The Pharma Innovation Journal 2023; 12(2): 3470-3474

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 3470-3474

www.thepharmajournal.com
Received: 16-11-2022
Accepted: 19-12-2022

Srejan Upadhyay
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Dr. Manmath Sontakke
Assistant Professor, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Aashi Chikara
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Samridhi Jain
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Keshav Jindal
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Harshita
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Srejan Upadhyay
Research Scholar, Department of Food Technology & Nutrition, Lovely Professional University, Phagwara, Punjab, India

Development and quality evaluation of protein-rich smoothie incorporated with amaranth seeds and dates

Srejan Upadhyay, Dr. Manmath Sontakke, Aashi Chikara, Samridhi Jain, Keshav Jindal and Harshita

Abstract
Smoothies are healthy blends of fresh or frozen fruits and puréed with yogurt, milk, or fortified plant milks and perhaps some nut butter or flax seeds. The present study focused on the formulation of protein rich smoothie using amaranth seeds and dates in various proportions enriched with milk. The high lysine content of amaranth grain protein makes it an ideal nutritional supplement for traditional cereals to prepare a protein-rich, milk-based, amaranth and date smoothie. The preliminary trials were conducted by preparing smoothie with addition of amaranth seeds at different levels i.e. at the rate of 5, 10, 25, 30 and 40 percentages. Based on sensory evaluation the 25 percentage of amaranth seed addition was selected and optimized. Sensory evaluation of the products was done by using a Nine point Hedonic scales on the basis of flavour, colour and appearance, body and texture and overall acceptability. The product 25% amaranth seed smoothie can be prepared by incorporation of 50 gm amaranth seed, 50 gm dates, 100 ml milk, 2 ml vanilla essence The proximate analysis of selected product i.e. 25% of amaranth seed smoothie is analyzed It was observed that it had 80% moisture, 10% fat, 6.7% protein, 2.2% ash.

Keywords: Protein-rich smoothie incorporated with amaranth seeds and dates

Introduction
Throughout history, amaranth (*Amaranthus* spp.) has been eaten, especially by the Inca, Maya, and Aztec civilizations where it was a staple diet. There are roughly 60 different species of amaranth, although not all of them are included in regular menus. In addition to basic nutrition, the importance of diet has grown. Not only does nutrition work to sate hunger and provide necessary nutrients, but it also helps avoid related nutritional illnesses, reduces health risks, and improves human well-being. Aztec, Inca, and Mayan communities valued amaranth as a staple diet. The daily diet included amaranth in addition to corn and beans. There are roughly 60 different species of amaranth, although not all of them are included in regular menus. *Amaranthus* hybridus, and *Amaranthus* mantegazzianus are used to make breads, cakes, pastries, confectionery, and soups. Amaranth is one of the few crops whose grains and leaves can both be eaten as cereals. It is crucial to emphasize that the high lysine content of amaranth grain protein makes it an ideal nutritional supplement for traditional cereals that are deficient in this amino acid. According to Teutonico and Knorr (1985) [25] and Becker and others, a protein concentration of either 12.5% to 17.6% or 16.09% to 18.19% was detected (1989) [12]. Methionine levels are approximately 15.8 mg per gram of protein, whereas lysine levels are approximately 55.8 mg per gram of protein. The lipid content of amaranth varies greatly, depending on the species and genotype, from 1.9% to 9.7%.Higher concentrations of the fatty acids palmitic (19%), oleic (26%), and linoleic (47%) can be found. Amaranth oil has a high concentration of the unsaturated hydrocarbon squalene, which has been linked to a favorable effect on lowering blood cholesterol levels, and ranges in content from 2.4% to 8.0%. Amaranth is well known for having high levels of vitamins and minerals such as riboflavin, niacin, ascorbic acid, calcium, and magnesium (Singhal and Kulkarni 1988).. Most of the amaranth grain is made up of starch, which can range from 48% to 69% depending on the species.

Materials and Methodology
Sample procurement
1. Amaranth seeds- local market of Jalandhar
2. Dates- local market of Jalandhar
3. Milk- local market of Jalandhar

4. Vanilla essence- local market of Jalandhar

Preparation of amaranth seeds

1. 500 gm of amaranth seeds are cleaned and taken in a stainless-steel pan.
2. Roast it for 5 to 10 mins over low flame, or until we observe a mild fragrance.
3. 300 mL of water is added to the seeds and cooked for 20 more minutes.
4. The mixture is then cooled at room temperature

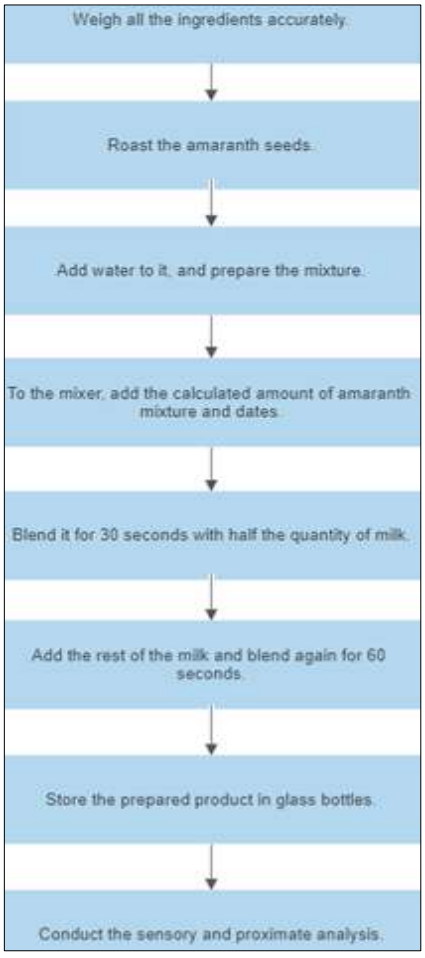
Product development (for 200 gm of the sample)

Table 1: Nutritional Composition of Amaranth Smoothie having 5 different samples

S. No.	Sample	Amaranth	Dates	Milk	Vanilla essence
1.	5%	10 gm	50 gm	140 mL	2 mL
2.	10%	20 gm	50 gm	130 mL	2 mL
3.	25%	50 gm	50 gm	100 mL	2 mL
4.	30%	60 gm	50 gm	90 mL	2 mL
5.	40%	80 gm	50 gm	70 mL	2 mL

Product Preparation

1. Weigh all the ingredients accurately.
2. In a mixer, add the amaranth mixture with dates and half the quantity of milk taken and blend for 30 seconds.
3. Add the remaining milk and vanilla essence and blend again for 60 seconds.
4. Pour the smoothie in glass bottles and store for 1 hour then proceed with testing.



Process flowchart

Proximate analysis

Equipment and Materials required for Proximate Analysis

Hot air oven, Soxhlet Apparatus, Kjeldhal extraction unit (Digestion unit, Distillation unit, Titration unit), Muffle Furnace, Hot plate, Desiccators, Weighing Balance, Water bath, and Bunsen Burner.

Required glassware for proximate analysis

Beaker, Conical Flask, Petri plates, Silica crucible, Round bottom flask, Extraction flask, Metal tong, Measuring Cylinder, Burette, Pipette, Digestion Flask and Test tubes.

Other materials required

Cotton, Filter paper, Muslin cloth, Sharp Knife

Chemicals Required for Analysis

Petroleum ether, N- free concentrated sulphuric acid, Dilute sulphuric acid, Potassium sulphate, Copper sulphate, Mercuric oxide, Sodium thiosulphate, Boric acid, Methyl red indicator, Sodium hydroxide and Ethanol.

A) Determination of Moisture content

Hot air oven method

Materials Required

Sample size (5 gm), Hot air oven (105-110^{0}C), Petri plate, Weighing Balance and Desiccator.

Protocol

1. Use distilled water to clean the Petri plate.
2. Dry the petri dish in an oven at 100°C for 1-2 hours.
3. Cool in a desiccator, then weigh (W_1).
4. Place a 5 g sample in the petri dish (W_2).
5. For 4-5 hours, place a petri dish containing the sample in a hot air oven set to a temperature of 105-110^{0}C.
6. Remove the petri dish and chill it in a desiccator.
7. Take out of dessicator and weigh it as soon as you can (W_3).
8. Once there has been no additional change in the weight, place the plate containing the sample back in the oven for another hour.

Calculations

Weight of sample= (W_2-W_1) g
Moisture removed= (W_2-W_3) g
% Moisture Content= (Weight of moisture removed/Weight of sample) x 100
= [(W_2-W3) x 100]/(W_2-W_1)

Here, W_1= 42 g i.e., the weight of empty petri plate after cooling in a dessicator
And W_2= 47 g i.e., the weight of petri plate with sample
So, Weight of sample taken= (47-42) g = 5 g
Now, W_3= 43 g i.e., the final weight obtained after putting in a hot air oven
So, moisture removed= (W_2-W_3) g = (47-43) g = 4 g
Therefore, % Moisture Content= (Weight of moisture removed/Weight of sample) x 100
= [(W_2-W_3)/ (W_2-W_1)] x 100
= 4/5 x 100 = 80%
So, 80% of the moisture content found in the sample.

B) Determination of Ash Content
Muffle furnace combustion method:
Materials
Sample size (5 gm)**,** Muffle furnace (550^{0}C)**,** Silica crucible, Hot plate**,** Desiccator,and Weighing Balance.

Protocol
1. Take a dried, empty silica crucible and weigh it (W_1).
2. Weigh a 5 g sample that was placed in the crucible (W_2).
3. To get the vapors out of the sample, keep the crucible containing it on a hot plate or in a gas oven.
4. Maintain the crucible containing the sample in a muffle furnace at a temperature of 550 °C once all fumes have been completely removed.
5. Remove the crucible from the furnace after five hours and place it in a desiccator to cool.
6. Weigh it after chilling (W_3).
7. Remain the crucible containing the sample in the furnace for the following hour at the same temperature in order to get a steady weight.

Calculations
Weight of sample (W_4) = (W_2-W_1) g
Material burnt (W_5) = (W_2-W_3) g
Ash content = ($W_4 – W_5$) g
Percent (%) ash content = (Ash content x 100) / Weight of sample
= [($W_4 – W_5$) x 100] / W_4

Here, W_1 = 23.104 g i.e., the weight of empty silica crucible
W_2 = 28.104 g i.e., the weight of crucible and sample
W_3 = 23.214 g i.e., the weight of the sample after chilling along with the crucible
W_4 = ($W_2 – W_1$) = 28.104 – 23.104 = 5 g i.e., the weight of sample
W_5 = ($W_2 – W_3$) = 28.104 – 23.214 = 4.89 g i.e., the material burnt
So, the ash content = ($W_4 – W_5$) = 5 – 4.89 = 0.11 g
Therefore, % ash content = 0.11/5 x 100 = 2.2%
So, finally, the % of ash content found in the 5 g sample is 2.2%

C) Determination of Fat Content
Ether extraction using Soxhlet Apparatus
Materials
Sample (5 gm), Petroleum Ether (b. pt. 40-60 °C)**,** Filter paper**,** Soxhlet unit, Weighing balance**,** Hot air oven (110 °C), and Desiccator.

Protocol
1. Make a sufficient size packet by weighing 5 grams of pre-dried sample into a pre-dried filter paper to the nearest mg.
2. Dry the sample to constant weight at 95-100 °C for around 5 hours if it contains more than 10% moisture.
3. Determine the boiling flask's weight.
4. Fill that boiling flask with 250 mL of petroleum ether.
5. Insert the packet into Soxhlet's unit's extraction flask.
6. Assemble the condenser, Soxhlet flask, and boiling flask.
7. Attach the assembly condenser to the water supply and boiling flask is heated to 60 °C.
8. For about 4 hours, extract using a Soxhlet extractor at a rate of 5 or 6 droplets per second condensation.
9. Dry the boiling flask with fat extraction in an air oven for 30 minutes at 100 °C, cool it in a desiccator, and weigh it.

Calculations

$$\text{Crude Fat (\%)} = \frac{\text{Weight of fat (g)}}{\text{Weight of sample (g)}} \text{x} 100$$

Weight of fat= (Final weight – empty flask weight)
Weight of sample = 5 g
Weight of fat = Final weight of sample and flask - weight of empty flask
Final weight of sample and flask = 115.02 g
Weight of empty flask = 114.52 g
So, weight of fat = (115.02-114.52) g = 0.5 g

$$\text{Crude Fat (\%)} = \frac{\text{Weight of fat (g)}}{\text{Weight of sample (g)}} \text{x } 100$$

So, crude fat (%) = (0.5/5) x 100 = 10%
Therefore, after doing proximate analysis, the crude fat came out to be 10%

D) Determination of Protein content
Micro-kjeldhal's method
Materials
N-free concentrated sulphuric acid -5mL, Catalyst mixture (1 gm) which includes Potassium sulphate K_2SO_4 (91gm), Copper sulphate $CuSO_4$ (8.2 gm), and Mercuric oxide HgO (0.8 gm), Sodium thiosulphate (5gm), Sodium hydroxide NaOH (40%), Boric acid (2%), dissolve 2gm boric acid in water to make 100 m, Methyl red indicator, 30% Hydrogen peroxide H_2O_2, weighing balance, Beaker, Measuring cylinder, Conical flask, Titration unit (burette, pipette), and Digestion flask.

Protocol
- Weigh 0.2gm of defatted ground material accurately into a digestion flask of 30 mL.
- Add 5 mL of H_2O_2 and 1 g of the catalyst mixture.
- Digest for 30 to 40 minutes or until clear liquid is produced.

If H2O2 is not added, digest for a couple of hours at 45 degrees Celsius until colourless or pale green-yellow.
- Blank digestion takes place concurrently.
- Transfer the digested sample to a 50 mL volumetric flask and add double-distilled water to get the volume to 50 mL.
- Pour 5 mL of digest (from 50 mL of volume) into the distillation apparatus, then add 5 mL of 40% NaOH containing 5 gm of sodium thiosulfate. Wash the equipment with a small amount of water. Run the condenser's water simultaneously.
- Fill a 100 mL beaker with 10 mL of 2% boric acid solution, and 4 drops of methyl red indicator, and place the beaker under the condenser with the tip dipped in the solution.
- Let the digest come to a boil before collecting the 70 mL of distillate ammonia that has been released in the boric acid solution.
- Use methyl red indicator to titrate the distillate against

0.01 N H_2SO_4; the end point should be persistent and somewhat pink in colour.
- Complete blank titration concurrently.
- Write the burette reading down.

Calculations

$$\text{Percent of N (\%)} = \frac{(\text{sample}-\text{blank})\times \text{N of acid} \times 0.014 \times \text{D.F.}}{\text{Aliquot taken} \times \text{wt.of sample}} \times 100$$

Where; N- Normality of H_2SO_4 = 0.01 N, sample reading = 2.7 mL, and weight of sample = 0.2 g
D.F.- dilution factor
So, after analysis, the Nitrogen content was come out to be 1.072%
Protein (%) = % N × 6.25
Therefore, the protein (%) = 1.072% x 6.25 = 6.7%

Results and Discussions
So, from the above data, the following output is obtained

Table 2: Proximate Composition of 25% amaranth smoothie

S. No.	Tests conducted for analysis	Result (%)
1)	Moisture Content	80
2)	Ash Content	2.2
3)	Fat Content	10
4)	Protein Content	6.7

It was found that the prepared amaranth smoothie of 25% sample of 50 gm amaranth was the best among all. So from the table, the moisture content in the smoothie was 80% after doing the proximate analysis and testing, ash content was found to be 2.2%, fat content was found to be 10% and protein content was 6.7%.

Table 3: Sensory Analysis of Amaranth Smoothie

Panellists	Appearance	Taste	Colour	Texture	Overall Acceptability
P1	8	8	8	7	8
P2	7	7	8	7	7
P3	8	8	7	7	7.5
P4	7	8	8	8	8
P5	8	7	7	8	7.5
P6	8	8	8	8	8
P7	7	8	8	7	7.5

Table 3 shows the sensory scores that were determined by averaging the results of five semi- trained panelists, which included graduate students and faculty members who worked as academic staff members and had some prior expertise in sensory evaluation. The sensory test was carried out in accordance with the hedonic rating test, which uses a 9-point scale.

Conclusion
The significance of our project is to find out the nutritional components and health benefits of amaranth smoothie enriched with dates and milk. As it is already shown above in the nutritional table that it is a protein rich food. Due to its beneficial profile of unsaponifiable and high fatty acid content, amaranth is considered a functional food. Several research revealed that it has hypocholesterolemic, antioxidant, and anti-carcinogenic benefits. As a result, amaranth grain products become highly sought-after for consumption as food or as dietary supplements in many communities.

Reference

1. Sajid EK. Comprehensive review on milk based smoothies: Current status and nutritional impact; c2022.
2. Willett WC, Ludwig DS. Milk and health. New England Journal of Medicine. 2020;382(7):644-654.
3. Marangoni F, Pellegrino L, Verduci E, Ghiselli A, Bernabei R, Calvani R, et al. Cow's milk consumption and health: a health professional's guide. Journal of the American College of Nutrition. 2019;38(3):197-208.
4. Suh JH. Critical review: metabolomics in dairy science-evaluation of milk and milk product quality. Food Research International, 2022, 110984.
5. Kumar B, Singh VP, Pathak V. Quality characteristics of banana based milk smoothies developed from milk of Hariana, Sahiwal and cross breed cows. Asian Journal of Dairy & Food Research. 2020, 39(1).
6. Verduci E, D'Elios S, Cerrato L, Comberiati P, Calvani M, Palazzo S, et al. Cow's milk substitutes for children: Nutritional aspects of milk from different mammalian species, special formula and plant-based beverages. Nutrients. 2019;11(8):1739.
7. Venskutonis PR, Kraujalis P. Nutritional components of amaranth seeds and vegetables: a review on composition, properties, and uses. Comprehensive Reviews in Food Science and Food Safety. 2013;12(4):381-412.
8. Abalone R, Cassinera A, Gaston A, Lara MA. Some physical properties of amaranth seeds. Bio systems Engineering. (2004;89(1):109-117.
9. Chauhan A, Singh S. Influence of germination on physicochemical properties of Amaranth (*Amaranthus* spp.) flour. International Journal of Agriculture and Food Science Technology. 2013;4(3):215-220.
10. Bressani R. Composition and nutritional properties of amaranth. In Amaranth biology, chemistry, and technology. CRC Press; c2018. p. 185-205.
11. Paredes-López O, Cárabez-Trejo A, Pérez-Herrera S, González-Castañeda J. Influence of germination on physico-chemical properties of amaranth flour and starch microscopic structure. Starch-Stärke. 1988;40(8):290-294.
12. Becker R. Preparation, composition, and nutritional implications of amaranth seed oil. Cereal Foods World; c1989.
13. Bressani R, Sánchez-Marroquín A, Morales E. Chemical composition of grain amaranth cultivars and effects of processing on their nutritional quality. Food Reviews International. 1992;8(1):23-49.
14. Pedersen B, Kalinowski LS, Eggum BO. The nutritive value of amaranth grain (*Amaranthus* caudatus). Plant foods for human nutrition. 1987;36(4):309-324.
15. Webster TM, Grey TL. Glyphosate-resistant Palmer amaranth (*Amaranthus* palmeri) morphology, growth, and seed production in Georgia. Weed Science. 2015;63(1):264-272.
16. Thapa R, Blair MW. Morphological assessment of cultivated and wild amaranth species diversity. Agronomy. 2018;8(11):272.
17. Brainard DC, Bellinder RR, DiTommaso A. Effects of canopy shade on the morphology, phenology, and seed characteristics of Powell amaranth (*Amaranthus powellii*). Weed Science. 2005;53(2):175-186.

18. Abalone R, Cassinera A, Gaston A, Lara MA. Some physical properties of amaranth seeds. Bio systems Engineering. 2004;89(1):109-117.
19. Klimczak I, Małecka M, Pachołek B. Antioxidant activity of ethanolic extracts of amaranth seeds. Food/Nahrung. 2002;46(3):184-186.
20. Venskutonis PR, Kraujalis P. Nutritional components of amaranth seeds and vegetables: a review on composition, properties, and uses. Comprehensive Reviews in Food Science and Food Safety. 2013;12(4):381-412.
21. Abalone R, Cassinera A, Gaston A, Lara MA. Some physical properties of amaranth seeds. Bio systems Engineering. 2004;89(1):109-117.
22. Chauhan A, Singh S. Influence of germination on physicochemical properties of Amaranth (*Amaranthus* spp.) flour. International Journal of Agriculture and Food Science Technology. 2013;4(3):215-220.
23. Bressani R. Composition and nutritional properties of amaranth. In Amaranth biology, chemistry, and technology. CRC Press; c2018. p. 185-205
24. Paredes-López O, Cárabez-Trejo A, Pérez-Herrera S, González-Castañeda J. Influence of germination on physico-chemical properties of amaranth flour and starch microscopic structure. Starch-Stärke. 1988;40(8):290-294.
25. Teutonico RA, Knorr D. Amaranth: composition, properties, and applications of a rediscovered food crop. Food technology. 1985;39(4):49-61.