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BIOCHEMICAL AND SENSORY EVALUATION OF ALMOND SEED FLOUR ADDITION TO MILLET SEED FLOUR

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ABSTRACT

Almond tree is a drupe, composed of a fleshy hull surrounding a hard shell, which protects the edible seed or kernel. Kernels of the cultivated sweet almond consist mainly of lipids, protein, fiber, and high concentrations of vitamin E.6 Almond kernels contain varying amounts of amygdalin, a diglucoside that is broken down into hydrogen cyanide and Benz aldehyde in response to crushing of the kernel and exposure to water or saliva. This research work is aimed to investigate the Biochemical and sensory evaluation of Almond seed flour addition to millet seeds plants extraction and biochemical determination methods have been used to analyze the samples for the study. The results show that Almond seed flour [[100 Almond: 0 Millet Seed powder]; AM1 [[97.5 Almond seed Flour: 2.5 Millet Seed powder]; AM2 [[95 Almond Seed flour: 5 Millet Seed powder]; AM3 [[92.5 Almond seed Flour : 7.5 Miller powder]; AM4 [[90 Almond Seed flour : 10 Millet seed powder]; AM5 [[87.5 Almond Seed flour: 12.5 Millet seed powder]; AM6 [[85 Almond seed flour: 15 Millet seed powder]; while table 3 indicate the mineral determination of A [[100 Almond seed flour: 0 Millet seed powder]; AM1 [[97.5 Almond seed flour: 2.5 Millet seed powder]; AM2 [[95 Almond seed flour: 5 Millet seed powder]; AM3 [[92.5 Almond seed flour: 7.5 Millet seed powder]; AM4 [[90 Almond seed flour : 10 Millet seed powder]; AM5 [[87.5 Almond seed flour : 12.5 Millet seed powder]; AM6 [[85 Almond seed flour : 15 Millet seed powder]; respectively.

Keywords: Biochemical; Sensory Evaluation; Almond seed flour; Millet Seed Flour

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INTRODUCTION

Almond is a term applied to the seed of the almond tree (*Prunus dulcis* (Mill.), a member of the genus *Prunus L.* within the *Rosaceae* family, native to south-central Asia and cultivated in Mediterranean-type climates, including California (United States), the Mediterranean, central Asia, and Australia. Almond, (*Prunus dulcis*), tree of the rose family (*Rosaceae*) and its edible seed, native to southwestern Asia, *Prunus dulcis* is an economically important crop tree grown primarily in Mediterranean climates between 28° and 48° N and between 20° and 40° S, California producing nearly 80 percent of the world's supply. Almonds grown as nuts may be eaten raw, blanched, or roasted and are commonly used in confectionery baking. In Europe almonds are used to make marzipan, a sweet paste used in pastries and candy, and in Asia almonds are often used in meat, poultry, fish, and vegetarian dishes. Almonds are high in protein and fat and provide small amounts of iron, calcium, phosphorus, and vitamins A, B complex, and E. Cultivated almonds have been designated with a variety of taxonomic synonyms, including *Amygdalus communis L.*, *Amygdalus dulcis* Mill (Hagerman and Butter, 1977). And *Prunus amygdalus Batsch*, due to their cross fertility with other species such as peach. In addition to commercially cultivated almonds, there are at least 30 species of wild almonds described which are generally bitter than cultivated varieties. The fruit of the almond tree is a drupe, composed of a fleshy hull surrounding a hard shell, which protects the edible seed or kernel. Kernels of the cultivated sweet almond consist mainly of lipids, protein, fiber, and high concentrations of vitamin E. Almond kernels contain varying amounts of amygdalin, a *diglucoside* that is broken down into hydrogen cyanide and benzaldehyde in response to crushing of the kernel and exposure to water or saliva. Almond phenotypes are characterized as sweet (*nonbitter*), semi bitter, or bitter, depending on the concentration of amygdalin in the kernel. Due to the high amygdalin content (>3%), bitter almonds are a significant source of benzaldehyde, which is an important flavoring substance also known as oil of almond or almond essence. However, most almond producers and processers focus on cultivated sweet almonds, and the popularity of sweet almonds in comparison with other nuts has soared in recent years. Almonds are the most widely produced tree nut in the world, reaching over 1.2 million metric tons during the 2017/ 2018 season. The U.S. state of California is the major almond growing region in the world, producing 81% of the world almond production, followed by Australia (7%), Spain (4%), Iran (1%), and Tunisia (1%). In the United States, sweet almonds are the most highly consumed tree nut at 2.17 pounds (984 g) per capita per year, approximately 4 times the consumption rate of walnuts, and the second most highly consumed tree nut. The eating quality of almonds is influenced by a number of factors, including the physiological development of the almond kernel in the field, the harvest and shelling conditions of the almond, and the processing and storage conditions. Almond kernels develop in the shell surrounded by a hull; as the kernels mature, the hull dries and splits open, allowing the in-shell nut to dry naturally before harvest (Kirtikar, 1999). In California, almonds are harvested by mechanically shaking the trees to knock the ripened and split drupes to the ground, where they are allowed to dry for 8−10 days before being collected. The harvested almonds are then transported to huller−sheller facilities where the hulls are removed to produce in-shell almonds, or the hulls and shells are removed to produce almond kernels, by passing through a series of rollers (Ukoha, 2003). Most almonds are shipped and sold after shelling, which allows the kernels with pest, mold, or mechanical damage to be sorted out and kernels to be graded by size (Turner, 2002). All California-grown almonds sold in North America Millet is grown all over the world due to the low cost of cultivation, its biodiversity—pearl millet (*Pennisetum glaucum*), foxtail millet (*Setaria italica*), proso millet (*Panicum miliaceum*), and finger millet (*Eleusine coracana*)—and high biological properties. Probably, it is the first cereal cultivated by man and the first reports about the cultivation of millet date back to about 5550 BC (Corner, 1997). It should be noted that millet does not contain gluten, which cannot be consumed by people with celiac disease (life-long intolerance to ingested gluten) as it causes autoimmune disorders affecting the gastrointestinal system. Millet protein is rich in essential amino acids except tryptophan and lysine, which are generally limiting amino acids in cereals and legumes. On the other hand, the proteins are relatively rich in sulfur-containing amino acids such as cysteine and methionine. Millet grains are characterized by low fat content (1.5–5%), but they are rich in carbohydrates (60–70%) and contain 7–12% of proteins and 2–7% of fiber. They are a good source of vitamins (especially vitamin B: thiamine, folacin, niacin, and riboflavin) and minerals such as magnesium, iron, and calcium. Moreover, they contain some essential fatty acids like linoleic, oleic, and palmitic acids found in a free form (Thamson and Barry, 2006).

Millets can be used in the management of type 2 diabetes due to their hypoglycemic property; their antioxidant activities have been reported as well. Moreover, according to Ugese *et al.* (2008), foxtail millet hydrolyzates can decrease hypertension and the risk of cardiovascular diseases, which are part of metabolic syndrome (MS). It is defined as a multiplex risk factor for atherosclerotic cardiovascular disease and type 2 diabetes and consists of five main factors, such as atherogenic dyslipidemia, high blood pressure, dysglycemia, a pro-thrombotic state, and a pro-inflammatory state. The pathogenesis of MS is still not clear; however, it is known to be related to metabolic disorders leading to the development of obesity, insulin resistance, and hypertension. One of the causes of the occurrence of diabetes mellitus is hyperglycemia, which is related to insufficient or inefficient insulin secretion and alterations in carbohydrate, protein, and lipid metabolism. One of the methods for preventing postprandial hyperglycemia is inhibition of carbohydrate absorption after meals. In the first step, polysaccharides in the gastrointestinal tract are hydrolyzed by α-amylase to dextrin or oligosaccharides, which are a substrate for the action of α-glycosidase, which leads to the release of a large amount of glucose. Therefore, inhibition of enzymes involved in polysaccharide degradation can reduce postprandial hyperglycemia (AOAC, 2005).

Long-lasting high blood pressure can lead to the development of hypertension and cardiovascular diseases, such as stroke, coronary heart disease, and peripheral arterial disease. The main role in maintaining normal blood pressure is played by the angiotensin-converting enzyme (ACE). Its excessive activity causes vascular muscle hyperplasia, reduction of vascular lumen, and development of hypertension (Nwosu *et al.*, 2008).

Statement of the Problem

Almond seed flour and millet seed are not commonly grown in Nigeria like other parts of the countries, those plants contains some biochemical content that are beneficial to the body. Most of the content the body need to maintain die are found from the plants, this research intend to discuss the benefits of those plants in the body and also determine the biochemical analysis of the plants. Millet seed plants are expensive and are mostly consumed in Nigeria with patients with diabetics. Although due to lack of materials most of the biochemical contents of those plants have not being determine in this study.

Aim of the Study

The aim of this research is to investigate Biochemical and sensory evaluation of Almond seed flour addition to millet seeds.

Objectives of the Study

The objectives of this study include;

i. To investigate the biochemical analysis of Almond and millet seed
ii. To determine the sensory quality evaluation of Almond and Millet Seeds
iii. To proffer a solution on the above-mentioned objectives

Justification of the Study

This study is prone to determine the biochemical analysis of Almond seed flour in addition to millet seed flour, these plants are known to contain Carbohydrates, protein, Calcium, potassium, lipids, minerals and facts etc. This study intends to investigate and discuss the health benefits of the plants. Consuming those plants can help to lower cholesterol and reduce high blood pressure and other health benefits are discussed in this study.

LITERATURE REVIEW

History of Millet

The various species called millet were initially domesticated in different parts of the world, most notably in East Asia, South Asia, West Africa, and East Africa. However, the domesticated varieties have often spread well beyond their initial area. Specialized archaeologists called *palaeoethnobotanists*, relying on data such as the relative abundance of charred grains found in archaeological sites, hypothesize that the cultivation of millets was of greater prevalence in prehistory than rice, especially in northern China and Korea. Millets also formed important parts of the prehistoric diet in Indian, Chinese Neolithic and Korean Mumun societies (Ugese *et al.*, 2008).

Description of Millet

Generally, millets are small-grained, annual, warm-weather cereals belonging to the grass family. They are highly tolerant of drought and other extreme weather conditions and have a similar nutrient content to other major cereals (Ukoha, 2003).

Cultivation of millet

Pearl millet is one of the two major crops in the semiarid, impoverished, less fertile agriculture regions of Africa and Southeast Asia. Millets are not only adapted to poor, dry infertile soils, but they are also more reliable under these conditions than most other grain crops. This has, in part, made millet production popular, particularly in countries surrounding the Sahara in western Africa (Turner, 2002).

Millets, however, do respond to high fertility and moisture. On a per-hectare basis, millet grain production can be 2–4 times higher with use of irrigation and soil supplements. Improved breeds of millet with enhanced disease resistance can significantly increase farm yield. There has been cooperation between poor countries to improve millet yields. For example, 'Okashana 1', a variety developed in India from a natural-growing millet variety in Burkina Faso, doubled yields. This breed was selected for trials in Zimbabwe. From there it was taken to Namibia, where it was released in 1990 and enthusiastically adopted by farmers. 'Okashana 1' became the most popular variety in Namibia, the only non-Sahelian country where pearl millet—locally known as mahangu—is the dominant food staple for consumers. 'Okashana 1' was then introduced to Chad. The breed has significantly enhanced yields in Mauritania and Benin (Corner, 1997).

Physical description of Almond Tree

Almond trees are deciduous with a hardy dormancy. Typically growing 3–4.5 metres (10–15 feet) tall, the trees are strikingly beautiful when in flower; they produce fragrant, five-petaled, light pink to white flowers from late January to early April north of the Equator. The flowers are self-incompatible and thus require insect pollinators to facilitate cross-pollination with other cultivars. The growing fruit (a drupe) resembles a peach until it approaches maturity; as it ripens, the leathery outer covering, or hull, splits open, curls outward, and discharges the pit. Despite their common label, almonds are not true nuts (a type of dry fruit) but rather seeds enclosed in a hard fruit covering (Thamson and Barry, 2006).

Cultivation of Almond Seed

The sweet almond is cultivated extensively in certain favourable regions, though nut crops are uncertain wherever frosts are likely to occur during flowering. While more than 25 types of almonds are grown in California, Marcona and Valencia almonds come from Spain, and Ferragnes are imported from Greece. Old World almond cultivation was characterized by small plantings mainly for family use; trees interplanted with other crops; variability in age, condition, and bearing capacity of individual trees; and hand labour, often with crude implements. Modern almond growers are typically more industrial, with vast orchards of at least three types of trees the same age(Hagerman and Butter, 1977). Mechanized tree shakers are often used to expedite harvesting, and many growers must rent honeybees during flowering season to pollinate their trees. Indeed, the annual pollination of the almonds in California is the largest managed pollination event in the world, with more than 1.1 million beehives brought to the state each year. Colony collapse disorder (CCD), which has led to a global decline of honeybee populations, threatens the multibillion dollar industry (Kirtikar, 1999).

3.0 MATERIALS AND METHODS

3.1 Plant Material

Almond and millet seeds used were bought from market traders of Ugbokolo main market. The seeds were transported in cleaned sacs to microbiology laboratory where they were sun-dried for five hours.

3.2 Sample Preparation

3.2.1 Plant extraction

Almond and millet seeds were collected and dried under the sun for five hours and the seeds were separated from the coat using a mutter thereafter, they were ground into powder using hand grinding. The Almond seeds sample used was added with the flour of millet powder seeds to obtain the biochemical analysis interest.

Determination of Carbohydrates of Almond and millet Seeds

Carbohydrates are the most abundant class of organic compounds found in living organisms. Carbohydrates are a major source of metabolic energy both for plants and animals. A diet that does not contain carbohydrates can lead to muscle breakdown, ketosis, and dehydration. 100mg of Almond and Millet seeds flour were dispensed in boiling tubes to hydrolyze the sample and 5ml of 2.5N HCL was added in it. It was kept in a water bath for 3 hours, removed from water bath and cooled to room temperature. After cooling it was neutralized by adding solid sodium carbonate until effervescence ceases. Then whole volume was made 100ml by adding distilled water and centrifuged, supernatant is used as a sample.

Sugar Extraction of the Plants

The Almond and millet seeds samples were extracted with 80% ethanol for 5hr in a Goldfish apparatus. The quantity of soluble sugars in the extracts was estimated by the phenol-sulphuric acid method of Dubois *et al*. (1956).

Sensory Analysis of the Plants

Although measuring volatiles in almond and millet seeds headspace and comparing quantities with known sensory thresholds may give insight into the potential flavor profile of samples, the only way to assess flavor as it is perceived by human beings is to perform sensory analysis. Descriptive sensory analysis is a method of revealing and quantifying individual sensory dimensions of a food product.

The Almond and millet seeds sample collected in this study were evaluated on the basis of their quality attributes (taste, mouth feel, aroma, appearance, constituency, color and overall acceptability). Using nine points' hedonic scales, although the panelists were not trained but their selection was random.

Result

The results obtained in this study have been shown in the tables below.

Table 1: Composite Mixture of Almond seed flour with addition of Millet seed flour

FLOUR	A	AM1	AM2	AM3	AM4	AM5	AM6
Almond (%)	100	97.5	95	92.5	90	87.5	85
Millet (%)	10	2.5	5	7.5	10	12.5	15

Key: A= Almond, M = Millet, AM= Almond Millet

Table 2: The Proximate composition (%) and Energy (Kcal/100g) values of the Millet seed flour and Almond Seed flours

Sample	moisture	protein	fat	fibre	ash	carbohydrate	energy
M	8.50	27.14	2.85	9.44	10.39	41.68	300.93
A	10.22	3.68	1.37	2.45	2.88	79.4	344.15
AM1	10.20	3.95	1.42	2.63	3.07	78.74	343.95
AM2	10.15	4.21	1.55	2.83	3.25	78.02	342.83
AM3	10.10	4.65	1.65	2.98	3.38	77.26	342.06
AM4	10.04	5.25	1.73	3.16	3.63	76.21	341.83
AM5	10.02	5.83	1.85	3.35	3.77	75.19	340.89
AM6	9.99	6.68	1.93	3.51	3.99	73.91	339.74

key = A [[100 Almond: 0 Millet Seed powder]; AM1 [[97.5 Almond seed Flour: 2.5 Millet Seed powder]; AM2 [[95 Almond Seed flour: 5 Millet Seed powder]; AM3 [[92.5 Almond seed Flour : 7.5 Miller powder]; AM4 [[90 Almond Seed flour : 10 Millet seed powder];

AM5 [[87.5 Almond Seed flour : 12.5 Millet seed powder]; AM6 [[85 Almond seed flour: 15 Millet seed powder];

Table 3: The mineral composition of the millet seed flour and Almond seed flours (mg/100g)

Sample	Ca	Mg	P	K	Na	Fe
M	1978.12	357.12	135.87	1486.12	167.79	34.75
A	234.06	199.06	219.06	3856.06	239.06	12.56
AM1	277.66	203.01	216.98	3796.81	237.28	13.11
AM2	321.26	206.96	214.90	3737.56	235.49	13.67
AM3	364.86	210.91	212.82	3678.31	233.72	14.22
AM4	401.57	214.86	213.97	3710.19	237.41	13.96
AM5	435.07	218.82	211.89	3650.95	235.63	14.52
AM6	478.49	222.77	209.81	3591.70	233.85	15.07

key = A [[100 Almond seed flour: 0 Millet seed powder]; AM1 [[97.5 Almond seed flour: 2.5 Millet seed powder]; AM2 [[95 Almond seed flour: 5 Millet seed powder]; AM3 [[92.5 Almond seed flour: 7.5 Millet seed powder]; AM4 [[90 Almond seed flour : 10 Millet seed powder]; AM5 [[87.5 Almond seed flour : 12.5 Millet seed powder]; AM6 [[85 Almond seed flour : 15 Millet seed powder];

Discussion

The result obtained in this study has being show below; **Table 1** indicate the total Composite Mixture of Almond seed flour with addition of Millet seed of the samples, the composition of mixtures were labeled as AM1 to AM6 respectively. AM1 indicate the first mixture of the plant seed flour from both samples in percentage, it ranges between 85% to 100% for Almond seeds flour and 5 to 12.5% for millet seeds flour. **Table 2** shows the Proximate composition (%) and Energy (Kcal/100g) values of the Millet seed flour and Almond Seed flours in all the samples, most of the content analyzed were protein, fat, fiber, ash, carbohydrate and energy contents specifically. After which the results were obtained as illustrated in table 2 above. **Table 3** shows the mineral composition of the millet seed flour and Almond seed flours (mg/100g). This shows the composition of some valuable mineral elements such as Ca, Mg, P, K, Na, and Fe. The sample used the same method from table two for analysis for the mentioned mineral elements.

The results obtained in this study indicate that almond seeds flour and millet seed flours contains most minerals and Proteins the body need for energy, growth and good health immunity response to diseases. Therefore, based on the recent review and findings from other researchers in addition with result obtained from this study Almond seeds flour and millet seed flour are good in consumption.

Conclusion

These researchers intend to investigate the biochemical analysis of Almond and millet seeds flour, and to determine the sensory quality evaluation of Almond and millet seed flour. Most of the biochemical properties of Almond and millet seeds flour have duly been assessed in this study, the plants used for the study were reviewed and known to be consumable and of health benefits worldwide.

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