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Full Length Research Paper

Nutritional composition of pear fruits (*pyrus communis*).

Mahammad M.U.[1], Kamba A. S[2], Abubakar L. [1] and Bagna E.A.[1]

[1]Department of chemistry shehu shagari college of education, sokoto
[2]Department of Chemistry, Institute for Quran and General Studies, Sokoto, Nigeria

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Nutritive and anti-nutritive composition of pears fruit (*Pyrus communis)* were evaluated using standard method in, 2010. The objective of the study is to investigate the nutritional properties of pear fruit. The results analysis shows that the moisture content of seed, pulp and peel were 52.3± 1.15, 78.0± 0.57 and 64.2± 075% respectively and ash content for the seed and pulp are 2.20 ± 0.40 and 5.34± 0.57%, while that of peel had 1.60 ± 0.35% . The crude protein content is 26.00 ± 0.0% seed, pulp 14.38 ± 0.07%, while peel contains the least protein content 9.45± 0.26. The crude lipid and fibre were also found in significant amount in all the samples. The available carbohydrate content of seed, pulp is 98.21 ± 3.54%, 89.08 ± 2.02% while peel has 96.01± 00. Calculated energy values were in the range of: seed > peel > pulp. The results of mineral analysis indicated that both the samples contained appreciable amount of mineral elements with potassium as the predominant element in the samples. Amino acid composition Glutamic has highest values in both the seed and pulp 11.73, 6.58 followed by Aspartic with 8.56 seed and 5.79 for pulp while Methionine is the least 1.05 in the seed and Tyrosine with 0.34 in the peel.Anti-nutritional analysis showed that HCN, nitrate, oxalate, phytate were lower than the reference toxic standards. Therefore, the seed, pulp and peel of pear have potential nutritional uses.

Key word; Nutritional: Anti-nutrition Factors; Proximate; *Pyrus communis.*

INTRODUCTION

Fruits form an important part of the diet and are usually regarded as good foods.They are major sources of vitamin C, folic acid and dietary fibre (Brian and Cameron,1995). Foods of plant origin are capable of contributing appreciable quantities of nutrients, including protein, needed by both children and adults if properly processed and blended (Okaka *etal*., 2002). Pears (*pyrus communis*) are native to coastal and mildly temperate region of Western Europe and North Africa. The tree is medium in size, reaching 10-17 m tall. Leaves are alternately arranged, simple, 2-12cm long; the flowers are white, 2-4cm in diameter and have five petals. The pear fruit is 1-4 cm in diameter, the fruit is composed of the receptacle or upper end of the flower-stalk greatly dilated, enclosed within its cellular flesh is the true fruit (Brian and Cameron, 1995). Pears fruit are excellent source of vitamin C, less allergenic than many other fruits and its juice is sometimes used as the first juice introduced to infants [Vadivel and Janardhanam, 2005).]. Pears are consumed fresh and canned. The nutritional importance of *p. communis* is not known to majority of people consuming these fruits.

The world largest pear producing country is People's Republic of China as 11 June 2008 with total production of 12,625,000 tonnes followed by Italy with 840,516, then United state of America with799,180 while Spain has a total production of 537,400 tonnes, Argentina , South Korea, Turkey, Japan, South Africa are the 5th ,6th, 7th ,8th and 9th producing countries with total production of 520,000, 425,000, 349,420, 325,000 and 325,000 respectively while Netherlands is the least pear producing country with 224,000 tonnes per annum.

*Corresponding author Email: shafiuabdullahi@yahoo.com, Tel: +234 07032302272

These are the ten largest pear producing countries in the world (FOA /US, 2008).

Pears has play a significant role in many industries of such are their uses in wood making industries, Pear wood is one of the preferred materials in the manufacture of high-quality woodwind instruments and furniture (Info Tabac, 2010). It is also used for wood carving, and as a firewood to produce aromatic smoke for smoking meat or tobacco. Pear leaves were smoked in Europe before tobacco was introduced (Info Tabac, 2010).

MATERIALS AND METHODS

Sample collection and treatment

The fruits were botanically identified at the taxonomy section, Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria.

Preparation of pulp, peel and whole seeds of pears fruits sample

The pear fruits were purchased at Sokoto central market in sokoto state during raining season in the month of April, 2010. The fruits were opened manually in the laboratory; Both the pulp, peel and whole seeds were sun dried for four days, pulverised to a coarse powder (using pestle and mortar of La Mexicana brand. with the help of a mesh (80 t0 100 mesh, 0.18 to 0.15mm) and packed in cleaned labelled bottles prior to the commencement of the analysis, the sample are kept for 2 days at room temperature .The dried powdered samples were used for the analysis other than moisture content in which fresh samples were used.

Proximate analysis of pulp, and seeds of pears fruit

The proximate analysis was carried out in triplicates according to the methods described earlier AOAC (1990) Nitrogen content was converted to protein using a factor 6.25 (Sotelo *etal.,*1995). and carbohydrate was calculated by difference. The energy content (kJ) of the samples was estimated by multiplying the percentages of crude protein, crude lipids and available carbohydrate with the recommended factors of 2.44, 8.37 and 3.57 respectively (Hassan and Umar, 2006).

Moisture content was determined by the methods described by AOAC (1990). A dried and clean crucible was placed in an oven for 30 minute, cooled in a dessicator and weighted.

One gram (1g) of the fresh sample was weighed into a preweighed crucible and placed into a hot drying oven at 105^0C for 24 hours. The sample was removed, cooled and placed in a desiccator for some time and weighed again the process was repeated until a constant weight was obtained.

$$\% \text{ Moisture} = \frac{\text{Lost weight}}{\text{Sample weight}} \times 100$$

Mineral analysis

Sample Digestion

Wet digestion procedure was used for determination of mineral element. One gram (1g) of the dry powder samples was digested with a mixture of nitric / perchloric / sulphuric acids in the ratio of (9:2:1 v: v) respectively.

The Na and K Contents of the samples were determined using flame emissions spectrophotometer (200-A model, Buck Scientific Ltd UK), phosphorus by Vanado-molybdate methods [5]. While other elements like Calcium, Magnesium was determined using atomic absorption spectrophotometer (Alpha 4 model, Buck Scientific Ltd USA). All analyses were carried out in triplicate and reported as mg/100 g dry matter.

Anti Nutritive Analysis of the pear pulp, peel and seeds

The method described earlier by Hassan *etal.,* 2009_b was adopted for the determination of phytate and Hydrocyanic acid were determined by the AOAC (1990) method. Oxalate and nitrate were analysed by the methods of Hassan *etal*., 2009_b.

Nitrate Determination

$1cm^3$ of the sample was pipetted into screw cap test tubes. $9cm^3$ of the 20% acetic acid and 0.5g of Bray's indicator powder were added to each test tube, Shaken for one minute and kept in a dark place. Each test tube was put in centrifuge tube holder and centrifuged at 3000 revolutions per minute until the supernatant liquid was clear. The film on top was removed and the clear red solution was poured into a cuvette of spectrophotometer (LF 2400 Wandaus, Germany) and the concentration of NO^-_3 in mg/L measured. The process was repeated three times. The process was repeated three times. From the results, the concentration of NO^-_3 in the sample was calculated using equation below.

$$NO^-_3 \text{ in mg/L} = \frac{NO^-_3 \text{ in mg/l X volume of sample}}{\text{Weight of sample}} \times 100$$

Analysis of Amino Acid

Two grams of the sample was used to measure of nitrogen (Kjeldahl) (AOAC, 1990). Amino acids content in the samples was determined using ion exchange chromatography by Technicon Sequential multisampling Amino Acid Analyzer, adopting the method of (Hassan *etal*., 2009). Defatted sample was dried and milled into a fine powder.30mg of the powder was weighed into a glass ampoule to which 5 cm^3 of 6 M HCl and 5 moles norleucine (2-amino hexanoic acid) internal standard was added. The ampoule was evacuated by passing nitrogen gas to prevent oxidation of some amino acids during hydrolysis. The ampoule was then sealed with Bunsen burner flame stored in an oven thermostat at 110oC for 24 hours. After hydrolysis, the ampoule was cooled, broken at the tip and the content was filtered. The filtrate was then evaporated to dryness at 40oC under vacuum in a rotary evaporator. The residue was dissolved to 5µL (for acid and neutral amino acids) or 10 µL (for basic amino acids) with acetate buffer, pH 2.2. The aliquot was then loaded into cartridge of amino acid analyser. The chromatograms obtained along with automatic pen records indicate amino acids peaks corresponding to the magnitude of their respective concentrations. Quantification was performed by comparing the peak area of each amino acid in the sample to the area of the corresponding amino acid standard of the protein hydrolysate (0.02 µ mole)

Statistical Analysis

Data were expressed as mean (standard deviation). The significant differences between the groups were assessed by one-way

Analysis of Variance (ANOVA) test using SPSS 10.0 (an IBM Company Headquarters, 233. S.Wacker Drive, 11thfloor Chicago, Illinois 6060) and ($P< 0.05$) was considered as significant difference.

RESULTS AND DISCUSSION

The results of the Nutritional composition of seed, pulp and peel of peer fruit (*Pyrus communis*) are summarized in tables 1-5 below.

DISCUSSION

Proximate composition of seeds, pulp and peel pears fruits

The result showed that the seed has moisture content of 52.3 ± 1.15% which is higher than those of vegetable spaghetti seed 45.67±2.03%, while the peel and pulp are lower than the vegetable spaghetti respectively (Hassan *etal*., 2009$_a$). The higher moisture content of seed and pulp is associated with rise of microbial activities during storage (Hassan *etal*., 2009$_a$) The moisture content in the fruit edible portion (pulp and peel) was comparable to some other vegetables (72-92%)(Hassan *etal*., 2009$_{a;b}$)

The ash content of the pears fruit ranged between 2.20 ± 0.40, 5. 34± 0.57, 1.60 ± 0.35% for the pear fruit seed, pulp and peel respectively which are significantly difference between the sample analysed ($p<0.05$). The crude protein concentration of fruit analyzed ranged between 6.00 ± 0.01 % for the seed, which is significantly ($p<0.05$) higher than the pulp and peel of the sample used, this shows that the pears fruit parts can be used to enrich human and animal feed or can serve as protein supplement in formulation of baby food. Proteins are essential component of diet which supplies adequate amounts of amino acids (Pugatenthi *etal*., 2004) Protein deficiency causes growth retardation and abnormal swelling of the belly (Zarkada et al., 1997).

The crude lipid content of pear fruit seed is within the range of 2.06 ± 0.75% while the value obtained for the pulp 5.60 ± 0.57%, which is lower than that of the pulp of vegetable spaghetti 12.00 ± 00% and significantly higher ($p<0.05$) compared to the seed and peel content (Hassan *etal*., 2009$_a$). Lipids are essential because they provide the body with maximum energy (Dreon *etal*., 1990).

Low crude fibre and ash content were observed in both the fruit samples analyzed which recorded (0.60 ± 0.12, 0.53 ± 0.06 0.72 ± 0.08) for seed, pulp and peel respectively, in which the higher fiber content may caused intestinal irritation and low digestively resulting in the decrease in nutrient utilization. Fiber helps in the maintenance of human health by reduce cholesterol level in the body and decreasing the risk of various cancers and improved general health (Hassan *etal*., 2009$_a$).

Higher percentage of carbohydrate determined by difference ranged between 98.21 ± 3.54, 89.08 ± 2.02 and 96.01±00 in seed, pulp and peel respectively of the fruit under investigation may indicate it possible use as high carbohydrate source in food formulation and fodder for animals The seed and the pulp of the fruit can be considered as a potential source of carbohydrate. High carbohydrate content of feed is desirable while deficiency causes depletion of body tissue (Barker, 1996).

Low ash content and fiber reported in the present study is an indication of the sample to have low amount of mineral elements, since ash content is an index of minerals present in the sample (Hassan *etal*., 2009$_{a.}$).

Mineral composition of seeds, pulp and peel pears fruits

The concentration of different mineral elements of seed and pulp and peel of pear fruit analyzed, indicate low level of calcium, magnesium sodium, potassium and phosphorus were observed when compared with recommended dietary allowance by (NRC,1989). Low amount of phosphorus and calcium determined in the sample may still contribute in bone formation. Also low potassium may till reduces the risk of stroke while low sodium content may add value in osmotic regulation of the body fluids and transmission of nerve impulse (Hassan *etal*., 2009$_{a.}$).

Amino acids Composition of seed and pulp of pears fruits

The nutritive value of the plants protein quality are usually assessed by comparing it essential amino acids content with reference standard ideal protein set by (FOA,1991], which is based on the amino acids need for the children aged 2- 5 years.

The results of amino acid analysis showed that the seed contained the highest essential amino acids needed, with above 100% chemical score, while the pulp however been poor source of protein but still contribute in solving protein malnutrition problem, with sulphur containing amino acids as the most limiting amino acids, therefore the pulp has a chemical score of less than 100%, but still will contribute to a large percentage of total body requirement.

However in comparison with the reference standard for ideal protein, the value for leucine and Isoleucine contents of *pears* seeds were above the recommended amino acid requirements (4.6g/100g protein) for infants, while the pulp content of amino acids is adequate for both pre-school children between the age of 2 –5 years, school children between the age of 10 – 12 years and the adults (Hassan *etal*., 2009$_{b.}$).These amino acids were found to be higher than 1.9g/100g protein set as

Table 1: Proximate composition of seed, pulp and peel of pear fruit (*Pyrus communis*)

Parameter	Concentration (% dry weight)		
	Seed	Pulp	Peel
Ash	2.20 ± 0.40	5.34± 0.57	1.60 ± 0.35
Crude protein	26.00 ± 0.01	14.38 ± 0.07	9.45± 0.26
Crude lipid	2.06 ± 0.75	5.60 ± 0.57	0.72± 0.08
Crude fibre	0.53 ± 0.06	0.60 ± 0.12	0.23± 0.08
Moisture	52.3 ± 1.15	78.0 ± 0.57	64± 0.75
Carbohydrate	98.21 ± 3.54	89.08 ± 2.02	96.01±00
Calorificvalue (KJ/100g)	1694.79	1599.02	1683.29

Values are expressed as mean ± standard deviation of three replicates.
Significantly different P< 0.05

Table 2: mineral composition of seed, pulp and peel of pear fruit (*pyrus commins*).

Mineral element	Seed	Pulp	Peel
Sodium	8.31 ± 3.87	5.70 ± 3.87	2.06± 0.08
Potassium	195.2 ± 2.26	91.7 ± 4.9	56.2± 0.26
Calcium	19.6± 0.75	14.9 ± 0.02	4.2± 0.06
Magnesium	15.4± 0.75	10.06 ± 0.01	8.04± 0.52
Phosphorous	5.29 ± 0.02	2.92 ± 0.02	1.0± 0.01

Values are expressed as mean ± standard deviation of three replicates.
Significantly different P< 0.05

Table 3: Amino acids composition of pears fruit seed and pulp. (mg/100g protein)

Amino acid	Seeds	Pulp
Protien	26.00 ± 0.01	14.38 ± 0.07
Leucine	6.86	4.98
Isoleucine	3.69	3.18
Methionine	1.05	0.72
Phenylalanine	3.76	3.13
Lysine	4.38	3.28
Therionine	2.20	2.12
Tyrosine	3.04	0.34
Valine	3.86	3.02
Aspartic	8.56	5.79
Glutamic	11.73	6.58
Serine	3.14	1.77
Glycine	3.67	2.81
Alanine	4.45	2.71
Histidine	3.26	2.87
Arginine	4.81	3.09
Cystine	1.68	0.56

reference standard (FOA, 1991]. This implies that the amino acids composition in the seed and pulp of pear fruit has a high biological value and could contribute in meeting the human requirements of these essential amino acids.

Anti-nutritional composition of seeds, pulp and peel of pears fruits

The levels of the anti-nutritional factors are reported in table 5. The phytate, oxalate, Cyanide and Nitrate determined in the sample are all below the recommended toxic levels caused by the presence of anti-nutritional factors (Birgitta and Caroline, 2000)]. Anti-nutritional factors interfere with metabolic processes, so that growth and bioavailability of nutrients are negatively influenced. These factors stand as indices for judging the nutritional value of any given food substance (Binita and Khtarpaul, 1997). Oxalate can bind to calcium in food thereby rendering calcium unavailable for normal physiological and biochemical roles such as the maintenance of strong teeth, nerve impulse transmission, clotting factor in blood

Table 4: Comparison of essential Amino Acids Composition of the Seeds and Pulp of pears fruit with FAO/WHO/UNU reference value

Amino acid	Composition (mg/100gprotein)		FAO/WHO/UNU reference value*	Chemical score	
	Seed	Pulp		Seed	Pulp
Isoleucine	3.69	3.18	2.8	132	114
Leucine	6.86	4.98	6.6	104	75
Lysine	4.38	3.11	5.8	76	54
Methionine + Cysteine	2.73	1.28	2.5	144	51
Phenylalanine + Tyrosine	6.74	3.47	6.3	107	55
Threonine	2.20	2.12	3.4	65	62
Valine	3.86	3.02	3.5	110	86

* Source: FAO/WH/UNU (1991).
Chemical scores are calculated using the formula= Amino acid of the sample analyzed / Standard Reference value of the amino acid

Table 5: anti-nutritional composition of seed pulp and peel of pear fruit (pyrus commins)

Anti-nutritional factors	Concentration (mg/ 100g dry weight)		
	Seed	Pulp	Peel
Phytate	5.48 ± 0.60	2.17 ± 0.07	1.58±71
Hydrocyanic	2.10 ± 0.08	1.14 ± 0.90	2.82±62
Oxalate	15.95 ± 1.01	11.64 ± 0.69	2.01±24
Nitrate	14.17 ± 1.94	10.41 ± 0.29	5.63±23

Values are expressed as mean ± standard deviation of three replicates.

and cofactor in enzymatic reactions (Ladeji *etal*., 2004). Loss of calcium leads to degeneration of bones, teeth and impairment of blood clotting process (Badifu and Okeke 1992)Phytic acid (Inositol hexaphosphate) found in plant materials, is known for its chelating effect on certain essential mineral elements such as Ca, Mg, Fe and Zn to form insoluble phytate salt (Agte *etal*., 1999).

CONCLUSION

The present study suggests that pear fruit is a nutritious fruit having enough essential nutrients. Although no single plant can provide with adequate level of all nutrients require by human being, yet the pears fruit contain many essential nutrient like carbohydrate, protein, ash and moisture contain, it also provide with some essential element like calcium, phosphorus, sodium and magnesium moderate enough to meet with the recommended daily allowances. Moreover, the amino acid content of the fruit is rich, in which out of 26 known amino acid pear fruit seeds and pulp contain 17 amino acid, Nine (9) of these are considered as essential while eight (8) are non essential amino acids. Additionally and more importantly, certain anti-nutritive agent were discovered like nitrate, phytate, tannins and oxalate which are toxic and interfere with digestion and absorption, but all are below the toxic levels or acceptable daily intake, therefore the fruit has low anti-nutritional factors and it could serve as potential source in food formulation.

REFERENCES

Agte VV, Tarwadi KV, Chiplonkar SA(1999). Phytate Degradation during traditional cooking: Significance of the Phytic Acid Profile in Cereal-Based Vegetation Meals. *Journal of Food Composition and Analysis.* **12:** 161-167.

AOAC (1990). Official methods of analysis 14th edition. Association of official analytical chemists. Washington D.C

Badifu GI, Okeke EM (1992). Effect of bleaching on oxalate hydrocyanic acid and saponin of four Nigerian leafy vegetables. J.Agric. Sci.Tech. : 71-75.

Barker MM (1996). Nutrition and dietics for health care. 9th edition, Churchill Livingston New York, N. Y PP. 92-101.

Binita R, Khtarpaul N (1997). Probiotic fermentations: Effect on antinutrients and digestability of starch and protein of indigenous developed food mixture. Nutri. health. Pp 139-147.

Birgitta, G, Caroline G(2000). Exploring the Potential of IndigenousWild Food Plants in Southern Sudan. Proceedings of a Workshop Held in Lokichoggio, Kenya, pp. 22-25.

Brian AF, Cameron AG(1995) Food Science, Nutrition and Health. Fifth Edition. EdwardArnold Publisher, London. 266-284.

Dreon DM, Uranizan KM, Krauss RM, Austin MA, wood P D (1990). The effects of polyunsaturated fat and monounsaturated fat on plasma, lipoproteins. J. Am. Med. Assoc. 263: 2462.

FOA/ WHO/UNU, (1991). Protein Quality Evaluation. Food and Agricultural Organisation of the United Nation Rome, Italy.

FOA/ US (2008). Food and Agricultural Organization of United Nations: Economic and Social Department: The Statistical Division, faostat.fao.org/site/567.Accessed,13th September, 2010

Hassan LG, Usman BB, Kamba AS, Hassan SW (2009). Nutritional compositions of Vegetable sphaghetti *(Hastala past a)* Nigeria Food Journal, VOL. 27, NO. 2 2009a

Hassan LG, Usman BB, Kamba AS, Hassan SW (2009). Protein and amino acid composition of Hastala pasta spaghetti squasch. *Tropical and SubtropicalAgroecosystems 10:295-299b.*

Hassan LG, Umar KJ (2006) NutritionalValue of BalsamApple (*Momordica balsamina L).* Leaves. *Pakistan Journal of Nutrition*, 5 (6): 522-529

Info Tabac: histoire du tabac, accessed 3 June 2010, htt:/info-tabac.noname.fr/histoire-du-tabac.htm.

Ladeji O, Akin CU, UmaruHA (2004). Level of antinutritional factors in vegetables commonly eaten in Nigeria. A frican. Journal of Natural Science. : 71-73.

Okaka JC, Akobundu ENT, Okaka ANC(2002). Human nutrition: An Integrated Approach. 2 ed. OCJANCO Academic Publishers, Enugu. Pp 312-320.

Pugatenthi M, Vadivel V, Gurumoorthi P (2004). Comparative nutritional evaluation of little known legumes, tamarindus indica, Erythrima and Sesbania bispinosa. Trop. Subtrop. Agroecosyst 4: 107-123.

Sotelo AE, Contrerar S, Flores S (1995). Nutritional value and content of antinutritional compounds and toxics in ten wild legumes of Yucatan peninsula. Plant Food for Human Nutrition. 47: 115-123.

Vadivel V, Janardhanam K(2005). Plant foods for Human nutrition Pp 60: 69-75. 4“The wonder of pears” free diets. http//:www.freediets.com/fruits-vegetables/thewonderof pears. Access 12 August ,2010

Zarkada CG, Voldeng HD, Vu Uk (1997). Determination of the protein quality of three new northern adapted cultivan or common and micotypes soya beans by amino acids analysis J. Agric. Food chem.. 45: 1161-1168.