AUCTORES
Globalize your Research

Journal of Nutrition and Food Processing

Tolcha Techane Alemu *

Open Access

Research Article

Effect of Chickpea, Banana Peel flour and Fenugreek Spice Flour on the Physico-Chemical Properties and Sensory Quality of Wheat Bread: A Review

Tolcha Techane Alemu *

Department of Post-harvest Management, Jimma University College of Agriculture and veterinary medicine, Jimma, Ethiopia.

***Corresponding author:** Tolcha Techane Alemu, Department of Post-harvest Management, Jimma University College of Agriculture and veterinary medicine, Jimma, Ethiopia.

Received date: March 21, 2023; Accepted date: June 27, 2023; Published date: July 05, 2023

Citation: Tolcha T. Alemu (2023), Effect of Chickpea, Banana Peel flour and Fenugreek Spice Flour on the Physico-Chemical Properties and Sensory Quality of Wheat Bread: A Review, *J. Nutrition and Food Processing*, 6(5); **DOI:10.31579/2637-8914/135**

Abstract:

This paper is aimed to review the updated scientific information regarding the effect of bread made from wheat flour, chickpea, fenugreek and banana fruits flour and their effect on physicochemical properties and nutritional values. Bread is global stable food particularly for African people and Asian. However, most of time bread made from on wheat cereal and it is nutritional poor due to deficiency of essential amino acids such as lysine, methionine and threonine. Specially, addition of legumes is important to increase protein content of bread. Because of legume flours, contain amino acid composition and fiber content, are ideal ingredients for improving the nutritional value of bread and bakery products is high. For more improvement of nutritional quality of bread addition of fruits like banana fruit is good due to nutritional content of them. So, to get bread which has good physicochemical properties with high nutritional values addition of chickpea and banana fruits flour are very important. Legumes like fenugreek are also good source of protein and used as spice to increase sensory properties when they added at optimum level. Therefore, supplementation of wheat flour with inexpensive staples and local available grains such as fenugreek, chickpea and banana help in improving the nutritional quality of wheat products bread.

Key words: banana; bread; fenugreek; nutritional values physic-chemical properties

Introduction

1.1. Background and justification

Bread is a universally fermented food product that is accepted as a very convenient form of food that has desirability to all population rich and poor, rural and urban. Its origin dates back to the Neolithic era and is still one of the most consumed and acceptable staple in all parts of the world (Abdelgha for et al., 2011). Bread as a daily food is of high interest, therefore its production and distribution deserves improvement. According to report of Batten field, et al. (2016), Wheat flour is best adapted for bread making, as it contains gluten in the right proportion to make the spongy loaf. Wheat may contain some anti– nutritional factors like phytate and tannins especially if not properly processed (Baba et al., 2015). Bread made from wheat grain only is nutritional poor.

Therefore, to improve nutritional quality of bread based wheat blending ration of other cereal or grain is important. Specially, addition of legumes is important to increase protein content of bread. Because of legume flours, contain amino acid composition and fibre content, are ideal ingredients for improving the nutritional value of bread and bakery products is high. For more improvement of nutritional quality of bread addition of fruits like banana fruit is good due to it contains water, carbohydrates, protein, Vitamin B6, potassium, fiber, and fat (Giami et al.,2004). This generally affects sensory qualities and overall acceptability of bread (Eddy et al., 2007). Moreover, it has no sodium and great source of Vitamin C and contains natural sugars sucrose, fructose and glucose giving substantial boost of energy. Banana flour can be made from bananas that are ripe or raw by drying in oven at 65oc. Banana is a good source of carbohydrates and nutritionally interesting bioactive compounds. Nowadays bananas are being considered as a food ingredient (Ovando-Martinez et al., 2009). During traditional making bread different spice herbs like fenugreek will be added for imparting flavor. Besides, it provides tremendous amount of active ingredients for health promotion and disease prevention. It's leaves and seeds powder is recommended in food formulations and serves as medicinal herb (Afzal et al., 2016; Zharfi et al.,2012).

The fenugreek seeds contain 25-30% protein, 7-9% lipids, 20-25% insoluble fiber, and 5-7% saponins along with ample amounts of volatile

oils, free amino acids, mucilaginous fiber and flavonoids (Raju and Bird, 2006). Fenugreek used as flavoring agent. Wheat is considered nutritionally poor, due to deficiency of essential amino acids such as lysine and threonine, whereas fenugreek flour has high protein content, rich in calcium, iron and beta-carotene. Fenugreek seeds contain 20 % soluble fibre, which can act as functional agent in wheat dough. The presence of bitter saponins in fenugreek seeds limits their acceptability in foods. However, it has been possible to debitter fenugreek seeds by using various domestic processing methods. The major or mandatory ingredients in bread making are flour, water, salt, and yeast (Malomo et al.,2011). Other ingredients like sugar and oil are also important to increase flavor of bread. Those ingredients have to added by a series of process involving mixing, kneading, proofing, shaping and baking (Dewettinck et al., 2008).

The consumption of bread and other baked goods such as biscuits, doughnuts and cakes produced from wheat flour is very popular, but the low protein content of wheat flour, which is the most vital ingredient used for the production of different kinds of baked goods has been major concern in its utilization (Young, 2001). However, wheat is a good source of calories and other nutrients but its protein is of lower nutritional quality when compared to milk, maize, and pea as its protein is deficient in essential amino acids such as lysine and threonine (Dewettinck et al., 2008). Flours from chickpea are among the most predominant studied for the production of composite flour wheat breads (Ali et al., 2000). Chickpea is one of the top important legumes on the basis of whole grain production. It has been used for the preparation of various traditional foods (Ravi and Suvendu, 2004), such as an ingredient in bread preparation. Whole chickpea contains 17.1% protein, 5.3% fat and 3.0% minerals supply energy 1507 kJ/g. Different traditional oriental foods are prepared using chickpea flour both at household and industrial levels. They are also a source of high-quality protein and have been known as a poor man's meat (Man, 2015).

Chickpea flours can be an excellent choice for improving the nutritional value of bread. The high lysine, low methionine content complements that of wheat flour proteins, which are poor in lysine and relatively higher in the sulphur-containing amino acids. Most of time bread is normally consumed by many people at breakfast, lunch and sometimes dinner (Njie,2016).

1.2. Statement of the Problem

The main challenge that consumers face in their daily menu is that the shortage of certain amino acids and fatty acids. In order to produce protein and fiber rich products, it is essential to blend the flours of these products with oil seed proteins, such as chickpea flour.

Malnutrition is a very common problem in developing countries. This problem includes both macro and micro nutrient deficiencies among these vitamin deficiencies and protein deficiencies are the most significant. The inclusion of chickpea flour into the composite flour of wheat was enhancing the protein content of the bread to be produced. Unfortunately, animal sources of proteins, which are used to compliment the starchy diets were expensive and out of reach for low-income families. Protein quality is a critically important problem in many developing countries, where human diet consists mainly of cereals. Blending wheat with chickpea and banana flour was used as a way of enhancing its protein quality and combating health problem as well. Many people in our country make bread from wheat flour which contains mainly carbohydrates. However, banana contains important vitamins, fibers and minerals which could enhance the nutritional and sensory profile of bread if we made wheat bread blending with banana flour and chickpea. Problems of flavor of bread also there but, by addition fenugreek as spice it is possible to increase it is flavor and other properties. Therefore, the objective of this review is to review effect of chickpea, banana peel and fenugreek spice flour on the physicochemical properties and sensory quality of wheat bread.

Literature review

2.1. Wheat

Wheat is one of the world's most popular cereal grains. Bread wheat, or common wheat, is the primary species, and for at least one-fifth of man's calorie intake (Ohiagu et al., 1987). Wheat is the world's leading grain crop, whose importance is derived from the physical and chemical properties of the gluten, which make possible the production of leavened bread. White and whole-wheat flour are key ingredients in baked goods, such as bread. Other wheat-based foods include pasta, noodles, semolina, bulgur, and couscous. It is highly controversial because it contains a protein called gluten, which can trigger a harmful immune response in predisposed individuals (Gudeta et al.,2023).

Wheat has an ash (minerals) content of about 1.5%. The contents of ash in all kinds of bread ranged from 0.76-0.98% ,but those which produced from brown bread had ash content ranged from 1.58- 1.68%. It is grown all over the world for its highly nutritious and useful grain, as one of the top three most produced crops, along with corn and rice. It is used in the production of bread, biscuits, feeds, confectionary, amongst many, utilization (Smith, 2010).

2.1.1. Chemical composition of wheat grain

The primary quantitative component of wheat grain is starch. Cereal grains store energy in the form of starch. The amount of starch contained in wheat grain varies but is generally between 60 and 70% of the weight of the grain. Starch is basically polymers of glucose. Chemically, at least two types of polymers are distinguishable: amylose, an essentially linear polymer, and amylopectin (USDA, 2009).

2.1.2. Nutritional content of wheat

Wheat quality can be defined as the ability of a variety to produce flour suitable for a specific product. Wheat Grain is mainly composed of proteins (7-18%), lipids (1.5-2%) and carbohydrates (60- 75%), together with other minor components such as certain vitamins and minerals. Proteins and carbohydrates, especially starches, have considerable influence on three grain characteristics closely linked to the technical wheat qualities required for baking or pasta manufacture (Sramková et al.,2009).

Parameter	Wheat flour
Moisture	14.25
Ash	1.82
Fiber	1.7
Fat	0.98
Protein	12.5
Carbonhydrate	68.75

Source: (Bellal, 2016)

Table 1: nutritional composition of wheat flour

2.1.3. Importance of wheat in bread making

Apart from its use in bread making, wheat also finds wide application in pastry and semolina products, and for fermentation to make alcoholic beer, (Palmer JJ et.al 2001. The wheat plant is fairly hardy and can grow under a wide variety of environmental and soil conditions. Wheat is unique among cereals because its flour possesses the ability to form visco-elastic dough when mixed with water. Baked goods such as bread, cakes and meat pie are particularly pleasing foods with numerous advantages over other staple foods. The products are superior in nutritional quality, particularly the protein and vitamin contents, when compared to staple foods such as rice, potatoes, bananas and cassava. Bread is rarely eaten alone when compared to other staple foods. Moreover, bread is superior in that it is a solid that can easily be carried, and it forms an ideal material for enrichment with vitamins, minerals and protein concentrates (Adeniji,2015).

2.2. Principles of baking and bread making procedures

The term baking strictly refers only to the operation of heating dough product in an oven. Bread is made by many different procedures depending on tradition, the amount (cost), the type of energy available, the type and consistency of the flour available, the type of bread desired, and the time between baking and eating. The minimum formula for bread is flour, yeast, salt, and water such that when any of these ingredients is missing, the product cannot be regarded as leavened bread. The function of baking is to present flour in an attractive, palatable and digestible form (Chukwu U, et. al .1998).

Preparation of Wheat Flour

Whole-wheat flour, for the preparation of bread.

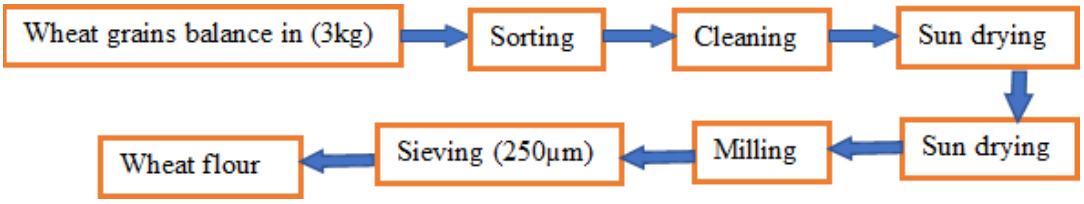
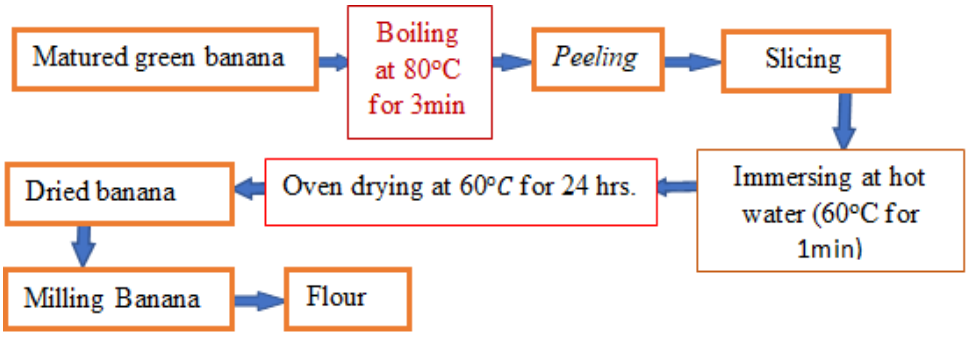


***Figure 1**: Flow chart of wheat flour* (Source: AACC, 2011)

2.3. Banana

Bananas and plantains are today grown in every humid tropical region and constitute the 4th largest food crop of the world after rice, wheat and maize (Arias et al., 2003). Consequently, bananas and plantains can be a very cheap food to buy and are, hence, an important food for low-income families (Hailu,2013).



(Source: Ovando-Martinez *et al. 2009)*

Figure 2: flow chart for the preparation of banana flour

2.3.1. Health Benefits of Banana

Banana stands out for having a high starch/resistant starch content, deserving industrial interest for developing new products. Moreover, it has a wide range of vitamins and minerals present in both pulps and peels (Singh, et al., 2016). The fruit has an excellent source of nutrients comprising of vitamin B6 (28%), vitamin C (15%) and potassium (12%), Vitamin A, and negligible quantity of sodium and high fiber which when incorporated into wheat flour for bread production can enhance healthy bowels, cardiovascular health, protection from strokes, ulcers, improve blood pressure, may boost mood and reduce water retention because of low sodium.

Flour, the main byproduct of green banana, is one of the most common forms of preserving bananas as well as their masses. It has high starch content and is widely used in infant feeding as a source of energy and also has excellent medicinal properties, especially for cases of gastrointestinal infection (Bezerra et al., 2013).

2.4. Chickpea

Chickpea (Cicer arietinum L.) is an important pulse crop grown and consumed all over the world. It is a good source of carbohydrates and protein, and the protein quality is considered to be better than other pulses. Chickpea has significant amounts of all the essential amino acids except sulfur containing types, which can be complemented by adding cereals to daily diet.Starch is the major storage carbohydrate followed by dietary fibre, oligosaccharides and simple sugars like glucose and sucrose. Lipids are present in low amounts but chickpea is rich in nutritionally important unsaturated fatty acids like linoleic and oleic acid. β-sitosterol, campesterol and stigma sterol are important sterols present in chickpea oil. Calcium, magnesium, phosphorus and especially potassium are also present in chickpea seeds. Chickpea is a good source of important vitamins such as riboflavin, niacin, thiamin, folate and the vitamin A precursor, β-carotene. Chickpea is cholesterol free and is a good source of dietary fibre, vitamins and minerals (Hirdyani,2014).

2.4.1. Chickpea constituents

2.4.1.1. Proteins

Chickpea is rich source of complex carbohydrates, proteins, vitamins and minerals (de Almeida Costa,et al., 2006). Protein calorie malnutrition is observed in infants and young children in developing countries and includes a range of pathological conditions arising due to lack of protein and calories in the diet.Among the different pulses, chickpea is reported to have higher protein bioavailability.Chickpea's high protein content is characterized by a good balance of amino acids, which is better than for any other common plant. Proteins of high quality are those which are fully digested and whose amino acid composition closely matches the amino-acid pattern for humans and animals given by FAO and WHO standards. Chickpea is often described as the protein hope of the future containing 40%) of protein in its seed.

2.4.1.2. Fat Content

Total fat content in raw chickpea seeds varies from 2.70-6.48 % (Danek et al.,2021) reported lower values (~ 2.05 g 100-g) for crude fat content in desi chickpea varieties. Oleic and linoleic acid are unsaturated fatty acids that are contained in larger proportion in chickpea with sound health implication as compared to saturated animal fat. In addition to this chickpea also contains adequate amount of carbohydrate, digestible fiber, minerals, and vitamins. In Ethiopia, the Ethiopia Nutrition Institute (ENI) supplementary food program is the major user of the chickpea in the country following its introduction in to Ethiopia. Traditional foods that were made with chickpea by ENI were Injera fermented flat pancake-like bread commonly eaten by the highland Ethiopians). Wots and Alliches (sauces served with Injera), Kitta, Dabbo, Dabbokolo and porridge are also foods that were prepared from chickpea.

2.4.1.3. Vitamins

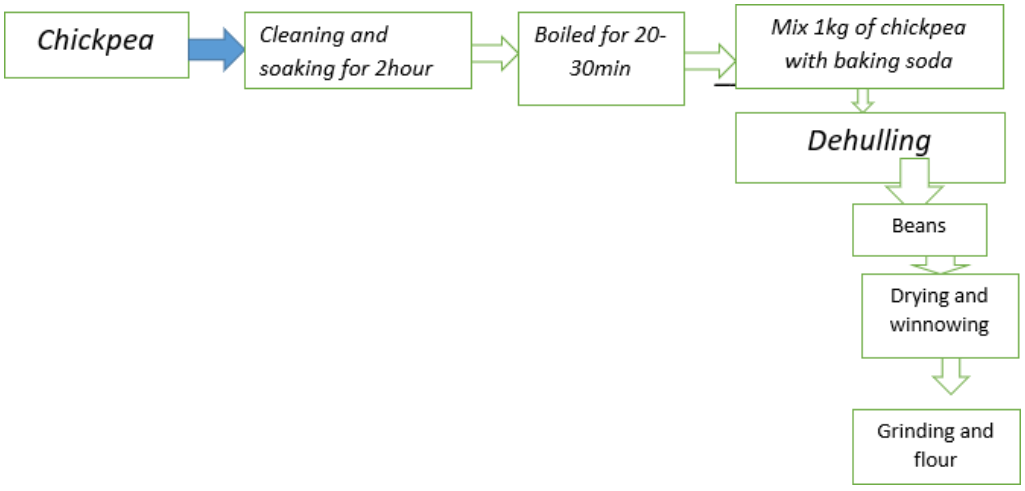
Pulses are a good source of vitamins. Chickpea can complement the vitamin requirement of an individual when consumed with other foods. Chickpea is a relatively inexpensive and good source of folic acid and tocopherols (Jukanti, et al., 2012).

2.5 Preparation of chickpea flour

The chickpea was process in to flour; using the method of Sekyere et al. (2022) (Figure.3). Inactivation of the anti-nutritional factors e.g. trypsin inhibitors can be destroyed with moist heat. When legumes are roasted destruction of trypsin inhibitors were not complete, but roasting previously soaked chickpea can effect complete destruction of anti-nutritional factors. Also rapid destruction can take place if the chickpea was briefly boiled (20-30 minutes), then soaked and then cooked in water with baking soda or sodium bicarbonate**.**

When the chickpea were cooked these chemicals e.g. sodium bicarbonate the simmering water was changed to allow the beans to simmer in clean water.

Addition of salt at the beginning of cooking chickpea will prolong the cooking time.



(Source Ovando-Martinez *et al*. 2009)

Figure 1: Flow chart for the preparation of chickpea flour

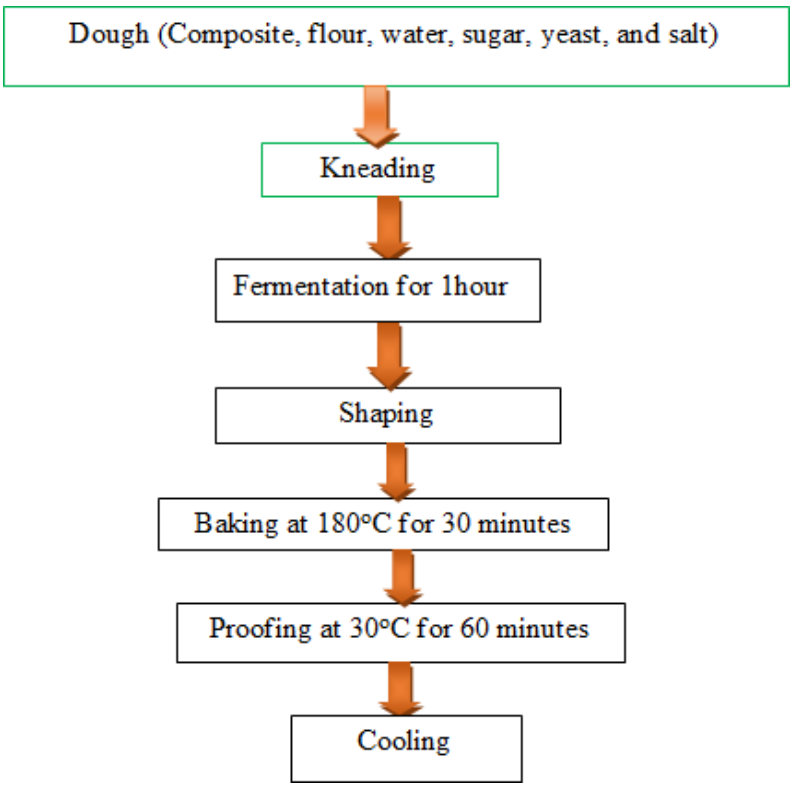
2.6. Fenugreek and nutrition contents

Fenugreek belongs to the legume plants and is an environmentally friendly plant. The plant is widely used as a spice that not only improves the taste of food, but also contributes to metabolic functions and overall health. Fenugreek seeds contain 260.3 to 295.0 g kg-1 of protein, whose quality is determined by the composition of different protein fractions and amino acids (Leela and Shafeekh 2008). Fenugreek seeds are used as spice for enhancing flavor.

Fenugreek seeds have been valued for their medicinal properties. Micro¬biological analyses revealed that fenugreek extracts exhibit antimicrobial activity against numerous bacteria (Mandal et al. 2016). As rich sources of protein, lipids, fatty acids and minerals, fenugreek seeds and leaves cater to the bo¬dy's needs for essential nutrients and deliver numerous health benefit.

2.7. Preparation of bread

The dough was prepared using the straight dough method (Chuahan, et al, 1992). The ingredients will be used in this baking formula were wheat flour, chickpea flour, fenugreek, banana flour, water, sugar, salt and yeast. All ingredients were mixed by traditional method then kneading, the dough was fermented for 1hrs, shaping and going to be collected with clean muslin cloth at room temperature, punched, and scaled to dough pieces. It was proofed at for 15 minutes and be baked in oven at 250oC for 30 minutes (Giami, et al.2000).



Source; *(Giami, et al., 2000).*

Figure 4: flow chart for the preparation of bread

2.7.1. Major bread ingredients

Bread usually contains several ingredients that would help improve its quality. Some of the basic identified ingredients were flour, table salt, water, yeast, sugars, and flavors and at least flour improver to improve dough handling properties, increase quality of fresh bread and extend the shelf life of stored bread (Rosell et al., 2001).

2.7.2. Flour

Flour was the most important ingredient in bread formulation, as it was responsible for formation of viscoelastic dough when hydrated with water was capable of supporting gas cells and retaining gas (Habtamu,2012).). Strong (hard-wheat) flour in which the high protein content ranged from 9% to 15% of dry weight is the basic ingredient for most baked products. Flour consists of starch, gluten, non-starch polysaccharides, lipids and trace amounts of minerals. Starch, a major component of wheat flour, making up to 80% of wheat flour dry weight, significantly affects the dough rheological properties, particularly the starch gelatinization upon heating in the presence of water. Almost 85% of starch is converted to sugars, ready for transformation by yeast into carbon dioxide (CO¬2) and alcohol during dough fermentation (Belderok, 2000).

2.7.3. Water

Water is the second main ingredient on the label, and the control of it is important. The main function of water is hydration. It is the least expensive ingredient in the formulation. Water is vital throughout the bread making processes for dissolution of salt and sugar, assisting the dispersion of yeast cell, starch and sucrose hydrolysis, activation of enzymes to form new bonds between the macromolecules in the flour and consequently alters the rheological properties of the dough. The optimum water level is crucial in determining the dough properties and subsequently the final quality of bread (Giannou et al., 2003).

2.7.4. Yeast

Yeast's roles in bread making are crucial by acting as a leavening agent, strengthen and developing gluten in dough and contributing to the flavor generation in the bread (Mondal and Datta, 2008). Yeast converts fermentable sugars into carbon dioxide and alcohol in a reaction called fermentation. Yeast is a living organism and its activity can be influenced by storage practices. Saccharomyces cerevisiae is major yeast in dough fermentation and has an important effect on dough rheological properties (Giannou et al., 2003).

2.7.5. Salt

The presence of salt (sodium chloride) primarily contributes to the improvement of bread flavor. Addition of salt at optimum level helps in conditioning the dough by improving its tolerance to mixing process, subsequently producing a more stable and stiff dough by affecting the dough rheological properties. Salt has an inhibiting effect on the formation of gluten during mixing and further restrict the gas expansion by yeast conversion in the dough system (Mondal and Datta, 2008). Hence, salt in bread formulation consequently strengthened the dough through protein interactions, presumably shielding charges on the dough gluten protein network by retaining the CO¬¬2 from the leavening agent (Lombard et al., 2000). Salt changes water interactions between components and it alters the configuration of gluten proteins, because of its composition for water.

2.7.6. Sugar

Sugar adds sweetness and contributes to the bread's browning. The main role for sugar in yeast bread is to provide food for the yeast. As the yeast grows and multiplies, it uses the sugar, forming byproducts of carbon dioxide and alcohol, which give bread its characteristic flavor. Sugar tenderizes bread by preventing the gluten from forming. It also holds moisture in the finished product.

Wheat (%)	chickpea (%)	Banana (%)	fenugreek	Protein %
100	0	0	0	13
90	5	2.5	2.5	14.5
80	5	10	5	17.7
70	10	15	5	20.8
60	20	10	10	35.4

Source: (Anstalt, S. V. 2013).

Table 2: Percentage composition of wheat, chickpea and banana flour composite bread

2.8. physico-chemical properties of bread

The bread making performances of flours determined using straightdough with the remixing procedure of Irvine and McMullan (1960) with the slight modification. The bread formula for each loaf included flour 100 g (14 per cent mb), yeast 3.5 g, salt 1.75 g, sugar 8 g and an adequateamount of water to obtain dough of optimum consistency.

After removing from the oven, loaves were immediately weighed and then placed on a wire grid for 2 h before volumes were determined. Loaf volume was measured by the rapeseed displacement method. Specific loaf volume calculated by dividing the loaf volume by loaf weight and the results were expressed as ml/g. Loaf weight increased with the increase in the level of fenugreek and chickpea in wheat flour.

The loaf volume of bread made from wheat flour lesser than supplementation with non-wheat flour increased. This might be due to the dilution effect on gluten content with the addition of non-wheat flour to wheat flour that has been reported to be associated with loaf volume depression effect of composite flours (Shrivastava et al.,2018). Other workers have also reported similar decrease in loaf volume of bread supplemented with non-wheat flours.As the level of fenugreek flours in the blend was increased, the crust colour of the breads changed from creamish white to the dull brown.

The proximate composition of the bread samples as shown in Table 4 the ash, fat, protein, TSS, and pH contents of the bread samples increased significantly with increased substitution of banana and chickpea flours.

According to report of (Dhingra and Jood,2002).) the sensory attributes increased with addition of chickpea and fenugreek flour. The cause of the result may be attributed to Mallard reaction between reducing sugars and high proteins content found chickpea. The researcher indicated that the inclusion of composite flour into wheat up to 60% could still give acceptable bread. This result was similar to findings reported by (Kotsiou et al.,2022).

Sensory qualities are the main criterion that makes the product to be liked or disliked (Noah et al., 2020). Descriptive sensory attributes scores of liking bread produced from wheat, banana and chickpea flour at different combination ratio.

The proximate contents for moisture, ash, fat, crude fiber and protein, lowest in whole wheat bread and higher in other chickpea, fenugreek and banana substituted samples. The proximate values increased with increasing levels of chickpea and banana substitutions. The moisture content of the bread varied between 31.87% and 34.6%. The moisture content increase with the increase in supplementation of other flours could be due to the fact that chickpea can absorb moisture in baked product (Manjiri et al.,2015).

Mashayekhi, and Mashayekh, (2008) reported increase in protein content of the bread as a result of the addition of chickpea flour. Other studies have also reported a similar increase of protein content in sorghum-soy composite flours. The fat content also increased from 0.5 to 2.4% in the composite breads produced from chickpea flour substitution.

composition Proximate	**Wheat flour**	**Fenugreek seeds powder**
Moisture	13.5	16.65
Ash	0.41	4.14
Protein	10	22.86
Fat	1.13	6.98
Fiber	0.31	7.90

Source: Kasaye and Jha,2015)

Table 3: Proximate composition of bread samples (%)

2.8.1. Organoleptic characteristics

From consumer's point of view, the sensory properties are very important. In the present study, these properties of the bread were evaluated by the panelists who were quite familiar with the product quality. The replacement of wheat flour with different proportions of fenugreek flours resulted in considerable changes in the sensory properties of bread

Crust colour.

As the level of fenugreek flours in the blend was increased, the crust colour of the breads changed from creamish white to the dull brown. The addition blend level of the fenugreek flours produced the darkest colour. Crust colour is the result of the maillard reaction between reducing sugars and proteins.The increased protein content of the fenugreek flour blended breads in the present study probably caused the darkest crust colour. A

decrease in crumb colour score with the increase in the level of substitution was noticed by Dhingra and Jood (2004).

Appearance.

Appearance score of the blended breads were significantly lower at supplementation of wheat flour with the fenugreek flour. The decrease in crumb colour scores with the addition of fenugreek to wheat flour may be attributed to the higher colour grade values of wheat-fenugreek flour blends.

Crust texture.

The noticeable changes were observed in the crust texture of breads. The crust texture was observed to decrease significantly with the increase in substitution of fenugreek flours with wheat flour. The crust texture was related to the external appearance of the bread top i.e. smoothness or roughness. Similarly, the deterioration in bread crust texture with puffed bengal gram beyond 20 per cent substitution level was also observed.

Flavour.

The flavour characteristics are also reflected in the odour of the bread and play an important role in the overall acceptability of the product. Addition of fenugreek to wheat flour modified the taste and mouth feel and impart fenugreek flavour to the bread at 20level of substitution, there was a sharp decrease in the scores for odour and taste, probably due to the dominating flavour of fenugreek (Pathania et al.,2017).

Taste.

The taste became bland and bread was considered little bit bitter, probably due to dominating

taste of fenugreek flour. However, substitution of all fenugreek flour in wheat flour had poorest taste score which was considered bitter in taste.

2.8.2. Bread HACCP

Commonly refers to the use of HACCP systems to minimize food safety risks in the bread processing, packaging, and transportation industries. The acronym HACCP stands for Hazard Analysis Critical Control Point (pronounced 'has sip'). Significant hazards for particular bread, puree, or not identified based upon scientific information. Foodborne hazards controlled through HACCP include physical, chemical, and microbiological agents that have the potential to cause an adverse health effect when a juice containing them is consumed, and that are reasonable likely to occur if not controlled. While consumers have historically been most concerned with chemical hazards such as pesticide residues and heavy metal contamination, microbiological contaminants have caused widespread problems in the industry, as noted above. The FDA has published a Hazards and Controls Guide that has extensive information on bread-related hazards, including some hazards that must be controlled by the HACCP plan. A simple process flow diagram for a bread baking plant could be Scaling,Mixing,Bulk fermentation,Make up,Proofing,Baking,Cooling,Packaging,Metal detection,Stacking,Storage and Shipping.Specific to the bread HACCP regulation is the control of fungus

2.8.3. Principles of HACCP

The seven principles of HACCP during preparation of bread making are:

Principle 1: Conduct a hazard analysis

Potential hazards Associated with a food are identified, along with measures to control hazards. Potential hazards that must be considered by bread, makers, processors and packagers

Principle 2: Determine the critical control points (CCPs)

CCPs are points in a food's production and processing at which significant hazards can be controlled or eliminated. Generally, the thermalprocessing steps of concentration and/or pasteurization are key CCPs in a processors/packagers HACCP plan.

Principle 3: Establish critical limit(s) (CLs) for each CCP

Each CCP must operate within specific parameters to ensure the hazard is being appropriately and effectively controlled.it is the step at which CCP exercised to control hazards.

Principle 4: Set up systems to monitor each CCP

Monitoring involves defining how the CCPs will be assessed, performing the monitoring at the appropriate time intervals, determining who will perform the monitoring, and finally maintaining the proper monitoring records.

Principle 5: Establish corrective actions

When a critical limit is not met (a process deviation), proper actions must be taken. These can include reworking product, diverting product to a non-food use, or destruction of product. Corrective actions can be both short- and long-term in nature. Appropriate records must be maintained.

Principle 6: Establish verification procedures

Verification is used to confirm that the system is working properly and that procedures outlined in the HACCP plan are being followed.

Principle 7: Record-keeping and documentation

This includes all records required in the various parts of the HACCP plan, as well as other key records such as sanitation logs, supplier agreements and shipping documents.

3. Conclusion

3.1. Conclusions

Bread is stable food product in different countries and it made from different ingredients. Bread made from only wheat flour is nutritionally poor. But by adding other grains and cereals it possible to increase nutrition contents. Therefore, the composite breads with chickpea and banana flour addition nutritionally superior (have higher protein, fat and crude fiber content) to -wheat bread.

The results of review indicated that the chickpea used in fortifying wheat and banana flours was able to increase the protein content, ash content and other physico chemical properties, as well as the fat in the various combinations without affecting the acceptance of the bread.

The composite breads with chickpea and banana flour substitutions were found to be nutritionally superior (have higher protein, fat and crude fiber content) to whole-wheat bread. Organoleptic attributes like taste, aroma, texture and color were generally higher acceptability than that of whole-wheat bread. Therefore, chickpea -composite breads had better overall acceptability than the whole-wheat bread. The supplementation of fenugreek seeds powder in wheat flour resulted in improved nutritional and antioxidant status with acceptable quality of bread. It was observed that crude protein, crude fiber and ash content of bread increased with the addition of fenugreek powder. It is concluded from the present study that fenugreek seeds powder can be added up to 15% in bread making flour that increased its nutritional profile and antioxidant activity without affecting sensory attributes adversely

References

1. Abdelghafor, R. F. M. (2011). Quality of bread from composite flour of sorghum and hard white winter wheat (Doctoral dissertation, University of khartoum).

2. Adeniji, T. A. (2015). Plantain, banana and wheat flour composites in bread making: Prospects for industrial application. African Journal of Food, Agriculture, Nutrition and Development, 15(4), 10182-10197.
3. Afzal, B., Pasha, I., Zahoor, T., & Nawaz, H. (2016). Nutritional potential of Fenugreek supplemented bread with special reference to antioxidant profiling. Pakistan Journal of Agricultural Sciences, 53(1).
4. Ahari, D.S., A.K. Kashi, M.R. Hassandokht, A. Amri and K. Alizadeh. 2009. Assessment of drought tolerance in Iranian fenugreek landraces. J. Food Agric. Environ. 7:414-419.weekly Bulletin
5. Anstalt, S. V. (2013). Food and agriculture organization of the United Nations.
6. Baba, M. D., Manga, T. A., Daniel, C., & Danrangi, J. (2015). Sensory evaluation of toasted bread fortified with bananaflour: a preliminary study. American journal of food science and nutrition, 2(2), 9-12.
7. Battenfield, S. D., Guzmán, C., Gaynor, R. C., Singh, R. P., Peña, R. J., Dreisigacker, S., ... & Poland, J. A. (2016). Genomic selection for processing and end-use quality traits in the CIMMYT spring bread wheat breeding program. The plant genome, 9(2), plantgenome2016-01.
8. Belderok, B., Mesdag, J., Mesdag, H., & Donner, D. A. (2000). Bread-making quality of wheat: a century of breeding in Europe. Springer Science & Business Media.
9. Bezerra, C. V., Rodrigues, A. M. D. C., Amante, E. R., & Silva, L. H. M. D. (2013). Nutritional potential of green banana flour obtained by drying in spouted bed. Revista Brasileira de Fruticultura, 35, 1140-1146.
10. Chukwu, U.N., Chi's Business Consulting Group Inc, (2000). Method for hydrating dry edible beans. U.S. Patent 6,033,692.
11. Danek-Majewska, A., Kwiecień, M., Winiarska-Mieczan, A., Haliniarz, M., & Bielak, A. (2021). Raw chickpea (Cicer arietinum L.) as a substitute of soybean meal in compound feed for broiler chickens: Effects on growth performance, lipid metabolism, fatty acid profile, antioxidant status, and dietary value of muscles. Animals, 11(12), 3367
12. De Almeida Costa, G. E., da Silva Queiroz-Monici, K., Reis, S. M. P. M., & de Oliveira, A. C. (2006). Chemical composition, dietary fibre and resistant starch contents of raw and cooked pea, common bean, chickpea and lentil legumes. Food chemistry, 94(3), 327-330.
13. Dewettinck, K., Van Bockstaele, F., Kühne, B., Van de Walle, D., Courtens, T.M. and Gellynck, X., 2008. Nutritional value of bread: Influence of processing, food interaction and consumer perception. Journal of Cereal Science, 48(2), pp.243-257.
14. Dhingra, S., & Jood, S. (2002). Organoleptic and nutritional evaluation of wheat breads supplemented with soybean and barley flour. Food chemistry, 77(4), 479-488.
15. Dhingra, S., & Jood, S. (2004). Effect of flour blending on functional, baking and organoleptic characteristics of bread. International journal of food science & technology, 39(2), 213-222.
16. Eddy, N. O., Udofia, P. G., & Eyo, D. (2007). Sensory evaluation of wheat/cassava composite bread and effect of label information on acceptance and preference. African Journal of Biotechnology, 6, 2415–2418.
17. Giami, Alain. "De l'impuissance à la dysfonction érectile. Destins de la médicalisation de la sexualité." (2004): 77-108.
18. Giannou, V., Kessoglou, V. and Tzia, C., (2003). Quality and safety characteristics of bread made from frozen dough. Trends in Food Science & Technology, 14(3), pp.99-108.
19. Gudeta, A. N. (2023). Aspects of immunogenetics, infections, and nutrition on the risk of celiac disease autoimmunity in an Ethiopian pediatric birth cohort (Doctoral dissertation, Lund University).
20. Habtamu, S. (2012). Addis Ababa Institute of Technology (AAiT) School of Graduate Studies Department of Chemical Engineering.
21. Hailu, M., Workneh, T. S., & Belew, D. (2013). Review on postharvest technology of banana fruit. African Journal of Biotechnology, 12(7).
22. Hefnawy, T. M. H., El-Shourbagy, G. A., & Ramadan, M. F. (2012). Impact of adding chickpea (Cicer arietinum L.) flour to wheat flour on the rheological properties of toast bread. International Food Research Journal, 19(2).
23. Hirdyani, H. (2014). Nutritional composition of Chickpea (Cicerarietinum-L) and value added products-a review. Indian Journal of Community Health, 26(Supp 2), 102-106.
24. Jukanti, A. K., Gaur, P. M., Gowda, C. L. L., & Chibbar, R. N. (2012). Nutritional quality and health benefits of chickpea (Cicer arietinum L.): a review. British Journal of Nutrition, 108(S1), S11-S26.
25. Kasaye, A. T., & Jha, Y. K. (2015). Evaluation of composite blends of fermented fenugreek and wheat flour to assess its suitability for bread and biscuit. International Journal of Nutrition and Food Sciences, 4(1), 29-35.
26. Kotsiou, K., Sacharidis, D. D., Matsakidou, A., Biliaderis, C. G., & Lazaridou, A. (2022). Physicochemical and functional aspects of composite wheat-roasted chickpea flours in relation to dough rheology, bread quality and staling phenomena. Food Hydrocolloids, 124, 107322.
27. LeelaN.K. Shafeekh K.M. (2008). Fenugreek, in chemistry of spices. Ed. by Parthasarathy VA., ChempakamB. and Zachariah TJ. CAB International, Wallingford, UK, 242-259. legumes. Food Chem. 94, 327 330.
28. Lombart, D. (2005). Nusa Jawa: Silang Budaya Kajian Sejarah Terpadu, Bagian II: Jaringan Asia. PT. Gramedia Pustaka Utama bekerja sama dengan Forum Jakarta-Paris dan Ecole Francaise d'Extreme Orient.
29. Malomo, S. A., Eleyinmi, A. F., & Fashakin, J. B. (2011). Chemical composition, rheological properties and bread making potentials of composite flours from breadfruit, breadnut and wheat. African Journal of Food Science, 5(7), 400-410.
30. Man, S., Păucean, A., Muste, S., & Pop, A. (2015). Effect of the chickpea (Cicer arietinum L.) flour addition on physicochemical properties of wheat bread. Bulletin UASVM Food Science and Technology, 72(1), 41-49.
31. Mandal, S., & DebMandal, M. (2016). Fenugreek (Trigonella foenum-graecum L.) oils. In Essential oils in food preservation, flavor and safety (pp. 421-429). Academic Press.
32. Manjiri, P., Ramesh, M., Yogesh, R., Manoj, S., & Neha, D. (2015). Automated localization of optic disk, detection of microaneurysms and extraction of blood vessels to bypass angiography. In Proceedings of the 3rd International Conference on Frontiers of Intelligent Computing: Theory and Applications (FICTA) 2014: Volume 1 (pp. 579-587).Springer International Publishing.
33. Mashayekhi, B., & Mashayekh, S. (2008). Development of accounting in Iran. The International Journal of Accounting, 43(1), 66-86.
34. Mccullough, D.G., Poland, T.M., Cappaert, D., Clark, E.L., Fraser, I., Mastro, V., Smith, S. and Pell, C., 2007. Effects of chipping, grinding, and heat on survival of emerald ash borer, Agrilus planipennis (Coleoptera: Buprestidae), in chips. Journal of Economic Entomology, 100(4), pp.1304-1315.

35. Mondal, A. and Datta, A.K., 2008. Bread baking–A review. Journal of Food Engineering, 86(4), pp.465-474.
36. Njie, H. (2016). The interaction of economic livelihood strategies and literacy and numeracy practices of urban Gambian women with low educational attainments. International Journal of Education and Literacy Studies, 4(3), 73-87.
37. Noah, A. A., & Omoyeni, S. E. (2020). Evaluation of Nutritional, Microbial and Sensory Attributes of Rice Tuwo Flour Fortified with Soy and Plantain Flour Blends. Journal of Advances in Microbiology, 20(9), 121-129.
38. Ohiagu, C.C., 1987. Storage of food grains in the savannah zones of Northern Nigeria. Food Grain Production in Semiarid Africa. Ouagadougou: Safgra, pp.361-368.
39. Ovando-Martinez, M., Sáyago-Ayerdi, S., Agama-Acevedo, E., Goñi, I. and Bello-Pérez, L.A., 2009. Unripe banana flour as an ingredient to increase the undigestible carbohydrates of pasta. Food Chemistry, 113(1), pp.121-126.
40. Ovando-Martinez, M., Sáyago-Ayerdi, S., Agama-Acevedo, E., Goñi, I. and Bello-Pérez, L.A., 2009. Unripe banana flour as an ingredient to increase the undigestible carbohydrates of pasta. Food Chemistry, 113(1), pp.121-126.
41. Palmer, J.J., Kelly, J.S. and Hansen, J.D., 3M Innovative Properties Co, 2001. Orthodontic appliance with improved precipitation hardening martensitic alloy. U.S. Patent 6,280,185.
42. Pathania, S., Kaur, A., & Sachdev, P. A. (2017). Chickpea flour supplemented high protein composite formulation for flatbreads: Effect of packaging materials and storage temperature on the ready mix. Food Packaging and Shelf Life, 11, 125-132.
43. Radhakrishnan, S., Belal, I. E., Seenivasan, C., Muralisankar, T., & Bhavan, P. S. (2016). Impact of fishmeal replacement with Arthrospira platensis on growth performance, body composition and digestive enzyme activities of the freshwater prawn, Macrobrachium rosenbergii. Aquaculture reports, 3, 35-44.
44. Raju, J., & Bird, R. P. (2006). Alleviation of hepatic steatosis accompanied by modulation of plasma and liver TNF-α levels by Trigonella foenum graecum (fenugreek) seeds in Zucker obese (fa/fa) rats. International Journal of Obesity, 30(8),1298-1307.
45. Rosell, C.M., Rojas, J.A. and De Barber, C.B., 2001. Influence of hydrocolloids on dough rheology and bread quality. Food hydrocolloids, 15(1), pp.75-81.
46. Sekyere, A., Abubakari, S., & Akwaah, V. (2022). Quality Characteristics of Biscuits Made with Wheat, Unpolished Rice and Soyabean Flour. NVEO-NATURAL VOLATILES & ESSENTIAL OILS Journal| NVEO, 745-754.
47. Shrivastava, C., & Chakraborty, S. (2018). Bread from wheat flour partially replaced by fermented chickpea flour: Optimizing the formulation and fuzzy analysis of sensory data. LWT, 90, 215-223.
48. Singh, B., Singh, J. P., Kaur, A., & Singh, N. (2016). Bioactive compounds in banana and their associated health benefits–A review. Food chemistry, 206, 1-11.
49. Smith, G.C., 2010. Psychotherapy. In Encyclopedia of Stress (pp. 302-307). Elsevier.
50. Šramková, Z., Gregová, E., & Šturdík, E. (2009). Chemical composition and nutritional quality of wheat grain. Acta chimica slovaca, 2(1), 115-138.
51. USDA, N., 2009. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana.
52. Young, L.J., Lim, M.M., Gingrich, B. and Insel, T.R., 2001. Cellular mechanisms of social attachment. Hormones and behavior, 40(2), pp.133-138.
53. Zharfi, S., Movahed, S., Chenarbon, A.H. and Lavasni, A.R.S., 2012. Evaluation of Sensory Properties of Toast Bread Containing Banana Powder. Indian Journal of Science and Technology, 5(8), pp.3163-3164.

DOI: 10.31579/2637-8914/135