COMPARATIVE ANALYSIS OF SOME PHYSICO-CHEMICAL CHARACTERISTICS OF MANGIFERA INDICA L. FROM KULFO AREAS AT ARBA MINCH SOUTHERN ETHIOPIA

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ABSTRACT

Two varieties of Mangoes (Mangifera indica) namely; Fringe (Big seeded) and Abash (Small seeded) collected within kulfo garden area. The objectives of this project are to compare and analyze the nutritional and anti-nutritional contents that are present in the some varieties of mango (Mangifera Indica L.) around kulfo garden areas and to compare the nutritional and anti-nutritional properties of mangifera indica in two samples with each other. Analysis of the nutritional and anti-nutritional contents of the two varieties of Mangoes was investigated for their protein, fat, ash and dry matter contents. Similarly, mineral elements like Ca^{2+} and Mg^{2+}contents were also determined. Vitamin C and the anti-nutritive characteristic (oxalate and phytate) of two mangifera indica L. were assessed. The result in table 2 shows percentage composition of ash, dry matter and nutritive contents of the two varieties of mango. Our finding also revealed that the Mg, Ca, fat and vitamin C contents of small seeded (Abash) fruit has the highest percentage composition values of 16.98 mg/100g, 9.49mg/100g, 0.47% and 0.0075M respectively. The big seeded (Fringe) mango variety has the lowest values for Mg, Ca, fat and vitamin C at 16.13 mg/100g, 9.19 mg/100g, 0.43% and 0.0043M respectively. But, abash mango fruit (small seeded) variety has the greater value for protein than that of Fringe (Big seeded) 0.62%. The abash variety is most recommended for human consumption because of its high Magnesium, fat, vitamin C and calcium contents.

KEYWORDS: Mangifera indica L., Abash, Fringe, Soxhlet extractor.

1. INTRODUCTION

Mango is a fruit belongs to the genus Mangifera indica, consisting of numerous species of tropical fruiting trees in the flowering plant family Anacardiaceace followed by banana, pineapple, papaya and avocado (Sarkiyayi et al., 2013 , Kamila et al., 2014 and Takele, 2014). Mangifera indica is the most economically important fruit in the Anacardiaceae family. The genus Mangifera contains several species that bear edible fruits. Most of the fruit trees that are commonly known as mangos belong to the species Mangifera indica L. (Ubwa et al., 2014). Mango is considered as one of the most delicious fruits in Ethiopia. Its harvesting time is between January and May, which is in the dry season (Sompong and Pirote, 2009). It is also known as the "king of fruit," since it act as an antioxidant but low in calories and high in vitamins and minerals, mangoes make for a nutritious treat (Shobana and Rajalakshmi, 2010, Dharini et al., 2010).

Mango is known to be the most important tropical fruit of Asia, grown commercially in more than 87 countries. This contributes to nearly 50% of the worldwide production of tropical fruits (Stefan et al., 2003). The production of mango has been increasing over the years and so has been its demand (Menon and Goswami, 2013). The amount of mango production in Africa during 2009 is 13.6 million tones. Nigeria is the leading country followed by Egypt (FAO, 2009). In Ethiopia mango produced mainly in west and east of Oromia, SNNPR, Benshangul and Amhara (Desta, 2005). Mango production in Ethiopia is in fluctuated conditions, because of occurrence of diseases, lack of proper management and also weather conditions (Seid and Zeru, 2013).

The mango mainly constitutes pulp 33-70% followed by kernel 7-24% and peel 15-20% of the total fruit weight. Considering nutritional value, mango peel contains moisture, protein, ash, fibre and carbohydrates as 68.50, 2.05, 2.62, 5.40 and 26.5%, respectively and 453.92 kJ/100g energy (Muhammad et al., 2013). The kernel contains various nutrients such as high level of carbohydrates (starch), fats and some protein among others (Pitchaon, 2011). The fleshy fruit is eaten ripe or used green for pickles and other dishes and is a rich source of Vitamins A, C and D. Mangoes also contains essential vitamins and dietary minerals such as vitamins A, B, B_6, C, E and K and essential nutrients such as potassium, copper and 17 amino acids in good levels (Ilesanmi et al., 2011). The fruit flesh of a ripe mango contains about 15% sugar, up to 1% protein. Mango has antioxidant, anticancer and anti-cardiovascular abilities. Because of the high iron content they are suggested for treatment of

anemia and are beneficial to women during pregnancy and menstruation. Mangoes contain an enzyme with stomach soothing properties similar to pepsin. This comforting enzyme helps in digestion (Ijaz Ahmad et al., 2011).

The ripe fruit is variable in size and color, and may be yellow, orange, red or green when ripe, depending on the cultivar. When ripe, the unpeeled fruit gives off a distinctive resinous sweet smell. In its center is a single flat oblong seed that can be fibrous or hairy on the surface, depending on the cultivar. Inside the seed coat 1 - 2 mm thick is a thin lining covering a single embryo, 4-7 cm long, 3- 4 cm wide, and 1 cm thick (Fowomola, 2009). The process of classifying mangoes generally relies on its physical characteristics. This process is presently done using manual labor and is greatly dependent on the human visual system. Uniformity in the classification process is important so that its output is guaranteed to satisfy the requirements for exporting mangoes (Tomas, 2014). The main objective of the present study is to compare and analyze the nutritional and anti-nutritional contents of some varieties of mango grown in Arba Minch town and to determine which mango varieties have higher amount of functional properties.

1.1. Description of Study Area

Arbaminch (in English "forty springs") is a city and separate woreda in southern Ethiopia. Located in Gamo Gofa Zone of the Southern Nations, Nationalities and Peoples Region about 505 Kilo meters South of Addis Ababa, at an elevation of 1285 meters above sea level. Arba Minch received its name for the abundant local springs which produce a ground water forest. Besides the forty springs crossing the town is a river kulfo, affectionately referred to as "Cock River". This is used by the local people for washing cloths and farming and located at the base of the western side of the Great Rift Valley (Philip, 2009). The area of the study is conducted at Arba Minch town of Gamo Gofa Zone in Ethiopia. Arba Minch town is found in Southern Nation, Nationalities and People Region. It is located at 6^05'at North of equator and 37^032'east. The area covered under this town is about 2184 km^2, with altitudinal ranging from 1200 to 1400mm above sea level. The population of Arba Minch town is about 120,000 populations. Arba Minch receives the average rain fall of 900mm and an average annual temperature is about 29^oc.

2. MATERIALS AND METHODS

2.1. Chemicals and apparatus

The following material and chemical were used to carry out that study were 38% sulphuric

acid, 37% hydrochloric acid, 40% Sodium hydroxide and distilled water and apparatus such as laboratory mortar and pestle to powder the mango sample, air-dry oven for removing moisture, hot plate to heat the solution until a clear solution of mango kernel obtained and for digestion and soxhlet extractor to extract the oil (specifically, in mango sample for determination of crude protein and fat).

2.2.   Sample collection and Sampling procedure

The mango (Mangifera indica) cultivars were identified and matured fresh fruit samples of the mango cultivars were obtained Arba Minch town Kulfo garden areas. The "Kulfo" cultivar's locally known as "Abash and Fringe mango" was obtained from some mango plantations in Arba Minch town southern Ethiopia. The mango fruits were cleaned labeled and packed into plastic containers before taken to the laboratory for further analysis. Physical analysis was carried out on fruits of the identified mango (Mangifera indica) cultivars in order to determine the quantity of kernels recovery after harvesting and processing in relation to the total mango fruits.

2.3.   Determination of functional properties of the mango fruits

Functional properties of mango like Fruits weight and kernels dimension, mango kernel volume and specific gravity, pH of the fresh mango kernels, titrable acidity of fresh mango kernels and mango kernels bulk density were determined by using the prepared mango samples.

2.4.   Proximate analysis

The proximate parameters like dry matter content, total ash, crude protein in mango kernels, crude fat in mango kernels, vitamin C of the study mango variety samples were determined using the standard analytical method of Association of Official Analytical Chemists (AOAC) (2000). All measurements were in triplicate and reagents used were Analytical grade.

2.5.   Determination of anti-nutrients

The anti-nutrients screening of mango kernel such as phytate in mango kernels, oxalate in the kernels and Minerals are determined using the standard analytical method of Association of Official Analytical Chemists (AOAC).

3. RESULT and DISCUSSION

Two mango varieties comprising two improved varieties; Abash mango (AM) and Fringe mango (FM) were investigated for their functional properties, proximate composition, anti-nutrients and some other physical properties.

Table: 1: Determination of functional properties of mangifera indica L. fruits.

	Sample	Color	Length (cm)	Dimension (cm)	Firmness	Weight (g)	PH	Temperature (^{o}C)	Titrable acidity (%)
Abash Mango	T_1R_1	Yellowish	6.5	4.5	18.3	265	3.96	29	7.84
	T_1R_2	Yellowish	7.0	5.2	15.0	270			
	T_1R_3	Yellowish	6.0	4.2	15.2	257.5			
Fringe Mango	T_2R_1	yellowish	6.0	4.0	7.1	225	4.14	29	6.02
	T_2R_2	Yellowish	5.5	4.2	8.9	249.5			
	T_2R_3	Yellowish	5.5	4.0	15.0	257.5			

*T= Treatment and R= Root

The results reported in the table 1 reflect that the functional properties of the two mango varieties (Abash and Fringe) for their pH and titrable acidity were determined. The pH of the two mango verities (Abash and Fringe) ranged from 3.5 - 4.2 with average value of 4.05. Abash mango verity had the highest pH value of 4.14, while the minimum pH was observed in Fringe mango with the value 3.96. The results also show the percentage composition of titrable acidity which for Fringe mango verity 7.84% and Abash mango variety had 6.02%. Thus indicate that Fringe mango variety had the maximum titrable acidity, while the minimum titrable acidity was observed in Abash mango variety. Significant differences were observed among both Mango varieties studied (Table 1). Mango varieties; Fringe represented by T_1R_1, T_1R_2, and T_1R_3 had the higher mature yellowish 265 g, 270g and 257.5g respectively. While, the lower yellowish fruit weight was recorded in Abash represented by T_2R_1, T_2R_2 and T_2R_3 had 225g, 249.5g and 247.5g respectively. Data on kernels dimension were also found statistically significant (Table 1). Maximum kernels were observed in fringe 4.5cm, 5.2cm and 4.2cm represented by T_1R_1, T_1R_2 and T_1R_3 respectively. While, minimum kernel dimension were recorded in Abash represented by T_2R_1, T_2R_2 and T_2R_3 4cm, 4.1cm and 4cm respectively.

Data regarding fruit length of Mango varieties should significant differences (Table 1).Mango varieties; Fringe produced the higher fruit length represented by (T_1R_1, T_1R_2 and T_1R_3) 6.5cm, 7cm and 6.4cm respectively. While, the smaller fruit length represented by (T_2R_1, T_2R_2 and T_2R_3) 6cm, 5.5cm and 5.5cm recorded for Abash Mango variety respectively. The result in table 1 shows fruit firmness varied notably according to Mango varieties. The higher

fruit firmness values were detected in fringe represented by T_1R_1, T_2R_2 and T_1R_3 18.3, 15 and 15.2 respectively, while the lower data recorded on Abash fruit by T_2R_1, T_2R_2, and T_2R_3 7.1, 8.9 and 14.9 respectively.

Table 2: determinations of nutrients, anti-nutrients and mineral elements in mangifera indica Linn fruit.

Parameters	Samples	
	Abash Mango (T_1R_1)	Fringe Mango (T_2R_1)
Oxalate (mg/100g)	1.41	1.75
Protein (%)	0.62	0.46
Fat (%)	0.47	0.43
Dry matter (%)	17.4	15
Mg (mg/100g)	16.98	16.13
Ca (mg/100g)	9.49	9.19
Total ash (%)	6.20	16.20
Vitamin C (mg/1000g)	0.0075	0.0043
Phytate(mg/100g	0.61	0.75

Two varieties of mangifera indica L. namely Abash (small seeded) and Fringe (big seeded) were investigated for their protein, fat, ash and dry matter contents. Similarly, mineral elements like Ca^{2+} and Mg^{2+} contents were also determined vitamin C (ascorbic acid) and the anti-nutritive characteristic (oxalate and phytate) of two mangifera indica L. Were assessed. The result in table 2 shows percentage composition of ash, dray matter and nutritive contents of the two varieties of mango. Our finding also revealed that the Mg, Ca, fat and vitamin C contents of small seeded (Abash) fruit has the highest percentage composition values of 16.98mg/100g, 9.49mg/100g, 0.47% and 0.0075M respectively. The seeded (Fringe) mango variety has the lowest values for Mg, Ca, fat and vitamin C at16.13mg/100g, 9.19mg/100g, 0.43% and 0.0043 M respectively.

All the mango varieties show marked variations in respect of vitamin C or ascorbic acid (Table 2). The higher vitamin C contents were obtained from Abash Mango variety (0.0075%) represented by T_2R_1, while, the lower vitamin C was found in Fringe mango variety (0.0043%) represented by T_1R_1. The protein contents for eight mango cultivars were found statistically significant (Table 2). Abash Mango variety contained higher protein contents (0.62%) represented by T_2R_1, while lower protein contents were observed in Fringe Mango variety (0.46 %) represented by T_1R_1. This result was closely related to the result obtained by Safina et al., 2014. Results in Table 2 shows that the fats contents varied from variety to variety. Abash Mango variety had higher fat content (0.47%) compared to Fringe

mango variety (0.43%). This result also closely related to the result obtained by Safina et al., 2014. Mean squares explicated significant respective varieties were variations in the mineral contents of different mango varieties in (Table 2). Mg and Ca were recorded as the higher value 16.98mg/100g and 9.49mg/100g in Abash Mango fruit respectively. Mg and Ca were recorded as the lower value 16.13mg/100g and 9.19mg/100g in Fringe Mango fruit respectively. Generally the result obtained shows that the abash mango variety is most recommended for human consumption because of its high Magnesium, fat, vitamin C and calcium contents.

4. CONCLUSION

The study has shown that the improved mango varieties (AM and FM) have both excellent eating and nutritional qualities. These finding also reveal that the two varieties of mango contain appreciable amounts of nutrients that the body requires for its normal metabolic functions. The dietary parameters of the mango fruit pulps in this study; protein content, crude fat, sugars and ascorbic acid content on the average, meet local and international requirements recommended. The anti-nutrient contents are negligible by international standard. The Abash variety is most recommended for human consumption because of its high Magnesium, fat, vitamin C and calcium contents. Here we have determined some nutritional characteristics using Soxhlet extraction method described in AOAC (2000) was adopted and compare the result for developing accurate analysis method.

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