Novelty Journals

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (10-16), Month: November-December 2014, Available at: www.noveltyjournals.com

The Impact of Processing On the Nutrient Content, Vitamin and Mineral Composition of African Walnut *(Tetracarpidium Conophorum)*

[1]Okonkwo C.O, [2]Ozoude U.J

[1,2]Department of Biochemistry, College of Natural Sciences, Michael Okpara University of Agriculture Umudike, Nigeria

***Abstract*: Proximate analysis, vitamin and mineral compositions of the raw and the processed forms of Walnut (*Tetracarpidium conophorum*) were investigated to observe the impact of processing on these parameters using standard analytical methods. The result of the proximate analysis in percentage showed a significant increase in moisture content from 31.40±0.623-45.81±0.424. A significant decrease in ash content from 3.42±0.042-3.26±0.028, crude fibre from 5.58±0.170 - 4.89±0.042, 15.84±0.000-11.54±0.085 for ether extract, 22.88±0.028-19.82±0.050 for crude protein, and 20.88±0.467-14.69±0.078 for Carbohydrate. There was a significant reduction in all the minerals tested for when the nut was processed from 45.30±0.042-42.66±0.247 for calcium, 61.92±0.028-58.48±0.311 for magnesium, 9.50±0.028-8.67±0.042 for sodium, 25.65±0.219-24.82±0.02 for potassium and 19.25±0.000-17.20±0.000 for phosphorus. There was also a significant reduction in all the vitamins when the nut was processed from0.09±0.000-0.05±0.000 in B1, 0.05±0.000-0.03±0.000 in B2, 0.08±0.000-0.06±0.000 in B3, 4.14±0.021-2.74±0.064 in C, 9.83±0.014-6.58±0.170 in E and 3.59±0.014-3.16±0.035 in A. The result shows that processing of walnut has a significant impact on the mineral, vitamin and nutrient composition of walnut. Apart from the moisture content which increased significantly, every other parameter examined decreased significantly. Thus it may be more beneficial to consume walnut in the raw and unprocessed form in order to enjoy its nutrients in the whole and unadulterated form.**

***Keywords*: Composition, Content, Impact, Mineral, Nutrient, Processing, Vitamin, Tetracarpidium Conophorum.**

I. INTRODUCTION

Nutrition is one of the central cores to effectively understanding and managing your health, life cycle and growth. Edible nuts are cultivated and grown in a number of growing conditions and climates, and are valued for their sensory, nutritional, and health attributes. Nuts possess anti-inflammatory activity; reduce cell proliferation, and lower serum low-density lipoprotein absorption, thereby lowering total plasma cholesterol and LDL levels. Dietary phytosterols may offer protection from cancers such as colon, breast, and prostate cancers [Amaral *et al.* 2003].

Nuts also contain significant amounts of squalene and tocopherols. Squalene has important beneficial effects on health and tocopherols are powerful antioxidants, which in high doses may reduce the risk of (coronary heart disease) CHD [Ryan *et al.* 2006]. Low quantities of tocopherol which can be obtained from average nut consumption is beneficial on CHD [Kornsteiner *et al.* 2006].

Walnut (*Tetracarpidium conophorum*), is a nut commonly eaten as snack in Nigeria. Due to high cost of living and lack of enlightenment of the general public towards nutrition and food. There is need to diversify our source of nutrients and enlighten the public on the nutritive value of the foods we consume on a daily basis. This study is aimed or geared towards finding out the different nutrient composition of walnut, and how these nutrients are affected when processed. The study will also help us take healthy decisions concerning the foods we consume. The aim of this research is to evaluate the proximate, mineral and vitamin composition of walnut, the raw and processed forms.

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (10-16), Month: November-December 2014, Available at: www.noveltyjournals.com

African walnut is a member of the Walnut Euphorbiaceae family. It is a climber found in the wet parts of Eastern and Western Nigeria. (Ayodele, 2003). It has a weak stem with long rope like internodes and flourishes well when intercropped with nitrogen fixing plants such as *Elaeagnus ebbingei* or *Elaeagnus umbellate*. (Hemery, 2001).They are usually planted under an indigenous tree that can provide strong support for the heavy weight of the climber when fully established on the crown of the tree. The fruits are four winged ridged between wings and up to 3 inches in diameter with four round seeds (usually brown) in each fruit (Nuhu *et al*., 2000). The seed (subglobose) is about 2.5cm long and has wooly materials that attach the nut to the shell when cracked open. Walnuts are edible even when raw and give a bitter taste and a stimulating effect like kola. They can be cooked, roasted or sun dried and the roasted seeds could be ground like melon seeds and used as a thickener in soup preparation. The plant has been reported to possess antibacterial efficacy (Okerulu and Ani, 2001). Decoction of leaves and seeds serve as beverage which relieves abdominal pains and fever. Dried walnuts can be ground and turned into flour which can be used as composite flour during baking or in-place of milk in tea preparation. Sizes of the nuts are often determined by the climatic conditions and cultural practices such as water and harvest management. High kernel percentages are desirable.

II. MATERIALS AND METHOD

The raw material; walnut was purchased from Umuahia main market, Abia State. The raw walnut was cracked, washed, air dried and ground while the processed walnut was boiled for about forty five minutes, after which the shells were removed and the walnut was air dried and ground to obtain the powder which was used for the analysis.

The moisture content of the nuts was determined by the gravimetric method described by (James, 1995).Total ash was determined by the incineration method (AOAC, 1996).Protein was determined by Kjeldahl digestion method described by James (1995). The Fat content of the samples was determined by the continuous solvent extraction method using a soxhlex apparatus. The method was described by Pearson (1976). Crude Fibre was determined by the Wende method (James, 1995). The carbohydrate content was calculated by difference in nitrogen free extraction (NFE) as described by James (1995). For vitamins and minerals; the sample for the determination of the element was subjected to acid digestion using concentrated percloric acid and hydrochloric acid and subsequently the different elements were determined using appropriate methods as described below by James (1995). Calcium and magnesium content of the sample was determined by complexiometric titration method described by Yarbro and Golby (1958), Sodium and potassium were determined by flame photometry method described by Richard and Davis (1947). The phosphorus in the sample was determined by the ranado-molybdate (yellow) spectrometry described by James (1995). The spectrophotometric method by (Onwuka, 2005) was employed in the determination of vitamins.

III. RESULTS

Table 1 Result of the proximate analysis of the raw walnut and the processed walnut.

Sample	Raw Walnut	Processed Walnut
Moisture	31.40 ±0.623^{b}	45.81 ±0.424^{a}
Ash	3.42 ±0.042^{b}	3.26±0.028^{C}
Crude fibre	5.58 ±0.170^{b}	4.89 ±0.042^{c}
Ether extract	15.84 ±0.000^{d}	11.54 ±0.085^{e}
Crude Protein	22.88 ±0.028^{c}	19.82 ±0.050^{d}
Carbohydrate	20.88 ±0.467^{a}	14.69 ±0.078^{b}

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (10-16), Month: November-December 2014, Available at: www.noveltyjournals.com

FIG 1: PROXIMATE COMPOSITION (%)

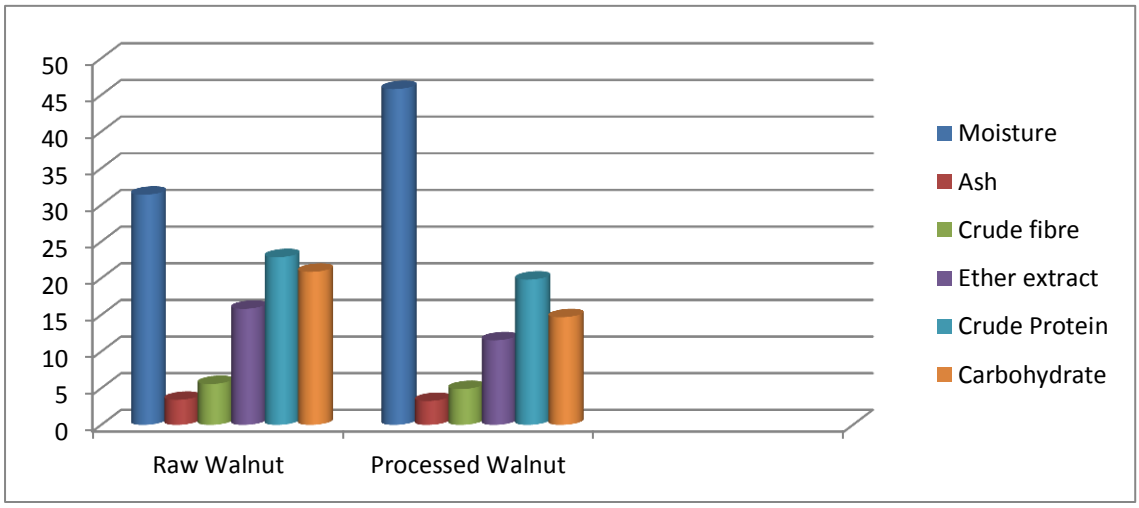

Fig 1: Histogramic Representation of the result of the proximate analysis carried out on walnut.

Table 2: Mineral Analysis of the raw walnut and the processed walnut

Minerals	Raw Walnut	Processed Walnut
Calcium	45.31 ±0.042[a]	42.66 ±0.247[b]
Magnesium	61.92 ±0.028[a]	58.48 ±0.311[b]
Sodium	9.50±0.028[d]	8.67 ±0.042[e]
Potassium	25.65±0.219[c]	24.82 ±0.021[d]
Phosphorus	19.25 ±0.000[a]	17.20 ±0.000[b]
Iron	1.30 ±0.007[c]	1.14 ±0.014[d]

(MINERAL COMPOSITION (mg/100g)

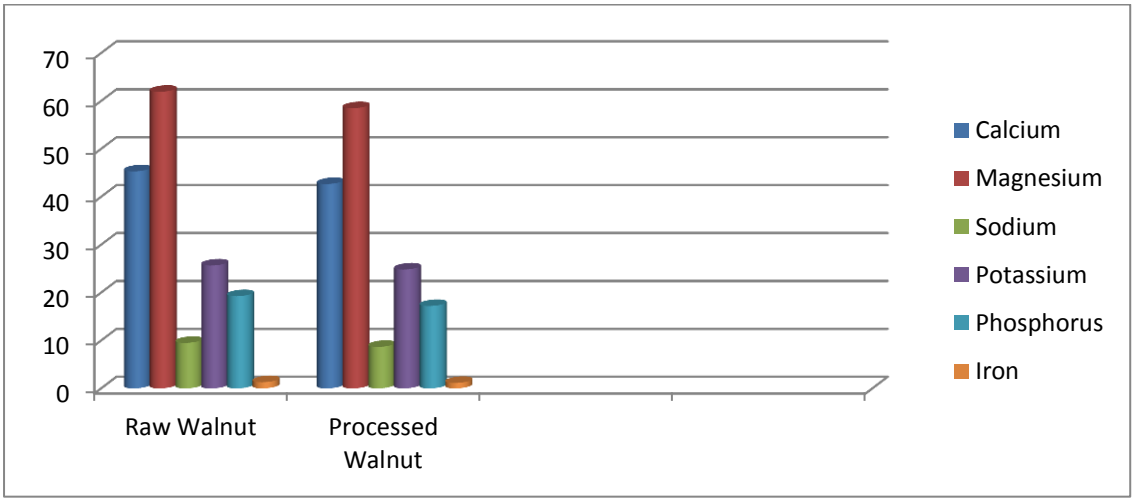

Fig2: Histogramic representation of the result of the Mineral composition analysis carried out on the walnut

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (10-16), Month: November-December 2014, Available at: www.noveltyjournals.com

Table 3: Result of the Vitamin analysis of the raw walnut and the processed walnut

Vitamins	RWN	PWN
Vitamin BI	0.09 ±0.000[a]	0.05 ±0.000[b]
Vitamin B2	0.05 ±0.000[b]	0.03 ±0.000[c]
Vitamin B3	0.08 ±0.000[b]	0.06 ±0.000[c]
Vitamin C	4.14 ±0.021[b]	2.74 ±0.064[d]
Vitamin E	9.83 ±0.014[a]	6.58 ±0.170[c]
Vitamin A	3.59 ±0.014[b]	3.16 ±0.035[c]

VITAMIN ANALYSIS (mg/100g)

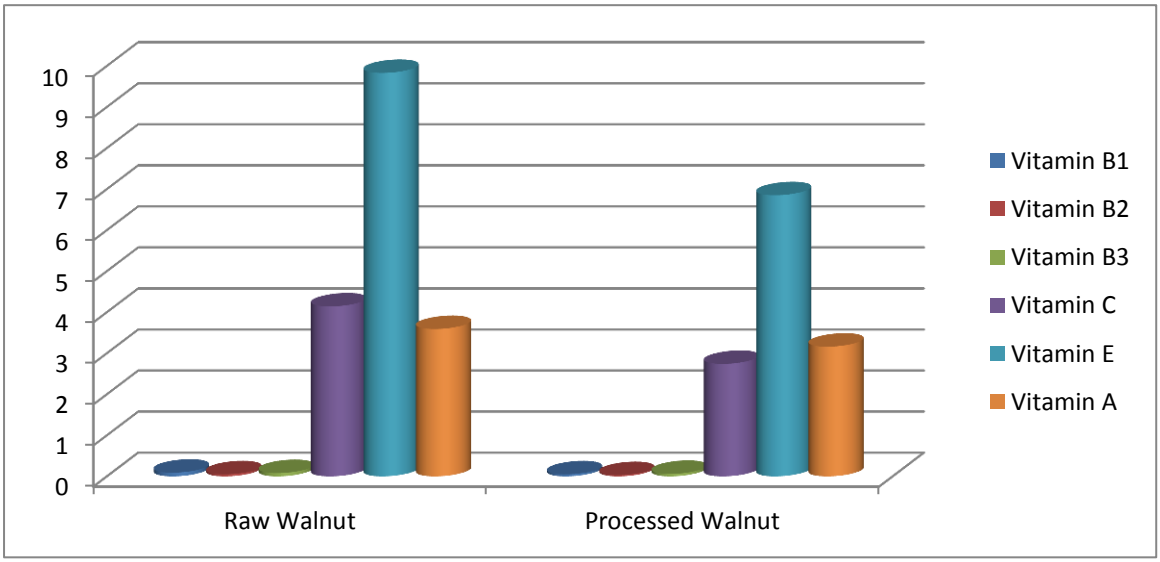

Fig 3: Vitamin composition of the raw walnut and the processed Walnut

The result from the tables shows values of triplicate determinations with their standard deviations. (Values with the same superscripts are not significantly different at P>0.05).

IV. DISCUSSION AND CONCLUSION

The significant (P<0.05) increase in moisture content from31.40±0.623 in the raw walnut to 45.81±0.424 in the processed walnut may mean that walnut is better stored in the dry form, this is because the presence of moisture or high range of moisture in nuts makes the nuts spoil faster indicating decrease in the shelf life of the nuts when it is processed.

The significant (P<0.05) decrease from 3.42±0.042 to 3.26±0.028 for ash, and from 5.58±0.170 to 4.89±0.042 for crude fibre when processed shows that processing reduces the nutritional quality of walnut. Ash is a non organic compound containing mineral compound of food and nutritionally it aids in the metabolism of other organic compounds such as fat and carbohydrate (Mc William 1978).

Crude fiber is known to aid digestion in humans.(Ihekoronye and Ngoddy, 1985) indicating that food or diet low in fiber content is undesirable and can cause constipation and that such diets have been associated with diseases of colon like

piles, appendicitis and cancer (Okon, 1983). Walnut may therefore be consumed preferably in the raw form since processing reduces ash content and crude fibre. For ether extract there was a significant ($P<0.05$) decrease from 15.84 to 11.54 f when processed. The fat and oil content of nuts contribute substantially to their high energy content (Ohler 1979, Wade and Staffor, 1968). Fat can also promote rancidity leading to development of unpleasant and odorous compounds (Ihekoronye and Ngoddy, 1985). Also, diets too high in fats predispose consumers to different illness such as obesity and coronary heart disease (Okpala and Chinyelu, 2011). Also significant ($P<0.05$) decrease in crude protein from 22.88 to 19.82 was observed. A high protein diet is recommended to help efforts to build muscle and loose fat.The use and necessity of high proptein diets in anaerobic exercise and body building is also being debated (en.m.wikipedia.org). Low protein consumption appears to alter the risk of bone breakage presumably through changes in Calcium homeostasis(Feskanich et al 1993)For Carbohydrate we had a significant ($P<0.05$) decrease from 20.88±0.467-14.69±0.078 as a result of processing.

The result of the proximate analysis showed a significant ($P<0.05$) change in all the nutrients tested for, indicating that processing has an immense effect on walnut. There was an increase in moisture, as well as decrease in ash content, crude fiber, ether, crude protein and carbohydrate. We also observed a significant ($P<0.05$) decrease in Calcium from 45.31±0.042-42.66±0.247, Mg from 61.92±0.028-58.48±0.311, Sodium from 9.50±0.028-8.67±0.042,Pottasium from 25.65±0.219-24.82±0.021.Phosphoorus from 19.25±0.000-17.20±0.000 and Iron from 1.30±0.007-1.14±0.014.The results showed that processing decreased all the minerals tested for in walnut significantly ($P<0.05$), it may therefore be advised that walnut be taken in its raw form for maximum efficiency. Calcium is essential for the normal development of the body. It is an important constituent of bones and teeth. It is also essential for many metabolic processes including nerve function, muscle contraction and blood clothing. A deficiency of calcium in the body leads to conditions such as rickets, osteomalacia and osteoporosis. A deficiency of calcium in the blood may lead to tetany. This shows that the presence of calcium in trace amounts is very necessary and can alleviate the impairments like rickets. Magnesium is important for proper functioning of muscle and nervous tissues. It is required as a cofactor for many enzymes in the body. Phosphorus just like calcium is important in bone formation, metabolism and in energy conversion and storage in the body. Sodium and potassium are important for nerve transmission and osmolarity while iron is an essential component in the transport of oxygen in the body. A deficiency of iron will lead to anaemia, therefore adequate intake of potassium and iron is necessary for a healthy life.

There was a significant ($P<0.05$) reduction in all the vitamins contained in walnut when processed. Vitamins have diverse biochemical functions, some such as vitamin D have hormone-like functions as regulators of mineral metabolism or regulators of cell and tissue growth as well as differentiation e.g. vitamin A, others function as antioxidants e.g. vitamin E and sometimes vitamin C (Bender 2003).

The B complex vitamins function as precursors for enzyme co-factors (Bolander F.F (2006). Apart from their role in assisting enzyme -substrate reactions, their other functions are equally important. This shows that processing has an obvious impact on the nutrients, minerals and vitamin content of walnut. It is therefore advised that walnut be consumed preferably in the raw form as much as possible since they can also be consumed without processing and have not been associated with toxicity in the raw form. Vitamin B1 is a co enzyme in the decarboxylation reactions of carbohydrate metabolism and a deficiency of it causes beri-beri. Vitamin B2 and B3 have the same function with other B complex vitamins;that is they are constituted of co-enzymes FAD and FMN (AOAC, 1999). Vitamin C is essential in maintaining healthy connective tissues, integrity of cell wall, and synthesis of collagen; it is also necessary to prevent scurvy. Vitamin A is essential for growth, vision in dim light and the maintenance of soft mucous tissues.

The nuts have appreciable amounts of vitamins, minerals and nutrients. The high content of ascorbic acid in wall nut also indicates that the nut in both raw and processed form can be used to prevent or at least minimize the formation of carcinogenic substances from dietary materials. The presence of carbohydrates, fat and protein also makes it a good source of energy. I recommend the enlightenment of consumers on the nutritional benefits of walnuts. Further studies could be carried out on the anti-nutritional and functional properties of walnut.

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (10-16), Month: November-December 2014, Available at: www.noveltyjournals.com

REFERENCES

[1] Anal. Chem., Arcingten, VA (1995). And nutritional value of six walnut (tetracarpidiuim conophorum) cultivars grown in Portugal," J. Agric Food Chem, vol. 51, no. 26, pp. 7698-7702.

[2] AOAC (1990). Official Methods of Analysis. Assn. of Official Anal. Chemists, Washington, D.C.

[3] AOAC. (2000). Association of Official Analytical Chemists. Official methods of Analysis (Vol. II 17th edition) of AOAC International. Washington, DC, USA.

[4] Ashley, C. W. (2001). The Ashley Book of Nuts (pp. 36-38). New York: Doubleday Association of Official Analytical Chemists, 15th edition,

[5] Ayodele , O. B., (2003). Nutrition in Nigeria Ibadan. Catoon Publishers, USA based in chemical, fatty acid and sterol composition," Eur Food Resources

[6] Bingham SA, Day NE, Luben R, (2003) Dietary fibre in food Book Group. Walnuts, almonds, peanuts, hazelnuts and the macadamia nut," Washington, DC, USA

[7] Burns J,Yokota T, Ashihara H,Lean ME,Crozier A. 2002;. Characterization of several hazelnut (Corylus avellana L.) cultivars "Fatty acid profile, squalene and phytosterol content of Brazil, pecan, 1149–1155. 171-178.

[8] E. Ryan, K. Galvin, T. P. O'Connor, A. R. Maguire, N. M. O'Brien, 2006"Fatty acid profile, squalene and phytosterol content of Brazil, pecan,pine, pistachio and cashew nuts," Int. J. Food Sci Nutr., vol. 57, no. ¾, pp. 219-228.

[9] E. Ryan, K. Galvin, T. P. O'Connor, A. R. Maguire, N. M. O'Brien, (2006). Colorectal cancer. J Natl Cancer Inst 93, 525–533. Contents of two Nigerian medicinal plants International.

[10] Hemery, G. E. (2001). Growing walnut in mixed stands. Quart J. Forestry, 95, 31-92. International Journal of Food Science and Nutrition, vol. 55, no. 3, pp.

[11] Ihekoronye A.I, Ngoddy P.O. (1985). Integrated food science and technology for the tropics. 1st ed. McMillan publishers. pp. 261- 291.

[12] James, (1995). "Nut consumption and body weight "Am J Clin Nutr, vol. 78(suppl), pp.647S–650S.

[13] Messiaen, C. M. (1992). The tropical vegetable garden. Maemillian ltd. London and Basing stoke. P 218-247.

[14] Nuhu, A. M., Mshelia, M. S. & Yakubu, Y. (2000). Antimicrobial screening of the bark extract of Pterocarpus erinaceous tree. Journal chemical society of Nigeria, 25, 85-92.

[15] O. A. C. (1999). Official Method of Analysis (16th ed., pp. 930-935). Washington D.C.:

[16] O'Brien, (2004) "Fatty acid profile, squalene and phytosterol content of Cancer Research (1997) Food, Nutrition and the Prevention of Cancer: a global perspective. Menasha, USA: BANTA

[17] Okerulu, I. O. & Ani, C. J. (2001). The phytochemical analysis and antibacterial screening of extracts of Tetracarpidium conophorum. Journal of Chemical Society of Nigeria, 26(1), 53-55.

[18] Okpala, L.C. and Chinyelu, V.A. (2011). Physicochemical, Nutritional and Organoleptic evaluation of cookies form pigeon pea (Cajanus cajain) and cocoyam (Xanthosoma sp) flour blends. AJFAND 11(6):5431-5443.

[19] Onwuka, G. I. (2005). Food Analysis and Instrumentation (p. 143). Surulere, Lagos:

[20] Pearson, D. (1976). The Chemical Analysis of Food (2nd edition). Edinburgh,London and New York: Longman Group Ltd. phenolics in 10 different nut types," Food chemistry, vol. 98, pp. 381- phenolics in 10 different nut types," Food chemistry, vol. 98, pp. 381-pine, pistachio and cashew nuts," Int. J. Food Sci Nutr., vol. 57, no. ¾, Polyp Prevention Trial Study Group. N Engl J Med 342, pp. 219-228. Publication-Madison, June 8.

[21] Pomeranz & Clifton, D. (1981). In food analysis theory and practices. Westport, L. T., AVI Publishing Comp. p 17, properties of defatted soyabean, peanut field pea and pecan flours. J. Food Sci. 42, 1440 - 1450.

[22] Pomeranz & Clifton, D. (1981). In food analysis theory and practices. Westport, L. T., AVI Publishing Comp. p 17, properties of defatted soyabean, peanut field pea and pecan flours. J. Food Sci. 42, 1440 - 1450.

[23] Richard R Overman and Davis A.K (1947).The Application of Flame Photometry to Sodium and Potassium Determinations in biological fluids.J.Biol.Chem

[24] Rosengarten, F., (1984). The Book of Edible Nuts. 5th Edn., Walker and Co., New York, USA., Pp:45.

[25] Schatzkin A, Lanza E, Corle D, (2000) Lack of effect of a Science Daily (2008).Substance in red wine, resveratrol, found to keep hearts young. University of WisconsinSciences,1(4):375-80

[26] Schatzkin A, Lanza E, Corle D, (2000) Lack of effect of a low-fat, high-fiber diet on the recurrence of colorectal adenomas. Polyp Prevention Trial Study Group. N Engl J Med 342, 1149–1155

[27] Spore, R.G. (1997). More Cash Return from Cashew. CTA., The Nether Land, Pp: 4. study. Lancet 361, 1496–1501.

[28] Terry P, Giovannucci E, Michels KB, Bergkvist L, Hansen H, Holmberg Wade, and Stafford, (1968). The chemical analysis of foods. 7th Edition. Churchill live store, p. 205-206

[29] Wade, and Stafford, (1968). The chemical analysis of foods. 7th Edition. Churchill live store, p. 205-206.

[30] WCRF, & AICR: World Cancer Research Fund & American Investigation of Cancer Research (1997) Food, Nutrition and the Prevention of Cancer: a global perspective. Menasha, USA: BANTA Book Group.

[31] Yarbro C.L and Golby R.L (1958).Complexiometric Titration of Urinary Calcium and Magnesium. Anal. Chem 30(4) :504-506.