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NUTRITIONAL AND PHYTOCHEMICAL EVALUATION OF FARMER FATTY CAKES OF CASHEW NUT (ANARCADIUM OCCIDENTALE L.)

Silué F. E.[1*], Méité A.[2], Kouakou N'. D.V.[3], Ouattara H.[4] and Kati-Coulibaly S[5].

[1,2,5]*Laboratoire de Nutrition et Pharmacologie, UFR Biosciences, Université Félix Houphouët-Boigny, Côte d'Ivoire*

[3]*Institut National Polytechnique Félix Houphouët-Boigny, Yamoussoukro, Côte d'Ivoire*

[4]*UPR Physiologie Animale, UFR Sciences Biologiques, Université Peleforo Gon, Korhogo, Côte d'Ivoire*

**Corresponding author: Silué Fatogoma Etienne*

Abstract

The Nutritional and phytochemical evaluation of farmer fatty cakes of cashew nut (Anacardium occidentale L.) from Côte d'Ivoire has been determined. The chemical composition (%) was: moisture (9.53 ± 53), ash (4.08 ± 1.67), fat (21.98 ± 0.01), proteins (25.75 g ± 0.001), Fibers (3.44 ± 0.35) and carbohydrates (38.30±0.12). The energy was 467.51 Kcal / 100g. The average mineral content (mg / 100g) shows that cashew nuts contain calcium (55.48 ± 0.03), sodium (8.96 ± 0.01), phosphorus (672.38 ± 0.54 Potassium (799.27 ± 0.44), magnesium (266.42 ± 0.32), iron (33.05 ± 0.13), zinc (16.32 ± 0.04), chromium (262.75 ± 0.88). The phytochemical analysis of cashew cakes revealed the presence of polyphenols, flavonoids and tannins. Anti-nutritional factors such as phytate and cyanidic acid have also been detected. It is obvious that cashew meal is a good source of energy, protein and minerals. However, what should be undelined is that, that the use of fatty cake of cashew nuts in in animal feed will be linked to factors other than their nutritional value, particularly their economic value.

Key words: Côte d'Ivoire, cashew nut, fatty cake, nutritional, phytochemical, fat, protein, ash, fiber, energy

I. INTRODUCTION

Artisanal methods of pressing oil seeds, especially cashew nut kernel, are locally used by the populations to obtain oil and cake of cashew nut that can be used by breeders. Indeed, since 1970, industrial processing of cashew nut tends towards complete mechanization of the production line. However, significant difficulties arise, due to the disparity of the nuts size and the brittle nature of the almonds. The different crushing processes are based on three principles: percussion, shearing (principle of the Oltremare process) or milling. According to the methods, the yields vary from 60% to 83% of whole almonds (Dogo *et al.*, 1999).

Incidentally, other products are valued from the nut industry. From the debris of pruned almonds, it is possible to obtain cashew butter which is a product similar to peanut butter or cashew kernel oil (Lautié *et al.*, 2001). After grinding, they can be used for livestock feeding (Dogo *et al.*, 1999). They are pressed on farm to improve the protein autonomy of the farms (Lautié *et al.*, 2001). The pressed cakes seem rich in fat, protein and carbohydrates.

From now, the literature on cashew nut in Côte d'Ivoire remains very limited, while the tables INRA-AFZ (2004) do not offer values on the chemical composition of these new products. Noweher, there is a strong demand from the field to know these values, which constitute a prerequisite for rationing calculations.

The objective of this study is therefore to determine the nutritional and phytochemical evaluation of the cashew kernel cake from the traditional pressing technique.

II. MATERIAL AND METHOD

2.1. Collection of samples

Broken almonds were obtained in a cashew husking unit in Bouaké in the center of Côte d'Ivoire.

2.2. Methods

2.2.1. Production of farmer oil-fed cakes

Farmer oil-fed cakes were produced from the same lot of cashew kernels at the educational farm of ''Ecole de Spécialisation en Elevage et Métiers de la Viande de Bingerville (ESEMV-B)''. The term "cake" refers to the residue derived from the pressing of the seeds of cashew nuts. The cashew nuts were roasted at 100 °C for 1 hour until gray. The almonds were crushed in a mill and then the dough, put in a polyethylene bag, and pressed with a manual press for 48 hours. The cake obtained is put in the sun for one day to be dried. The cake is obtained from an artisanal presse.

2.2.2. Determination of chemical composition

The bromatological analysis of cashew kernel cakes concerned the determination of moisture by dehydration, total nitrogen by the method of Kjedhal, crude cellulose by the Sheerer method, fat by the method of Soxhlet. All these analyzes were performed according to the procedure described by the Association of Official Analytical Chemist (AOAC, 1975). Metabolizable energy was estimated using the regression equation of Sibbad (1980) quoted by Labarbier and Leclercq (1992,): **EM = 3951 + 54.4MG - 88.7 CB - 40.8MM** where MG = fat; CB = crude fiber; MM = total ash.

2.2.3. Dosage of sugars

The reducing sugars were quantified according to the method of Bernfeld (1955). The total sugars are determined by the phenol-sulfuric method, as described by Dubois *et al.* (1956).

2.2.4. Analysis of minerals

The ash was obtained by incinerating a 2 g sample at 750 ° C for six hours in a muffle furnace (Nabertherm B 180, Germany). The sample was removed and cooled in a desiccator. Approximately 10 mg of the residue from the ash sample was removed and plated on a primer with double-sided adhesive carbon.

The composition of the minerals was determined by point microanalysis with a scanning electron microscope coupled with energy dispersive spectrometry (SEM-EDS (Supra 40 VP Zeiss, Germany).

2.2.5. Determination of phytochemical composition, *in vitro* antioxidant activities and antinutritional factors

The polyphenols were determined by the method of Singleton *et al.* (1999). The content of the flavonoids was determined according to the method of Meda *et al.* (2005). The tannins were determined by the method of Bainbridge *et al.* (1996). *In vitro* antioxidant activities were measured by the method of Choi *et al.* (2002). The phytates were quantified according to the method of Day and Underwood (1986).

III. RESULTS AND DISCUSSION

3.1. Production of oil-fats

The average on-farm artisanal extraction rate of cashew kernel fat was 60.75 ± 5.6 % and ranged from 45 to 67 %. The cake represents the majority of the final products obtained after processing: one (1) tone of pressed cashew kernel almonds produces about 720 kg of cake for 266 kg of oil. The value of the extraction rate is comparable to the average rate of extraction of the rapeseed meal obtained by Brunschwig and Lamy (2006) which was 59 %. However, they observed a higher average rate of 76 % for sunflower meal. The quantities of oilcake and oil are comparable to those of Jatropha cake, of which 1 tone of pressed Jatropha curcas seeds generates 500 to 800 kg of cake for 240 to 300 kg of oil (Devappa *et al.*, 2010). According to the Chamber of Agriculture of Brittain

(2009), the quality of pressing depends on several factors such as press performance, external temperature, cleanliness and the moisture of the nut.

3.2. Chemical composition of fatty cakes

Table 1 shows the approximate composition of the fatty almond farms of cashew nut almond. With the exception of moisture, all values are expressed relative to dry matter. The determination of the chemical composition (%) indicates that the cashew cake contained a moisture rate of 9.53 ± 0.05%. The humidity is somewhat higher than those reported by Aremu *et al.* (2006) and Omosuli *et al.* (2009) for defatted cashew nuts produced in Nigeria by 5.7% and 5.52%, respectively. This value is in agreement with that reported by Batal *et al.* (2005) and Bertin *et al.* (2008) for respectively 10% groundnut meal and 9.55% the fatty rape meal. Low water seeds can be stored for more time without deterioration. The protein content was 25.75 ± 0.9 %. This value is very similar to protein-rich foods such as soybeans, cowpeas, peas, melons, pumpkins and gourd seeds with values ranging from 23.1-33.0 % (Olaofe *et al.*, 1994), beans 19.4 % (FAO 1982).

The fat rate, with an average value of 21.98 ± 0.01 %, is in agreement with those reported by Brunschwig and Lamy (2006) for sunflower farms (20.2 %) and farmer meals Rapeseed in France, which range from 18.5 % to 30.6 %. Its fat content is comparable to that of the Jatropha oilcake, which still contains about 20 % oil after industrial oil extraction (Henning, 2005; Belewu and Sam, 2010). This average value of 21.98 ± 0.01 % is lower than the values of 36.70 and 34.95 % of the defatted cashew flour respectively reported by Aremu *et al.* (2006) and Omusuli *et al.* (2009). This difference may be due to the pressing times which vary according to the operator. Lipids are important in diets because they promote the absorption of fat-soluble vitamins (Bogert *et al.*, 1994). They are also a high energy nutrient and therefore no longer need to be added into the diet.

The ash rate of cashew nut cake in this study was 4.08± 0.02 %. Previous studies have shown that the ash content of cola nut, beans and cowpea was respectively 3.1 %,; 3.6 % and 3.2 % (Arogba *et al.*, 1999) and cashew meal 4.4 ± 0.1 % (Aremu *et al.*, 2006).

The cashew nut cake fiber rate of 3.44 ± 0.35 % is matches the USDA nutrient database for cashew nut content ranging from 3.0 to 3.8%. That value is high compared to 1.42 ± 0.2 % for fat-free cashew nuts as reported by Omosuli *et al.* (2009). The raw fiber helps to maintain the normal peristaltic movement of the intestinal tract, so that diets containing low fiber can cause constipation and possibly lead to colon diseases (piles, cancer and appendicitis) (Akinhanmi *et al.*, 2008 and Okon, 1983).

The value obtained for carbohydrates (by difference) 38.30±0.12 % is higher compared to the value of 25.39 % reported by Omosuli *et al.*, (2009). This value is acceptable with respect to the expected range of average values for legumes (20-60 % dry weight basis), Arkroyed and Doughty, (1964). The values obtained for reducing sugars and total sugars are respectively 2.66 % and 9.94 %. This result confirms those found by Rico *et al.* (2016) which are on average 6.3% sugars for fresh cashew kernels.[22]

The calculated metabolizable energy value (467.51Kcal / 100 g) showed that cashew meal was a concentrated source of energy. Energy deryting from cereals varied from 310.7-382.4 Kcal / 100g reported by Aremu *et al.*, 2006, Paul and Southgate (1980) argued that cashew meal has an energy concentration comparable to cereals.

Table 1: Chemical Composition of Cashew Nut Farmer Farms

Chemical composition	Content (% of DM)
Dry Matter* (DM)	90.47±0.05
Moisture	953±0.05
Crude Proteins	25.75±0.00
Lipids	21.98±0.01
Ashes	4.08±0.02

Fibres	3.44±0.35
Carbohydrates	38.30±0.12
Reducing Sugars	2.66±0.46
Total sugars	9.94±0.00
Energy * (kcal/100g DM)	467.51

Tests were performed in triplicate; Values are means ± Standard Deviation; CP: Crude proteins;
Dry matter * = dry matter in % of fresh matter. The digestible carbohydrate (DC) value is determined by calculation (Bertrand and Thomas (1910) quoted by Yao *et al* (2015) as follows:) as following: DC (%) = 100 - [proteins (%) + lipids (%) + ash (%)+ mosture (%)]

3.3. Mineral composition

Table 2 shows the mineral composition (mg / 100 g) of the cashew nut fatty cake. The most abundant minerals are Potassium (799.27 ± 0.44) followed by Phosphorus (672.38 ± 0.54), Magnesium (266.42 ± 0.32) and Cr (262.75 ± 0.88). The lowest minerals are Sodium (8.96 ± 0.01) followed by Zinc (16.32 ± 0.04), Iron (33.05 ± 0.13) and Calcium (55.48 ± 0.03).

Potassium has the most abundant concentration (799.27 ± 0.44 mg / 100 g). This result is consistent with the previous work on Nigerian agricultural products according to Olaofe and Sanni (1988), Aremu *et al.* (2006) and Omosuli *et al.* (2009). Sodium, iron and zinc are the least minerals rich. These results are in agreement with the observation of Olaofe and Sanni (1988) and Aremu *et al.* (2005) that iron and zinc are less abundant. Minerals such as Chlorine, Manganese and Copper have not been detected. These values are still higher than those reported by Pamploma-Roger (2006) for cashew nut flour, which found calcium (45.0 mg), phosphorus (490 mg), magnesium (260 mg), iron (6 mg), potassium (565 mg) and zinc (5,6 mg). The quantities of minerals that are calcium (52.0), sodium (6.6), phosphorus (570.0), potassium (670.0), magnesium (265.0), iron (7.1), zinc (5.9) reported by Rico *et al.* (2016) for cashew kernels from Côte d'Ivoire were similar to those found in the present survey.

Phosphorus and calcium are found together in the body to maintain body blood. Calcium is responsible for the formation of bones.

Its magnesium content, one of the highest in the plant kingdom, is exceeded only by sunflower seeds 354mg / 100g (Pamplona-Roger, 2006). It has been reported that magnesium is an activator of several enzyme systems and it maintains the transmission of nerve impulses (Ferrao *et al.*, 1987, Akinhanmi *et al.*, 2008).

Table 2: Mineral Composition of fatty cake of cashew nut

Mineral composition	**content (mg / 100 g)**
Calcium (Ca)	55.48±0.03
Sodium (Na)	8.96±0.01
Phosphorus (P)	672.38±0.54
Potassium (K)	799.27±0.44
Magnésium (Mg)	266.42±0.32
Chlorine (Cl)	Nd
Fer (Fe)	33.05±0.13
Zinc (Zn)	16.32±0.04
Manganèse (Mn)	Nd
Copper (Cu)	Nd
Chrome (Cr)	262.75±0.88
Ca/P	0.0825

Tests were performed in triplicate; Values are means ± Standard Deviation

3.4. Phytochemical composition

Table 3 shows the various phytochemical groups highlighted in the almonds. The results of the identification tests of the phytochemical groups show that the most represented compounds in cashew kernel almonds are polyphenols, tannins and to a lesser extent flavonoids. The presence of flavonoids shows that cashew cake will be good for the management of cardiovascular disease and oxidative stress, since flavonoids are biological antioxidants (Mbatchou and Kosoono, 2011).

These compounds have certain activities from the nutritional and therapeutic point of view. Indeed, they are potent antioxidants, anti-inflammatories, antifungals, antibiotics Meddleton *et al.* (1986) and Abalokoka *et al.* (2014). They protect the cells against the harmful effects of reactive oxygen species, such as singlet oxygen, superoxide, peroxylated radicals, hydroxyl radicals and peroxynitrile.

Table 3: Phytochemical composition and antioxidant activities of the crab cake of cashew nuts

Composition	Content (mg / 100 g DM)
Polyphenols	479.39±0,0
Flavonoids	55.48±0.06
Tannins	134.19±0.37
AOA (%)	75.11±0.00

Tests were performed in triplicate; Values are means ± Standard Deviation; AOA: Antioxidant Activity

3.5 Antinutritional Factors

Table 4 shows the various anti-nutritional factors highlighted in almonds.

The phytate content of the cashew nut cake determined in this research was 87.27±00 mg / 100g DM. This value is higher than that reported by Mbatchou *et al.* (2011) for of cashew nuts which was 6.78 mg / 100 g. A study in India found that the phytate content of foods ranged from 480 to 520 mg / 100 g (Pushpanjali and Santosh, 1995). Phytate levels in Korean foods ranged from 191.7 to 973.3 mg / 100 g for cereals and 508.5 to 1371.8 mg / 100 g for legumes (Joung *et al.*, 2004) In Indonesia, the content ranged from 8 to 319 mg / 100 g for Cereals and 24 to 1018 mg / 100 g for legumes (Sanny *et al.*, 2007). This value is lower than the levels listed in the countries listed. The high concentrations of phytates usually obtained in seeds should be considered as a potential risk in the context that these compounds may act as chelating agents on certain important nutritional ions such as zinc, calcium, magnesium and iron (Erdman, 1979).

The Cashew Nut Meal (Anacardium L.) has a cyanidic acid content of 1.07 ±00 mg /100g DM. This low level may be due to the naturally low cyanide content of cashew nuts (Nkafamiya *et al.*, 2015). The level of cyanide in the cashew kernel cake evaluated in this study is below the maximum acceptable level of 60 mg / 100 g per day for an adult (Monago and Akhidue, 2002).

Table 4: Composition of the antinutritional factors of the artisanal cake of cashew nut almond

Composition	Content (mg / 100 g DM)
Phytates	87.27±00
Oxalates	nd
Cyanidic acid	1,071±00

Tests were performed in triplicate; Values are means ± Standard Deviation

IV. CONCLUSION

This study indicates that farmer fatty cake of cashew nuts are rich in important nutrients compared to certain legumes and grains. The high presence of proteins and some minerals in oilcakes shows that they can be considered in the human and animal diet as a source to balance diets. The identification of the phytochemical group's shows that the most represented compounds in cashew cake are polyphenols, tannins, and to a lesser extent flavonoids. However, it should be noted, that the use of fatty cakes of cashew nuts will be linked to factors other than their nutritional value, particularly their economic value.

BIBLIOGRAPHY

[1] Abalokoka E.-Y., Bilabina I., Tchaou M. N. (2014). Valeur nutritionnelle et biochimique de l'amande d'un cultivar d'***Anacardium occidentale (Anarcadiaceae)***. *Journal of the Science Library*, **6**: 1-14
[2] Akinhanmi T.F., P.O. Akintokun and N.V. Atesie. (2008). Chemical composition and physicochemical properties of cashew nut (*Anarcadium occidentale*) oil and cashew shell liquid. *Journal of Agricultural, Food and Environnemental Sciences*, **2**: 1-10.
[3] Aremu M.O., Olonisakin A., Bako D.A. and Madu P.C. (2006b). Compositional studies and physicochemical characteristics of cashew nut (*Anarcadium occidentale*) flour. *Pakistan Journal of Nutrition*, **5**(4): 328-333
[4] Aremu M.O., olonisakin A., otene J.W., and Atolaye B.O. (2005). Mineral content of some agricultural products grow in the Middle Belt of Nigeria, *Oriental Journal of Chem*istry, **21**, 419-426.
[5] Aremu O.M., O. olaofe and T.E. Akintayo. (2006a). A comparative study on the chemical and amino acid composition of some nigeran under utilized legume flours. *Pakistan Journal of Nutrition*, **5**: 34-38
[6] Arkroyed W.R. and Doughty J. (1982). Legumes in human nutrition. Food and Agricultural Organization. *Nutrition Studies Publication*, **20**:1-152
[7] Arogba S.S. (1999). Studies on Kolanuts and Cashew Kernels moisture absorption isotherm: Proximate composition and functional properties. *Food Chemistry*, **67**: 223-228.
[8] Atasie V.N., Akinhanmi, T.F. and Akintokun P.O. (2008). Chemical composition and Physicochemical properties of Cashew nut (Anacardium occidentale) oil and Cashew nut Shell Liquid. *Journal of Agricultural, Food an Environmental Sciences*, **2**: 1-8
[9] Bainbridge Z., Tomlins K., Welling K. and Westby A. (1996). Analysis of condensed tannins using acidified vanillin. *Journal of the Science of Food and Agriculture*, **29:** 77-79.
[10] Batal A., Dale N. and Café M. (2005). Nutrient Composition of Peanut Meal. *Journal of Applid Poultry Research*, **14**: 254-257
[11] Belewu M.A., Sam R., (2010). Solid state fermentation of Jatropha curcas kernel cake: Proximate composition and antinutritional components. Nigeria and Ghana. *Journal of Yeast and Fungal Research*, 1(3): 44-46.
[12] Bertin M.-A., Bastien D., Chaigneau F., Molle J. et Joulie A. (2008). Valorisation des tourteauxfermiers de colza en production de viande bovine-Essai sur jeunes bovins charolais. Compte-rendu de synthèse n° 000932102. *Chambre d'Agriculture et Institut de l'Elevage*, France
[13] Bogert J.L., G.M. Briggs and D.H. Galloway. (1994). Nutrition and physical fitness. *Int Journal of Food Science Nutrition*, **45**: 223-230
[14] Brunshwing P. et Lamy J.-M. (2006): "Production à la ferme d'huile végétale et de tourteaux: possibilités et consequences". *Fourrages*, **187** : 329-342
[15] C.C. Monago and V. Akhidue. (2002). Cyanide poising. *Journal of Applird Sciences and Environnemental Management*, **6**(1) : 22-25
[16] Choi C., Kim S. C., Hwang S. S., Choi B. K., Ahn H. J., Lee M. Z., park S. H. and Kim S. K. (2002). Antioxidant activity and radical scavenging capacity between Korean medicinal plant and flavonoids by assay guided comparaison. *Plant Science*, **163**: 1161-1168.
[17] Day R. A. and Underwood A. L. (1986). Quantitative analysis 5th ed. Prentice. *Hall publication.* P. 701.
[18] Dernfeld D. (1955). Amylase β et α, In: method in enzymology 1, colowick S., P. and Kaplan N., O. *Academic Press*, pp 149-154.
[19] Devappa K.R., Makkara H.P.S., Beckera K., (2010). Jatropha Toxicity -A Review. *Journal of Toxicology and Environmental Health*, Part B. **13**(6): 476-507.
[20] Dogo N.N., N'Guetta M. and Neves E. (1999). L'anacardier, valorization du faux fruit et du fruit. Dossier thématique, Ecole nationale supérieure des industries alimentaires, Section Industries alimentaires régions chaudes (ENSIA-SIARC), Montpellier, France.
[21] Dr Georges Pamplona-Roger (2006). Santé par les Aliments. *Safeliz Editorial*, P46-47
[22] Dubois M., Gilles K. A., Hamilton J.K., Rebers P. A. and Smith F. (1956). Colormetric method determination of sugars and related substances. *Analytical Chimistry*, **28**(3): 350-556.
[23] Erdman JW. (1979). Oilseed phytates: Nutritional implementations. *Journal of American Oil Chemical Society*, **56**: 736-741.

[24] Ferrao J.E.M., Ferro A.M.B.C. and Antures A.M.G. (1987). Bambara groundnut (*Vigna subterranean*) Aspect of its nutritive value. *Gracia deorta seriede Estudos. Agronomic*, **14**: 35-39

[25] Henning R.K., (1992). Produktion und Nutzung von Pflanzenöl als Kraftstoff im Sahel, am Beispiel von Mali. Gesamtkonzept zur Verbreitung des Systemansatzes, GTZ, Eschborn

[26] INRA-AFZ. (2004). Tables de composition et de valeur nutritive des matières premières destinées aux animaux d'élevage. Ed. D. Sauvant, J.M. Perez, G. *Tran, INRA* Paris, 301 pp

[27] Joung H, Nam G, Yoon S, Lee J, Shim JE, Paik HY. (2004). Bioavailable zinc intake of Korean adults in relation to the phytate content of Korean foods. *Journal of Food* and c*omplementary Analysis*, **17:** 713-724

[28] Larbier M. et B. *Leclercq*, (1992). Nutrition et alimentation des volailles. *INRA Edit.* P63-90

[29] Lautié E., Dornier M., Filho M.S., Reynes M. (2001). Les produits de l'anacardier: caractéristiques, voies de valorization et marchés. *Fruits*, **56** (4): 235-248

[30] Mbatchou V. C. et Kosoono I. (2012**).** Aphrodisiac activity of oils from *Anacardium* occidentale L. seeds and seed shells. *Phytopharmacology***, 2**(1): 81-91

[31] Mbatchou V.C. and Kosoono I., (2011). Aphrodisiac activity of oils from *Anacardium occidentale* L. seeds and seed shells. *Journal of Phytopharmacology.* **2**(1): 81-91

[32] Meda A., lamien C. F., Ronito M., Milogo J. and Nacoulma O. G. (2005). Determination of total phenolic, flavonoids and proline contents in Burkina Faso honeys as well as their radical scavenging activity. *Food Chemistry*, **91**: 571-577.

[33] Meddleton E., Kardasnami J., (1993)**.** The flavonoids Advances In research since 1986. J.B. Harborne, *Chapman and Hall, London*. 617-652.

[34] Nkafamiya I. I., Osemeahon S.A, Andema A. K. and A. Akinterinwa. (2015). Evaluation of cyanogenic Glucoside Contents in Some Edible Nuts and Seeds in Girei, Adamawa State, Nigeria. *Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT),* et le volume ?27-33

[35] AOAC, (1975). Official methods of analysis of the Association of Official Analytical Chemistry. Washington DC. 12th ed

[36] Okon B.D., (1983). Studies on the chemical composition and nutritive value of the fruits of African star apple. M.Sc. Thesis, University of Calabar, p67

[37] Olaofe O., F.O. Adeyemi and G.O. Adeniran. (1994). Amino acid and mineral composition and functional properties of some oil seeds. *Journal of Agriculture and Food Chemistry*. **42**: 878-884

[38] Olaofe, O.F. and Sanni C.O. (1988). Mineral contents of Agriculture products. *Food Chemistry.* **30:** 73-79

[39] Omosuli S.V., Adewale T.I., Dare O., Agbaje R. and Bolanle J.O. (2009). Proximate and mineral composition of roasted and defatted cashew nut (Anarcadium occidentale) flour. *Pakistan Journal of Nutrition*. **8** (10): 1649-1651

[40] P. Brunschwing, et J.-M. Lamy (2006). Production à la ferme d'huile végétale et de tourteaux: possibilités et conséquences. *Fourrages.* **187**: 329-342

[41] Paul, A.A., and Southgate B.A.T. (1980). Mucancce and Widdowson's Composition of Food. (4th ed) *Her Majesty stationary office*, London. Uk pp.227-228)

[42] Pushpanjali and Santosh K. (1995). In vitro availability of iron and zinc from some Indian vegetarian diets: correlations with dietary fibre and phytate. *Food Chemistry.* **56**: 111-114.

[43] Ricard Rico, Mònica Bulló & Jordi Salas-Salvadó. (2016). Nutritional composition of rawfresh cashew (*Anacardium occidentale* L.) kernels from different origin. *Journal of Food Science and nutrition*. **4**(2):329-338

[44] Roger Hérisset., Gérard L., Bernard L.L., Pauline de F. et Guy D. (2009). Pressage à la ferme: produire son correcteur azote. *Dossier Cap Elevage* n°36. Chambre d'Agriculture de Bretagne. P24-32

[45] Sanny SLC, Elaine LF, Karl B, Umi F, Timothy BH, Gibson RS. (2007). The concentration of iron, calcium, zinc and phytate in cereals and legumes habitually consumed byinfants living in East Lombok, Indonesia. *Journal of Food and complementary Analyses.* **20**, 609-617.

[46] Sanny SLC, Elaine LF, Karl B, Umi F, Timothy BH, Gibson RS. (2007). the concentration of iron, calcium, zinc and phytate in cereals and legumeshabituallyconsumed by infants living in East Lombok, Indonesia. *Journal of Food and Complementary Analyses.* **20**: 609-617.

[47] Singleton V. L., Orthofer R. and lamuela-Raventos R. M. (1999). Analysis of total phenols and other oxidant substrates and antioxydants by means of Folin-Ciocalteu reagent. *Methods enzymol.* **299**: 152-178.

[48] Yao A. K., Koffi D. M., Blei S. H., Irié Z. B. et Niamke S. L. (2015). Propriétés biochimiques et organoleptiques de trois mets traditionnels ivoiriens (attiéké, placali, attoukpou) à base de granulés de manioc natifs. *International Journal of Biological and Chemical Sciences.* **9**(3): 1341-1353.