mg/g protein) and tryptophan (0.8–1.8 mg/g protein). The amount of protein digested and absorbed in the body is greatly affected by the amount of anti-nutritional factors present in the food. In a research a high interrelation was observed between digestibility of proteins and concentration of polyphenols while weak activity was observed of the trypsin inhibitors [8]. Another interesting fact about amaranth is the fat content. It contains about 5-8% of fat which is less in true cereals [9]. The amount of linoleic acid is also high about 50%. The ratio of saturated and unsaturated fat in the amaranth oil is 1:3. The oil of amaranth contains about 19% palmitic acid, 34% oleic acid and 3.4% stearic acid. Docosaenoic acid (C22: 1) is also present in the amaranth oil at a level of 9% [7]. There is a significant amount of squalene (~5%) found in amaranth oil. It is a precursor required by the body to synthesis steroids. It is very effective in reducing cholesterol levels of the blood. It is also believed to be effective in minimizing the risk of cancers. Squalene is naturally obtained from shark and whale liver oil. It is very expensive. Its presence in amaranth can increase the importance of these seeds as well as may lead to easier extraction and decrease in the pricing of this super health promoting substance [9].

The dietary fibre content of *Amaranthus cruentus*, Amaranth

hypochondriacus and *Amaranth caudatus* lies between 7.1% - 16.4%. Seeds of amaranth are also rich in mineral elements like phosphorus, magnesium, iron, calcium and potassium. The Ca:P ratio is around 1.9-2.6. Its seeds are also a good source of Vitamin E (546 ppm). It also contains significant amount of Vitamin B complex [9].

**TABLE 1**  
CHEMICAL COMPOSITIONS OF AMARANTH SEEDS

	Amaranth [A]	Wheat [B]
Starch (g/100 g)	61.4	71.2
Protein (g/100 g)	16.5	12.6
Dietary fiber (g/100 g)	20.6	12.2
Fat (g/100 g)	5.7	1.5
Ash (g/100 g)	2.8	1.6

Source A: Alvarez-Jubete et al. (2009); nitrogen-to-protein conversion factor 5.85.

Source B: Wheat, hard red winter, USDA National Nutrient Database for Standard Reference, Full Report 20072 from 12th January 2016; starch content was calculated by difference.

### 2.2 Sesame (*Sesamum indicum* L)

Sesame seeds are being used for both culinary and medicinal purposes. It has nutritional, preventive and curing benefits. In India, sesame seeds are very popular in Ayurveda. It contains many potent anti-oxidants which possess therapeutic effect. These seeds are known to have anti-cancerous, anti-hypertensive, anti-microbial, liver protective, diuretic properties. For all these properties compounds such as lignans, myristic acid, esters of glycerol, Sesamol, Sesamolol, and sesamin are responsible [12]. Sesame is a good source of protein, oils and minerals but is a poor source of starch. It also contains good amount of soluble fiber. The major soluble fiber present in it is mucilaginous gum about 8-11g/100 g. They are rich in alpha linolenic acid. These seeds also contains high amount of manganese, potassium, phosphorus, iron, zinc, calcium and copper. They are rich in many anti oxidants. These anti oxidants possess anti-inflammatory, anti-aging, anti-carcinogenic and anti-hypertensive properties [10].

**TABLE 2**  
COMPOSITION OF SESAME (PER 100G) [11]

Energy (calories)	574	Fe (mg)	9.6
Moisture (%)	4.7	Na (mg)	2
Fat (g)	51.9	K (mg)	400
Protein (g)	19.8	Vitamin A (IU)	0
Carbohydrate (g)	18.4	Carotene (µg)	17
Fibre (g)	10.8	Vitamin B1 (mg)	0.95
Ash (g)	5.2	Vitamin B2 (mg)	0.25
Ca (mg)	1200	Niacin (mg)	5.1
Mg (mg)	370	Vitamin C	0
P (mg)	540		

## 3. MATERIALS AND METHODS

For the preparation of the drink the materials required are amaranth, milk, sesame seeds, cardamom and pineapple. All these material were bought from local market. The

equipments required were mixer and grinder, baking oven, sprouter and gas burner.

### 3.1 Methods

#### 3.1.1 Sprouting

Sprouting is a process of germinating seeds. It mainly employed for germinating pulses. It improves nutritional value and destroys any anti nutrient present in the food. For the preparation of drink amaranth seeds were also germinated. The aim for germinating the seeds was to remove anti nutritional factors and to improve its nutritive value. The seeds were first washed in water to remove impurities. Then they were soaked in water for 20 minutes. After that they were wrapped in a muslin cloth and left for germinating for 3 days. After every 8 hours they were washed in cold water and kept aside. This process continued for the 3 days till the germination. After germination seeds were dried in the sun for 1 day. This was done make their grinding easy.

#### 3.1.2 Roasting

Roasting is a process of cooking food by dry heat. While roasting the food is placed on a hot tava or sand or fire and cooked. It gives a characteristic aroma to the food. By roasting seeds and grains grinding becomes convenient. The process of roasting was used with sesame seeds. The seeds were roasted on a low flame to 5-6 minutes. After roasting, colour of seeds changed from white to golden brown and a pleasant aroma was developed. Before grinding these were then cooled for 10 minutes.

#### 3.1.3 Grinding

It is a process in which large particles are cut or grinded into smaller particles by sharp blades. This process converts big chunks into fine particles. The level of grinding depends on the requirement of the food item to be prepared. By this process large particles can be grinded into coarse, fine or powder form. It can be done with wet or moist foods as well as with dry foods. This method was used with sesame seeds, amaranth seeds and pineapple. It was used to make amaranth flour and sesame powder. All the ingredients were grinded separately. The dry ingredients were grinded first then the wet ingredients were grinded.

#### 3.1.4 Baking

It is a method in which food is placed inside heated closed box called oven. The food gets cooked from the hot air. The air gets heated due to flow of electricity at the base of the box. For the extraction of sugar from pineapple this method was used. A fresh ripe pineapple was taken to make sugar. At first pineapple was cut into small cube. Then it was grinded till a fine paste is obtained. This paste was then poured in a baking plate and placed in the oven. The oven was pre-heated at 1000c. It was baked for 90 minutes at 1000c till its colour changed to golden brown.

#### 3.1.5 Boiling

Boiling is a method in which food is cooked in water. Usually vegetables, cereal, pulses are boiled in water. But for this experiment amaranth flour was boiled in milk. All the ingredients along with amaranth were boiled in milk for around 20 minutes. The process of boiling was done to

ensure that nutrients from each ingredient get leached into the milk. During this process milk gets a thick consistency.

#### 3.1.6 Extraction

After boiling, the milk is sieved through a muslin cloth. For extraction small amount of milk is poured in on the muslin cloth and it is twisted tightly then milk is squeezed from the cloth. By this process extraction is done to obtain amaranth milk drink.

### 3.2 Standardization of Recipes

Standardized recipes are the one that has been tried, tested, evaluated and adapted for use by a particular food service organization. It produces a consistent quality and each time yield the exact quality product when exact ingredients in exact measurements and exact procedures and exact equipment are used.

#### 3.2.1 Steps involved in making the product

1. Sesame seeds are roasted and then grinded.
2. Amaranth flour is prepared after grinding it in a mixer.
3. Take the pineapple and cut it into small cubes.
4. Grind pineapple cubes into a paste and place it in the oven.
5. Before baking pre heat the oven at 100oc for 10 minutes.
6. Place the baking tray in the oven. Cook it at 100oc till colour of the paste changes to golden brown.
7. Then scratch the baked pineapple. The golden brown product obtained is the pineapple sugar.
8. Boil the milk. Add to it amaranth flour, sesame powder, crushed cardamom, pineapple sugar and table sugar.
9. Boil it for 20 minutes.
10. Pour the milk slowly on the muslin cloth and extract the milk by squeezing it.
11. To this milk add few drops of pineapple extract.

**TABLE 3**  
STANDARDIZATION OF RECIPE FOR 1 SERVING

Ingredients	Amount
Amaranth	10 g
Sesame	5 g
Milk	200 ml
Pineapple	5 g
Cardamom	4-5 piece
Sugar	5 g
Pineapple extract	2 drops

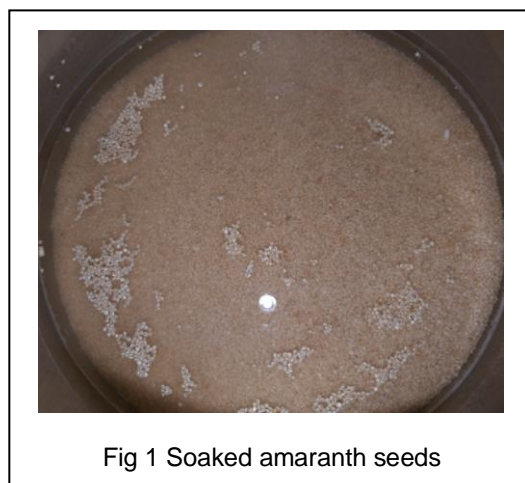


Fig 1 Soaked amaranth seeds



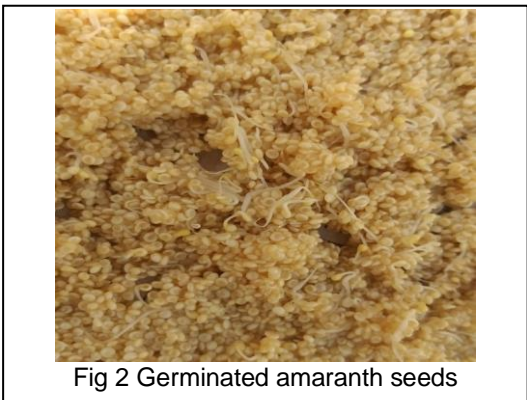


Fig 2 Germinated amaranth seeds



Fig 3 Raw ingredients



Fig 4 Baking Pineapple



Fig 5 Cooked product



Fig 6 Final product

#### 4 RESULTS AND DISCUSSION

The sensory evaluation was carried out the sample to check its acceptability using Hedonic rating test. The result was then analyzed by calculating mean and standard deviation of the sample.

**TABLE 4**  
SENSORY EVALUATION OF THE SAMPLE A BASED ON HEDONIC PARAMETERS

Sample	Taste	Textur e	Appeara nce	Aroma	Overall Acceptabi lity
1	7	7	8	8	8
2	7	7	8	7	7
3	7	8	8	7	7
4	6	8	8	6	6
5	9	8	9	9	9
6	8	8	8	8	8
7	9	6	8	8	9
8	8	8	7	9	9
9	9	8	6	9	9
10	9	7	8	9	8
11	8	6	9	8	8
12	8	9	8	9	8
13	9	7	8	9	8
14	8	7	7	9	8
15	9	9	9	9	9
Mean	8.06	7.53	7.93	8.26	8.06
Std. Dev.	0.96	0.91	0.79	0.96	0.88

##### 4.1 Interpretation of the sensory evaluation scores

Taste- This Sample A on the basis of taste scored 8.06 on the rating scale. It was sweet in taste. The taste of amaranth can be distinguished with flavour of mild bitterness. There was a bit of tangy flavour caused by the pineapple sugar.

**Texture-** For the taste Sample A scored 7.53 on the rating scale. The texture of the product was smooth and creamy. It was thick in consistency. The creamy texture was given by amaranth flour and sesame.

**Appearance-** The score achieved for appearance by Sample A was 7.93. The colour of the product was slightly yellow. This colour is imparted by amaranth flour and pineapple sugar. This product was of thick consistency due to addition of sesame powder and amaranth flour.

**Aroma-** For the aroma Sample A scored 8.26. The aroma was strong. The strong aroma was caused by sesame seeds, cardamom and pineapple sugar. To enhance to aroma of the product pineapple essence was also added. The sesame seed were roasted which gave this product a smoky flavour. Cardamom gave it a bold, fruity and refreshing aroma. The addition of pineapple sugar and essence gave the product a strong fruity and tangy aroma.

**Overall acceptance-** Sample A got the overall acceptance score 8.06. The overall acceptability of the product is good. The subject attracted towards this product due to strong aroma of pineapple and sesame. The flavour of both the ingredient was in balance and did not suppress each other characteristic flavour.

#### 4.2 Nutritive value results of the food product

On the basis of sensory evaluation Sample A was taken for laboratory testing of basic food nutrients. The laboratory test for the basic nutrients such as carbohydrates, protein, fats, calories, moisture and ash was carried out the developed food product. The result values were evaluated per 100 gram.

**TABLE 5**

*NUTRITIVE VALUE OF THE DEVELOPED FOOD SAMPLE\**

Parameter	Test result
Calories	110.53 kcal
Protein	4.16 g
Carbohydrate	14.72 g
Fat	3.89 g
Moisture	76.07 g
Ash content	1.16 g

\*Calculated by AOAC 2005

#### 4.3 Interpretation of the results

The results obtained from the laboratory test showed that the food product is rich in calories 110.53 kcal/100ml. It also showed that the drink contains a fair amount of proteins 4.16g. The carbohydrates content is also good 14.72g. The food product was also low in fat 3.89g.

### 5 SUMMARY AND CONCLUSION

The idea of preparing this product was to make a drink which is healthy, refreshing and contains good amount of nutrients. The purpose of taking amaranth as a main ingredient was its nutritional benefits. Amaranth is a cereal which contains all essential amino acids in good quantity, especially lysine which is lacking in other cereal grains. It is also rich in antioxidants which increase its demand as healthy cereal. On the other hand milk is protein and calorie

rich food. The combination of the items in a product makes it healthy as well as nutrient dense. The inclusion of sesame and cardamom in the product was done to give a characteristic flavour and aroma. Sesame is also rich in calcium which in combination of milk increases the calcium content of the drink. Sugar was also extracted from pineapple. The purpose was to use a healthy sugar which not only gives sweetness to the product but also provides its other nutritional benefits.

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