PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition 10 (6): 555-557, 2011
ISSN 1680-5194
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Amino Acid Profile and Micronutrient Composition of the African Pear (*Dacryodes edulis*) Pulp

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Abstract: The proximate composition, pH, titrable acidity, amino acid profile, mineral and water-soluble vitamins content of African pear pulp were analyzed. The moisture content was 13.79% which resulted to a high dry matter content of 86.79%. This suggests a nutrient dense pulp and a quicker dehydration rate with low energy input. A high oil content (32.56%) was also observed which will give a high yield of edible oil during oil extraction process. Some of the minerals found were sodium (3756.86 mg/kg), iron (15.33 mg/kg), manganese (89.72 mg/kg), copper (63.69 mg/kg) among others. Ascorbic acid (164.84 mg/100 g), niacin (17.11 mg/100 g) and pyridoxine (33.9 mg/100 g) was found. Among the essential amino acids, leucine (7.49 g/100 g protein) was highest while methionine (0.81 g/100 g protein) was lowest. Tryptophan was not detected in any of the samples. The nonessential amino acids were also found in varying amounts. Glutamic acid was highest (13.24 g/100 g protein) while histidine was lowest (2.19 g/100 g protein). The results show that African pear pulp can be a useful raw material for edible oil production while its cake can be useful in food and feed supplementation.

Key words: African pear, pulp, amino acids, vitamin, mineral, nutritional composition

INTRODUCTION

The African pear (*Dacryodes edulis*) is found in various parts of West and Central Africa. The fruit matures within the months of April and September and ripening is indicated by a change in colour from pink to bluish black (Kapsue and Kayem, 1998). The fruit is normally eaten raw or softened in hot water or ash and eaten as accompaniment to boiled or roasted maize (Ekpa, 1993).

While every measure is taken to boost food production through agriculture, a lot of interest is currently being focused on the possibilities of exploiting the vast potentials in the less familiar food plant resources existing in the wild (Rao, 1994). Many such plants have been identified, But the lack of accurate and consistent data on their chemical composition and nutritional properties has limited the prospect for their broad utilization (Vijayakuman *et al*., 1995). Such is the case of the African pear (*Dacryodes edulis*), which is grossly underutilized despite its annual yield and nutritional composition.

The seasonality of the African pear fruit and its high perishability also leads to very low economic value of the fruit in Nigeria. There are no commercially available products made from African pear fruit. The fruits are only consumed locally and sold as produce in local markets. There is therefore the need to study in detail the nutritional composition of the edible pulp in order to maximize its potentials.

This work is therefore aimed at investigating, in as much detail as possible, the nutritional composition of the edible fruit pulp, in order to ascertain its potential contribution to food formulations and diet in general.

MATERIALS AND METHODS

The mature ripe African pear was obtained from marked trees selected from the three geo-political zones of Imo state, Nigeria. The fruits were wiped clean using a soft cloth and then cut into two halves to release the seeds which were discarded while the edible pulp was used for the various analyses described below.

The proximate composition, pH and titrable acidity were determined using methods described by AOAC (1995). The amino acid profile was determined using methods described by Speckman *et al*. (1958). The chemical score was calculated with the formular:

Chemical score = g amino acid per 100 g test protein/g amino acid per 100 g reference protein x 100

(Ihekorpnye and Ngoddy 1985; FAO, 1985)

The mineral elements were determined using the methods described by AOAC (1995), while the water-soluble vitamins were determined using the method described by Augustine (1958).

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Table 1: Proximate composition, pH and titrable acidity of African pear pulp

Component	Content
Moisture (%)	13.79
Protein (%)	8.26
Dietary fibre (%)	9.17
Ash (%)	3.15
Fat (%)	32.56
Carbohydrate (%)	32.19
TTA (%)	5.90
pH	5.07

RESULTS AND DISCUSSION

The results of the proximate analysis, pH and titrable acidity of the African Pear Pulp (APP) are shown on Table 1. The moisture content (13.79%) falls within the range of values reported by Omoti and Okiy (1987), but generally lower than the values reported by Enwere (1995) for most fruits such as banana (70.7%) and orange (64.8%). The low moisture content of the African pear pulp indicates a high dry matter content and hence a high nutrient dense pulp. This is also advantageous in production of dehydrated fruit. Since a small percentage of moisture is contained in the pulp, it will take less time and energy to dry. This will reduce the nutrient losses associated with the drying/dehydration process.

The mean values for protein, dietary fibre and ash were 8.26%, 9.17% and 3.15% respectively. The fat content of 32.56% suggests that African pear pulp can be used as raw material in commercial oil extraction processes. The value compares well with most oil seeds such as soybean (20%) and groundnuts (27.7%) which are already in use in the vegetable oil industry (Enwere 1995). The high protein, dietary fibre and ash contents suggest that the cake left after oil extraction can be used in food and feed supplementations. The pH of the fruit pulp is 5.07 while the mean value for acidity is 5.90%. This suggests a moderate acidity of the fruit pulp.

The mineral content of the African pear pulp is shown on Table 2. The Recommended daily intake for each element is also shown on the same Table for comparison. The mean value for Sodium was 3756.86 mg/kg. This suggests that a daily consumption of half a kilogram of APF will provide the recommended dietary allowance (1500 mg) for Sodium (FNB, 1989). The mean values for zinc (8.64 mg/kg), manganese (89.72 mg/kg), copper (63.69 mg/kg), potassium (11.83 mg/kg) and Magnesium (5.06 mg/kg) all fell within the range of values for RDA for the individual elements. Since daily consumption of the APP is generally less than 1 kg per day, the quantity of pulp consumed will only supply a percentage of the RDA for these mineral elements. This is an important contribution to the diet for most people living in Southern Nigeria especially the low and middle income group. The calcium content (2.21 mg/kg) was much lower than the other mineral elements found in APP. It was also lower than the 159 mg/kg reported for avocado pulp but higher than the value 0.1 mg/kg reported for papaya fruit (Ihekorpnye and Ngoddy, 1985). The mean values for ascorbic acid (164.845 mg/100 g), niacin (17.1 mg/100 g) and pyridoxine (33.90 mg/100 g) was obtained for the APP samples analyzed (Table 2). These values compare favorably with the values reported for other fruits such as avocado, guava, citrus, papaya (Ihekorpnye and Ngoddy, 1985; Onyeka, 2008). This is encouraging since consumption of at least 200 g of pulp may provide the RDA for these vitamins as can be seen from the RDA values listed on the same Table 2.

Table 2: Mineral profile and water-soluble vitamins in African pear pulp

Constituent	Amount	RDA (FNB, 1989; Onyeka, 2008)
Sodium (ppm)	3756.86	1500 mg
Zinc (ppm)	8.64	5-16 mg
Iron (ppm)	15.33	6-18 mg
Manganese (ppm)	89.72	40-340 mg
Copper (ppm)	63.69	30-90 mg
Calcium (ppm)	2.21	400-1200 mg
Potassium (ppm)	11.83	5-80 mg
Magnesium (ppm)	5.06	0.6-6.0 mg
Phosphorus (ppm)	ND	
Ascorbic acid (mg/100 g)	164.84	15-60 mg
Thiamine	ND	
Riboflavin	ND	
Niacin (mg/100 g)	17.11	5-20
Panthotenic acid	ND	
Pyridoxine (mg/100 g)	33.90	0.3-2.0

ND = Not Detected

Table 3: Amino acid profile of African pear pulp

Amino acid	Amount (g/100 g protein)	Chemical score (%)
Lysine	3.60	85.71
Threonine	2.80	100.00
Valine	3.43	81.66
Methionine	0.81	37.12
Isoleucine	3.39	80.71
Leucine	7.49	178.33
Phenylalanine	3.85	137.61
Tryptophan	ND	
Histidine	2.28	
Arginine	4.73	
Aspartic acid	10.52	
Serine	2.64	
Glutamic acid	14.23	
Proline	2.93	
Glycine	3.90	
Alanine	4.04	
Tyrosine	2.90	

ND = Not Detected

The amino acid profile is shown on Table 3 in comparison with the chemical scores for the essential amino aids calculated from the WHO reference protein (Ihekorpnye and Ngoddy 1985; FAO, 1985). Among them, leucine had the highest value (7.49 g/100 g protein) with the chemical score of 178.33% while

methionine was lowest (0.81g/100g protein) with chemical score of 37.12. Tryptophan was not detected in any of the samples. The non-essential amino acids are also shown on Table 3. Glutamic acid (14.23g/100g protein) was highest while histidine (2.28g/100g protein) was lowest). The quality of protein in foods is determined by the content of amino acids especially the essential amino acid. The amino acids found in APP compares well with the amino acid profile of most plant proteins (Enwere, 1995; Ihekorpnye and Ngoddy, 1985).

Conclusion: From the results, it can be observed that the African pear pulp is a nutrient dense pulp with relatively low moisture content (13.79%). This suggests that drying/dehydration may be a reasonable/cost effective option for preservation of the pulp. The pulp also has high oil content (32.56%) and may be suitable for commercial oil production. The mineral, vitamin and amino acid profile of the pulp suggests that the pulp can be useful in food and feed supplementation.

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