

ORIGINAL ARTICLES

Nutritional Potentials of *Acacia Macrostachya* (Reichend) ex Dc Seeds of Burkina Faso: Determination of Chemical Composition and Functional Properties.

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ABSTRACT

Acacia macrostachya seeds from four small markets (Zone 1, Dassasgho, Naabi Yaar, Quatorze Yaar) of Ouagadougou were subjected to chemical composition and functional properties analyses. The proximate content of *Acacia macrostachya* seeds included moisture (varies from 6.02 to 6.99 % of fresh matter), total ash (varies from 3.34 to 4.97%), carbohydrates (varies from 20 to 29.1% of fresh matter), proteins (varies from 10.44 to 13.06% of fresh matter), crude fat (from 8.66 to 9.31 % of fresh matter), starch (from 11.2 to 35.6%). Potassium, Sodium, and Calcium content varies between 10.45 mg/100g to 14.60 mg/100g; 22.75 mg/100g to 72.18 mg/100g and 20 mg/100g to 40 mg/100g respectively. These results show good nutritional potential of *Acacia macrostachya*. This proximate composition of *Acacia macrostachya* seeds shows a fairly good nutrient constitution when compared to other common eating vegetables seeds.

Key words:

Introduction

Zamne is food made by coked seed of *Acacia macrostachya*, this food is well eating during several ceremonies in Burkina Faso.

The acacias are the essentially spiny woody plants of 2 to 8 m high, being a matter for the kind *Acacia*, of the family of the *Mimosaceae* and the family of the legumes Guinko, (1992); Baumer, (1995); Arbonnier, (2000); IPGRI, (2002). This family belongs to the order of the *Fabales*. About 1500 species of *Acacia* are counted in the world of which close to 1000 in Australia. In West Africa, about 25 species of *Acacia* presenting themselves as trees, bushes, shrubs and lianas, are counted Guinko, (1992).

The nutritional situation of the population of Burkina is marked by one under-feeding especially for the poor people. The national agricultural production consists of the cereals (maize, rice, sorghum, millet), of the legumes (bean, peanuts, pea, seeds...), of the fruits and vegetables, the oleaginous seeds, the walnuts and the animal products. The food of the populations is essentially agricultural and agriculture spreads on all the extent of the territory and occupy close to 80% of the population. Nowadays, the traditional returns go more and more in the food habits of our populations. It is now anchored in the culinary habits to include the seeds boiled of *Acacia macrostachya* in the menus of the receipts of the feasts and the religious or customary ceremonies in Burkina.

The seeds boiled of *Acacia macrostachya* are digestible and to a big dietary value. *Acacia macrostachya* seeds constitute important economical resources for numerous women EUREKA, (1997). In addition to the cereals products in Burkina, the WHO recommends a food complementation from local food and high nourishing value for landing to the malnutrition. In order to make a discriminating use of it, one must arranged of exact information on the density of the nutriments, the functional properties and the content of food in micro nutriments of the suitable complementary food. There are limited information or data on the physicochemical and proximate composition of the *Acacia macrostachya* seeds. This study appears in the

setting of the valorization of the local products.

Materials and methods

1.1 Sampling:

Samples of fresh seeds of *Acacia macrostachya* were purchased from four small markets of Ouagadougou (Burkina Faso) in April 2010: *zone 1*, *Dassasgho*, *Nabi-yaar*, *Quatorze Yaar*. In each small market four samples were purchased (Table 1).

Table 1: Samples codes and place of collection (small markets).

	<i>Zone 1</i>	<i>Dassasgho</i>	<i>Naabi Yaar</i>	<i>Quatorze Yaar</i>
Samples codes	M1a	M2a	M3a	M4a
	M1b	M2b	M3b	M4b
	M1c	M2c	M3c	M4c
	M1d	M2d	M3d	M4d

The collected seeds samples of *Acacia macrostachya* were identified in Laboratory of Botany and Ecology at the University of Ouagadougou.

The samples were dried and directly crushed and the corresponding flours sieved through a sieve of porosity of 1 millimeter for physical and chemical analysis.

1.2 Physical and Chemical Analysis:

Determination of the Moisture:

The level of moisture was estimated by desiccation with the drying oven at 103°C (method 925-10) AOAC, (1990).

Ash Analysis:

The ash content was estimated by incineration at 550°C (method 923-03) AOAC, (1990).

Mineral Analysis:

The Calcium, the sodium and the potassium contents were determined by flame photometry (Flame photometer M 410, Corning, USA), method (AOAC, 2000).

Determination of the Fat Content:

The determination of the fat content is made according to the method of extraction by the soxhlet Aa 4-38 AOCS, (1990) by using hexane as solvent.

Proteins Analysis:

Nitrogen was determined using the Kjeldahl method Matissek *et al.* (1989). The quantity of protein was calculated as 6.25×N AOCS, (1990).

Carbohydrates Analysis:

The content of total carbohydrates was determined according to the described by AOAC, (1990).

Starch Analysis:

The dosage of the starch was carried out according to the fast spectrometric method described by Jarvis and Walker, (1993).

Calculation of the Energy Value:

The theoretical energy value of the seeds was calculated starting from the analytical values for total protein, the fat content, the carbohydrates (including crude fibers) using the values of physiological energy deferred by Paul and Southgate (1985) according to the formula:

$$E \text{ (kJ)} = 17 \text{ (kJ / G)} \times \% \text{ total protein} + 38 \text{ (kJ / G)} \times \% \text{ fat content} + 17 \text{ (kJ / G)} \times \% \text{ carbohydrates}$$

This Energy was estimated for 100 g of Sample. Conversion into Kcal / g was carried out by multiplication by 4.184.

Results and discussion

2.1 the Moisture:

The water content of our *Acacia macrostachya* seeds samples collected in the different small markets varies from 6.02 to 6.99 % of dried matter (Table 2). These different contents are above those already returned by Savadogo et al. (2011) with *Cucumeropsis edulis* seeds samples (water content varies from 3.81 to 4.76 % of fresh matter) and those obtained by Akpambang et al. (2008) with two varieties of melon (*Colocynthis citrullus* and *Cucumeropsis edulis*) and a variety of almond (*Prunus amygdalus*). These results in water content can be bound and due to fact of the harvest period, the length of storage of the product (humidity of air and the temperature). The interest of the moisture analysis is of economic order because more the samples are rich in dry matter, more is the output in the conservation.

2.2 the Carbohydrates:

The carbohydrates content of our *Acacia macrostachya* seeds samples varies from 19.5 to 29.1% (Table 2) of dry mater. These results indicates that the seeds of *Acacia macrostachya* are not an excellent energizing food, this fact explain why the *zamné* was associated to millet fritters sometimes (*gnion* or *kouilou* in mooré local language) or of bean (*gaonré* in mooré local language) or couscous of millet (*wesla* in mooré local language). Our results are above of those of FAO databases FAO, (1970); FAO, (1998); but are located in the same interval with those obtained by Duke, (1978). The starch content of our *Acacia macrostachya* seeds samples varies from 11.2 to 35.6% (Table 2).

Table 2: Proximate composition (%) of *Acacia macrostachya* seeds.

small markets	Samples codes	Moisture	Protein	Carbohydrates	Starch	Lipids
M ₁	M _{1a}	6.19	12.07	20	21.30	8.66
	M _{1b}	6.86	10.44	22.40	19.55	8.94
	M _{1c}	6.78	11.76	25	16	9.04
	M _{1d}	6.20	12.61	24.10	24	9.06
M ₂	M _{2a}	6.75	12.65	22.80	23.40	9.31
	M _{2b}	6.99	11.12	19.50	21.60	8.69
	M _{2c}	6.82	12.24	29.10	34	8.71
	M _{2d}	6.51	13.05	27.90	34.50	9.29
M ₃	M _{3a}	6.36	13.06	24.70	26	nd
	M _{3b}	6.68	12.65	26.20	31.40	nd
	M _{3c}	6.60	12.1	21.80	20.20	nd
	M _{3d}	6.91	11.27	28.70	20.90	nd
M ₄	M _{4a}	6.78	13.05	22.80	21.60	nd
	M _{4b}	6.95	12.2	22.20	11.20	nd
	M _{4c}	6.02	11.76	26	24.40	nd
	M _{4d}	6.72	12.66	27.20	35.60	nd
Average		6.63±0.29	12.16±0.75	24.4±2.95	24.10±6.8	8.96±0.26

nd: not determined

The carbohydrates are more to bring the fuel of the organism like glucose. The contribution of the carbohydrates to the energy in a food ration recommended by the WHO, (1990) is from 55 to 75%. The main Function of carbohydrates is to provide your body with energy and Carbohydrates contain about 4 calories per gram. Generally carbohydrates are divided into 2 groups: simple and complex. Complex carbohydrates include fiber and starch are found in vegetables.

2.3 The Proteins:

The proteins content of our *Acacia macrostachya* seeds samples varies from 10.44 to 13.06% of dry mater (Table 2). These values are lower to the proteins values obtained by Ouattara, (2008) with *Acacia macrostachya* seeds samples (37.7%), those obtained by Onwuliri and Obu, (2002) with beans and those obtained by Akpambang *et al.* (2008) with *Cucumeropsis edulis* and *Colocynthis citrulus* seeds. Akpambang *et al.* (2008) reported 31.85% and 25.73 % of protein in *Cucumeropsis edulis* and *Colocynthis citrulus* respectively. This difference can be explained by the variety of the *Acacia macrostachya* seeds.

2.4 Mineral Content:

The ash and mineral content of *Acacia macrostachya* seeds are presented in Table 3. The ash content varies between 3.34 to 4.97 %. The ash content of samples M_{2d} is the higher and the sample M_{3d} had the lower value.

Potassium, Sodium, and Calcium content varies between 10.45 mg/100g to 14.60 mg/100g; 22.75 mg/100g to 72.18 mg/100g and 20 mg/100g to 40 mg/100g respectively (Table 3). These values are below of those obtained by Matos *et al.* (2009) on *Terminalia catappa* seeds. Matos *et al.* (2009) reported 9280 mg/100g, 27.89 mg/100g, 827.2 mg/100g, respectively for Potassium, Sodium and Calcium in *Terminalia catappa* seeds.

Sodium is an extracellular cation involved in the regulation of plasma volume, acid-base balance, nerve and muscle contraction. Calcium, Magnesium plays a significant role in photosynthesis, carbohydrate metabolism, nucleic acids and binding agents of cell walls Russel, (1973). High magnesium levels in drinking water have been linked to resistance to heart disease Fallon, (2001). The presence of these minerals in seeds or foods contributes to their medicinal values. Potassium is essential mineral and has important role in amino acids and proteins synthesis Malik and Srivastava, (1982). Potassium was reported to be the most abundant mineral in all seeds according to Adeyeye, (1992).

Table 3: Mineral composition (Sodium and Potassium) of *Acacia macrostachya*.

Samples	Total Ash	Sodium (mg/100g)	Potassium (mg/100g)	Calcium (mg/100g)
M _{1a}	3.89	25.28	13	30
M _{1b}	4.74	22.75	12.52	30
M _{1c}	4.01	23.65	12.80	40
M _{1d}	4.30	23.20	13.10	20
Average	4.23±0.37	23.72±1.10	12.77±0.24	30±8.16
M _{2a}	3.55	23.07	13.80	20
M _{2b}	4.26	32.37	14.20	20
M _{2c}	4.54	72.18	14.59	40
M _{2d}	4.97	37.77	14.63	20
Average	4.33±0.59	41.35±21.43	14.30±0.38	25±10
M _{3a}	4.52	71.86	13.23	40
M _{3b}	3.95	67.15	11	30
M _{3c}	3.90	60.20	11.50	20
M _{3d}	3.34	52.392	10.25	40
Average	3.92±0.48	62.90±8.48	11.49±1.26	32.5±9.57
M _{4a}	4.30	65.79	10.75	30
M _{4b}	4.18	57.26	10.45	30
M _{4c}	4.47	63.47	13.09	40
M _{4d}	4.12	51.91	11.12	20
Average	4.26±0.15	59.61±6.26	11.55±1.37	30±8.16

Vitamins and minerals present in the diet are necessary for normal growth and metabolism and influence the utilization of other nutrients such as protein. The deficiency of essential vitamins or minerals leads to several physiological disorders and diseases, slowed growth, and lack of deposition of proteins in tissues. An adequate supply of B- complex vitamins is necessary for critical protein utilization. The deficiency of minerals such as potassium, phosphorus, sodium, calcium, and magnesium also influences the capacity of the body to utilize amino acids and proteins (Ekanayake and Nair, 1998).

2.5 Energy Value:

The energy values of the different seeds samples of *Acacia macrostachya* varied from 213,14 Kcal/100g to 218,70 Kcal/100g. These values indicate that seeds of *Acacia macrostachya* are not excellent source energy. According to the data of the WHO (1990), the daily needs in energies are estimated in 545 to 2755Kcal for the men and 515 to 2110Kcal for the women.

The appreciation of the energy value made in isolation didn't interest on the nutritional plan. It is recognized since strong decade that the metabolism of the proteins is influenced by the energy contribution. The energy that the organism uses essentially comes from the oxidization of the digestible carbohydrates, of the lipids and incidentally the proteins. It is necessary to grant a particular attention therefore to the Protein/Energy contributions and to the proportions of energies brought respectively by the carbohydrates, the lipids and the proteins

Conclusion:

This present work revealed that seeds of *Acacia macrostachya* contain essential nutrients for human good health.

This study revealed the potential of *Acacia macrostachya seeds* respectively in proteins, carbohydrates, lipids, starch, calcium and Potassium. It is therefore necessary to encourage their production for a more disponibility, but also to promote their consumption by the population who usually uses these foods for their nutritive value but for their taste.

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