

Formulation and Quality Evaluation of Quinoa Pancake Mix Incorporated With Spinach

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ABSTRACT

Pancakes are a beloved breakfast staple, known for their fluffy texture and versatility. The classic pancake is a simple batter made from flour, eggs, milk, and a leavening agent like baking powder. This mixture is poured onto a hot griddle or frying pan, cooked until bubbles form on the surface, and then flipped to cook the other side. The result is a golden-brown pancake that can be enjoyed with a variety of toppings such as butter, maple syrup, fruit, or whipped cream. The beauty of pancakes lies in their simplicity and the endless possibilities for customization. When combined with quinoa flour, spinach creates a hearty batter that results in pancakes that are not only delicious but also packed with health benefits. Quinoa and spinach pancake mix represents a nutritious and innovative fusion of ingredients designed to offer a healthier alternative to traditional pancake options. Quinoa, a high-protein, gluten-free pseudo-cereal, provides a robust nutritional profile, rich in essential amino acids, vitamins, and minerals. Spinach, a leafy green vegetable, contributes significant amounts of iron, calcium, and antioxidants. The combination of these two superfoods creates a pancake mix that not only caters to health-conscious consumers but also enhances dietary diversity and nutrient intake. This mix is particularly beneficial for individuals seeking to increase their consumption of plant-based proteins and greens, offering a versatile and convenient solution for breakfast or snacks. The resulting pancakes are not only flavorful but also contribute to a balanced diet, supporting overall wellness and vitality.

DISCUSSIONINTRODUCTION

Pancake mix is a pre-made blend of ingredients designed for convenience and consistency in making pancakes. A typical pancake mix contains flour, a leavening agent like baking powder, sugar, and salt. Some mixes may also include powdered milk, eggs, or flavorings to enrich the taste and texture of the pancakes¹. In recent years, there has been a trend towards more health-conscious and innovative pancake mixes. These might incorporate alternative flours such as quinoa flour for added protein or spinach powder for an extra nutrient boost. The idea is to offer a more nutritious version of the beloved breakfast while maintaining the ease of preparation that pancake mixes are known for healthy and nutritious . (Ms. Adarsh. S r.et,al,2022)

Quinoa, an ancient grain native to the Andean region of South America, has been a staple in local diets for over 5,000 years due to its remarkable nutritional profile and adaptability. It stands out as a complete protein source, containing all nine essential amino acids, and is rich in dietary fiber, B vitamins, iron, and magnesium. Its resilience to poor soil conditions, droughts, and high altitudes makes it a sustainable choice for farmers. Spinach, with its origins tracing back to Persia, boasts a wealth of vitamins A, C, K1, folic acid, iron, and calcium. This leafy green is celebrated for its antioxidant properties and versatility in the kitchen, maintaining its nutrient density whether consumed raw or cooked (Abugoch, Let al 2009),. It thrives in cool climates and offers multiple harvests per season. Wheat flour serves as the structural foundation in baking; its gluten content imparts elasticity and strength to doughs and batters. While primarily composed of carbohydrates, it also contributes protein, fiber, and B vitamins to one's diet. The process of milling wheat grains into flour has evolved over centuries but remains central to many cultural cuisines worldwide. Together, these ingredients form a pancake mix that is not only rich in flavor but also encompasses a diverse range of nutrients essential for a well-rounded diet.

Quinoa, often hailed as a "superfood," is not a grain but a seed from the *Chenopodium quinoa* plant, which is related to beets and spinach. This pseudo-cereal has been cultivated in the Andean region for millennia and was a sacred crop of the Incas, who called it the "mother of all grains." Nutritionally, quinoa is exceptional; it's one of the few plant foods that contain all nine essential amino acids, making it a complete protein. It's also high in fiber, B vitamins, and minerals such as iron and magnesium. Quinoa's low glycemic index is beneficial for blood sugar control, and its high levels of flavonoids—quercetin and kaempferol—have potent anti-inflammatory, anti-viral, and anti-cancer effects. The United Nations declared 2013 as the "International Year of Quinoa" due to its potential to contribute to food security worldwide. (González J.A et al , 2015)

Spinach is a nutrient-dense leafy green vegetable that belongs to the amaranth family and is related to quinoa and beets. It originated in ancient Persia before spreading across Europe and Asia, becoming a staple in various cuisines. Spinach is loaded with vitamins and minerals; it's an excellent source of vitamin K1, which is necessary for blood clotting, and vitamin A, crucial for eye health. It also provides vitamin C, vitamin E, folic acid, iron, and calcium—all essential nutrients that contribute to overall health. (Bergquist SÅ et al 2005) The antioxidants found in spinach, such as lutein and zeaxanthin, are protective against oxidative stress and may reduce the risk of chronic diseases. Its versatility in cooking—from raw salads to steamed dishes

Procedure

1. In a large bowl, mix together the quinoa flour, wheat flour, and baking powder.
2. Add the palm sugar to the dry ingredients and mix well.
3. Add the dried and powdered spinach to the mixture. Transfer the pancake mix to an airtight container for

or incorporated into pastas and smoothies—makes spinach a favorite among chefs and nutritionists alike.

Wheat flour is the powdered form of wheat grain and is a staple ingredient in many food cultures around the world. It's produced by milling wheat grains to separate the endosperm from the bran and germ; white flour contains mostly the endosperm, (Joel, N et al , 2014) while whole wheat flour includes all parts of the grain. Wheat flour is rich in carbohydrates, providing energy for daily activities. It also contains protein—primarily gluten—which gives dough its elasticity and chewiness. Additionally, wheat flour offers dietary fiber, B vitamins (especially niacin, thiamin, and folate), and minerals such as iron. Its use in baking dates back thousands of years; today it remains essential for breads, pastries, pasta, and much more. The cultivation of wheat has shaped civilizations throughout history due to its importance as a food source. (Gupta HO et al , 2005)

MATERIALS AND METHODS:

Quinoa, Fresh spinach, Wheat flour, Palm sugar, Baking powder, Milk, Dehydrator or Sun drying , Mixing bowl, Kadai , Spatula

METHODS:

Drying of spinach:

- Temperature: Typically, spinach is dried at temperatures between 125°F to 135°F (about 52°C to 57°C) to preserve flavor and color while removing moisture. Adjust the temperature based on your equipment and desired outcome, but avoid temperatures that might scorch A.K.,

- Duration: Dehydrating spinach can take anywhere from 4 to 6 hours, depending on factors like slice thickness and humidity levels.

Drying of spinach :

The open sun drying was also carried out during the day time (temp: 37-45°C, RH: 25-37%). The untreated samples of spinach were dried as control samples. Spinach was dried from 91% ± 1 per cent moisture content to about 5±1 moisture content (w b). A.K., (Bhupendra Gupta, et al, 2012)

Preparation of quinoa flour:

Quinoa flour is made through a process that involves several steps:

1. Rinsing: Quinoa seeds are thoroughly rinsed to remove the natural coating called saponin, which can give a bitter taste.
2. Toasting: The rinsed quinoa is then spread on a baking sheet and toasted in an oven at around 350°F (175°C) for about 10-15 minutes. This step enhances the nutty flavor of the quinoa.
3. Cooling: After toasting, the quinoa must be allowed to cool completely.
4. Grinding: The cooled quinoa is then ground into a fine powder using a blender or food processor.
5. Sifting: Finally, the ground quinoa flour is sifted through a fine mesh strainer to ensure a smooth texture. (Demir MK , 2014)

storage

Cooking procedure:

1. Heat a non-stick pan or griddle over medium heat and lightly grease with oil or butter.
2. In a bowl, take the desired amount of pancake mix and gradually add water or milk, stirring continuously to avoid lumps. Aim for a batter that's not too thick nor too runny.

- Pour a ladleful of batter onto the hot pan and spread it gently into a round shape.
- Cook until bubbles form on the surface and the edges start to look set, then flip carefully with a spatula.

- Cook the pancakes on a medium heat setting which is about 375°F (190°C) on most stoves. After flipping, cook for another 1-2 minutes until golden brown. Serve hot with your choice of toppings like honey, syrup, etc.

Fig :1 Pancake cooking procedure



MOISTURE:

The moisture content of the samples was determined by using the method of (AOAC ,2007)

Procedure:

- The petri-dish with lid was weighed.
- 5g of sample was weighed into the petri-dish and spread evenly for uniform drying.
- Oven was set at 100 to 105°C and the petri-dish with sample was placed inside the oven with lid open for 15-17 hrs.
- The petri-dish was cooled in desiccator with lid open for 1-2 hrs.
- The petri-dish with sample was weighed.
- This was repeated for all samples till constant weight was achieved.

ASH CONTENT:

The principle of ashing is to burn off the organic matter and to determine the inorganic matter remained. Heating is carried out in two stages:- firstly to remove the water present and to char the sample thoroughly; and finally ashing at 550°C in a muffle furnace. This method is applicable to all food materials.

I SAMPLE PREPARATION

Randomly collect meat sample (\leq 100 g) and pass through a manual mincer twice or chop very finely and mix thoroughly. Place minced meat in small plastic bag. (Baraem P. Ismail , 2017)

II INSTRUMENT AND APPARATUS

Muffle furnace, temperature (0-1200) °C
Crucibles and lids

Thong

Thick gloves

III ANALYTICAL PROCEDURE

- The crucible and lid is first placed in the furnace at 550°C overnight to ensure that impurities on the surface of crucible is burnt off. Cool the crucible in the desiccator (30 mins).
- Weigh the crucible and lid to 3 decimal places.
- Weigh about 5g meat sample from (I) into the crucible. Heat over low bunsen flame with

S . N O	SAMPLE	VARIATIO N- 1	VARIATIO N - 2	VARIATIO N - 3
1	QUINOA	40 gm	45 gm	50 gm
2	SPINACH	10 gm	7 gm	5 gm
3	WHEAT FLOUR	30 gm	25 gm	20 gm
4	BAKING POWER	2 gm	2 gm	2 gm
5	PALM SUGAR	15 gm	20 gm	25 gm

TABLE-1 Different Variations of Sample With Measured Ingredients.

lid half covered.

When fumes are no longer produced, place crucible and lid in furnace.

- Heat at 550°C overnight. During heating, do not cover with the lid. Place the lid on after complete heating to prevent loss of fluffy ash. Cool down in the desiccator.
- Weigh the ash with crucible and lid to 3 decimal places.
- Ash must be white or light grey. If not, return the crucible and lid to the furnace for further 22 ashing.

IV CALCULATION

Ash Content (%) = $\frac{\text{Wt of ash}}{\text{Wt of sample}} \times 100$

PROTEIN :

Principle: The -CO-NH- bond (peptide) in polypeptide chain reacts with copper sulphate in alkaline medium to give a purple colour which can be measured at 540 nm.

Reagents Required: Biuret reagent(Mahesha H B 2012) Dissolve 3 g of copper sulphate (CuSO₄.5H₂O) and 9 g of sodium potassium titrate in 500ml of 0.2 mol/litre sodium hydroxide; add 5 g of potassium iodide and make up to 1 litre with 0.2mol/litre sodium hydroxide.

1. Protein Standard: 5 mg BSA/ml.

Apparatus and Glass wares required: Test tubes, Pipettes, Colorimeter, etc.,

Procedure:

- Pipette out 0.0, 0.2, 0.4, 0.6, 0.8 and 1 ml of working standard into the series of labeled test tubes.
- Pipette out 1 ml of the given sample in another test tube.
- Make up the volume to 1 ml in all the test tubes. A tube with 1 ml of distilled water serves as the blank.
- Now add 3 ml of Biuret reagent to all the test tubes including the test tubes labeled 'blank' and 'unknown'.
- Mix the contents of the tubes by vortexing / shaking the tubes and warm at 37 °C for 10 min.
- Now cool the contents to room temperature and record the absorbance at 540 nm against blank.
- Then plot the standard curve by taking concentration of protein along X-axis and

absorbance at 540 nm along Y-axis.

7. Then from this standard curve calculate the concentration of protein in the given sample.

Calculations:

OD of test (optical density)

Total protein (go) = X Concentration of standard OD of standard

RESULTS AND

The quinoa and spinach pancake mix was formulated in 3 variations as given in table 1. The formulated all three variations of pancake mix was subjected to traditional pancake mix evaluation, and the pancake mix that was given most average scores will be selected for further evaluation of nutrient content.

S #	Variation	Color	Flavor	Texture	Appearance	Taste	Overall Acceptability
1.	V1	7.5	7	8	7	6.5	7
2.	V2	8.5	8	8.5	8	8.5	8.5
3.	V3	7	6	7	6	7	6.5

Table - 2 Sensory Evaluation of Formulated Pancake mix

The mean score of the sensory evaluation is obtained for the variation 2 (v2) by overall acceptability. Therefore, from the results it is concluded that the quinoa and spinach pancake mix scored maximum score so it was further subjected to quality analysis.

Physicochemical properties:

The physical and sensory qualities of quinoa and spinach pancake mix impact towards the customers' acceptance of pancake mix. The physical properties such as appearance, taste and texture of pancake mix.

Nutritional Analysis:

Nutritional analysis of the pancake mix such as protein, fiber, fat and acidity were performed and the results were exhibited in the table 3.

CONCLUSION

The collective statistical analysis of sensory attributes indicated a preference for variation V2 by the tasting panel, which was characterized by its excellent flavor, aroma, and taste, along with all nine essential amino acids, high in fiber, magnesium, B vitamins, iron, potassium, calcium, phosphorus, vitamin E. The

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Sensory evaluation:

Sensory assessment stands as a crucial factor for the approval and consumption of any food item, gauged through senses like sight, taste, and touch. The sensory analysis for the development and quality assessment of quinoa and spinach pancake mix was conducted to determine their acceptability. This was based on attributes such as texture, appearance, flavor, aroma, and overall satisfaction using a nine-point hedonic scale by a panel of 10 trained evaluators. The variation that scores highest in the sensory assessment will be chosen for additional analysis. (Ilze Beitane et al, 2014). The results of sensory evaluation of formulated two variation is exhibited in the Table 2.

S.NO	NUTRIENT	VALUES
1.	PROTEIN	1.7 gm
2.	MOISTURE	1.1 %
3.	ASH CONTENT	7.5 %
4.	FIBER	0.7 gm
5.	TOTAL FAT	0.4 gm
6.	ACIDITY	0.9 %

Table - 3 Nutritional Analysis of Pancake Mix

The result of the study concludes that trail 2 product with acceptable sensory properties were mostly rated, high, proteins and amino acids, quinoa is rich in Fiber, Magnesium, Potassium, Iron and Folate (Safiullah Pathan' 2012). Spinach is a powerhouse of nutrients, including iron for healthy blood, vitamin K for bone health, and antioxidants that protect against oxidative stress. (Kim, M., et al. (2014). "Spinach Consumption and DNA methylation in Human Peripheral Blood Mononuclear Cells". The refreshing taste and nutrient rich quality of the pancake mix is optimal breakfast option compared to traditional breakfast

research revealed that quinoa pancake mix incorporated with spinach is a viable breakfast choice that maintains essential nutrients and antioxidants, and possesses a longer shelf life. The formulated product was subjected to physicochemical property analysis and quality evaluation, proving to be a wholesome and invigorating alternative compared to standard commercially available pancake mix

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