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Chemical composition of caterpillars sold in Kinshasa City, D.R. Congo

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ABSTRACT:

Three samples of dried caterpillars (E_A, E_B and E_C) from three markets of Kinshasa (Democratic Republic of the Congo) were analyzed to evaluate their nutritional value. Obtained results indicate that these caterpillars show high content in proteins (48% for E_A, 49 % E_B and 51% for E_C). Mineral elements (Ca, Mg, P and N) were also analyzed and concentration of glucose, lipids, fibers and energetic value determined. These results indicate that caterpillars sold in Kinshasa markets can be used to compensate low proteins and nutriments content of food for low income population.

Keyword: *Caterpillars, proteins, minerals elements, fibers, lipids.*

INTRODUCTION

The increasing of world population induces the increase of food production demand. Developing countries including Africa are the most affected world part by the food insecurity. It is therefore crucial to find sources of proteins and other nutrients [1-4]. Thus, edible insects should be seriously considered as a source of proteins. In fact, edible insects are known to be in huge quantity in the nature and have played an important role in the history of human nutrition. They are considered as having potential to contribute to the world's food security [2, 5-8].

Hundreds of insects species have been used traditionally as human food in many cultures not only because of their nutritive value but also because of their taste. The largest consumption of insects is in Africa, Asia and Latin America, but it is nowadays increasing in most European countries. Among the most frequently consumed insect species are caterpillars [5-15]. In sub-Saharan Africa, the nutritional contributions of insects and caterpillars are not only appreciated, but their potentials are seriously being considered in food security and poverty alleviation strategies. They are considered to possess satisfactorily energy and protein content, good amino acid and fatty acid profiles and high contents of a variety of micronutrients such as the minerals copper, iron, magnesium, manganese, phosphorous, selenium, and zinc and the vitamins riboflavin, pantothenic acid, biotin, and in some cases folic acid and contribute to traditional medicine [2-5, 7-9].

Caterpillars are the larval stage of *Lepidoptera*, commonly known as butterflies and moths. Depending on the species, these insects are rich in different minerals and vitamins. It was shown that consumption of 50 g dried caterpillars meets the daily human requirements of riboflavin and pantothenic acid as well as 30 % of the requirement of niacin [1-14]

In Democratic Republic of the Congo (DRC) many species of caterpillar are consumed in all part of the country and constitute a diet complement for children.

The aim of this work to evaluate chemical composition et evaluate nutritional value of three most sold species of caterpillars in the Kinshasa markets.

MATERIAL AND METHODS

Field of study

This survey was carried out in the city of Kinshasa , the capital city of the Democratic Republic of the Congo during the period of February to March 2015. Kinshasa has several markets were some food products are sold include caterpillars. These food products come seasonally from neighboring provinces mainly from Bandundu and Kongo central. Caterpillars are sold and consumed in fresh or dry state.

Size of sampling

Our sample is composed of three types of sold caterpillars (named E_A, E_B and E_C) in the Kinshasa markets (Fig.1).

E_A E_B E_C

Figure 1: Caterpillar samples

Three markets were retained: Kianza, Mbanza - lemba and Matete. Three kind of most used caterpillars were retained and 100 g of every caterpillar species were taken for each markets . This means that by a probabilistic sampling to several degrees, a process with two stages was applied to get a representative sample: At the first degree, three markets were randomly chosen (simple uncertain sampling) and at the second degree three species of were systematically chosen in every market (systematic sampling).

Thus, a sample of nine 100g packets of three different kind of dried caterpillars was used.

Type of survey and parameters

The survey was transverse descriptive and following parameters were analyzed: humidity, ashes, mineral salts, raw proteins, total fat matter, raw fibers, total glucoses and energetic value (calories).

Analysis

The data of the investigation were treated and represented as tables and figures as frequency, percentage and average using Microcal Origin 7.5 software.

RESULTS AND DISCUSSION

Results

Table 1 gives proteins concentration of different kind of caterpillars from different markets

Table 1: Proteins concentration of different kind of caterpillars from different markets

MARKET	Concentration (g/ 100g of dry caterpillars)		
	E_A	**E_B**	**E_C**
Matété	48.10	48.37	50.99
Kianza	47.14	48.90	50.64
Banza-lemba	47.31	48.28	50.29

Average	47.51± 0.38	48.52±0.26	50.64±0.15

Table 1 that all caterpillars' samples have between 47 to 50 % proteins. Sample E_C has the highest concentration when sample E_A has the lowest.

Figure 2 gives concentration of calcium in mg/ 100 g of dry caterpillars for different samples

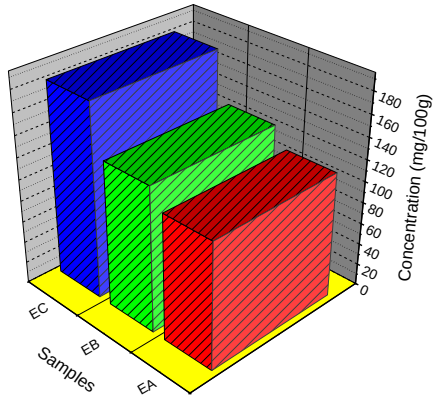

Figure 2: Calcium concentration of caterpillars samples

This figure shows that sample E_C has the highest concentration of calcium (180.90±0.97 mg/100g) and E_A the lowest (117.31± 0.49 mg/100g).

All obtained results from chemical analysis are summarized in table 2

Table 2: Results of chemical analysis of all caterpillars' samples

ANALYSIS	SAMPLES (100gr of dry insects)		
	E_A	**E_B**	**E_C**
Humidity (g)	9.69±0.23	9.55±0.30	9.37±0.25
Ashes (g)	3.60±0.07	3.91±0.05	3.99±0.11
Calcium (mg)	117.31±0.49	134.90±0.41	180.90±0.97
Magnesium (mg)	163.94±0.49	219.43±0.82	351.21±0.55
Phosphorus (mg)	192.01±0.03	234.15±0.08	255.04±0.02
Nitrogen (g)	7.60±0.06	7.76±0.04	8.10±0.03
Protein (g)	47.51±0.38	48.52±0.26	50.64±0.15
Fat matter (g)	8.03±0.11	9.16±0.26	14.16±0.49
Fiber (g)	9.77±0.15	14.50±0.12	8.96±0.11
Glucide (g)	30.84±0.30	28.77±0.33	22.54±0.33
Calories (cal)	385.74±0.60	391.45±1.38	420.26±3.84

These results show that sample E_C has the highest concentration of not only proteins and calcuim, but also of magnesium, phosphorus, nitrogen, fat and energetic value with the lowest humidity and fibers. Sample E_A as the lowest concentration of proteins, calcium, magnesium, phosphorus, nitrogen, fat and energetic value.

Figure 3 gives proteins concentration of common foods compared to that of the three samples of caterpillars

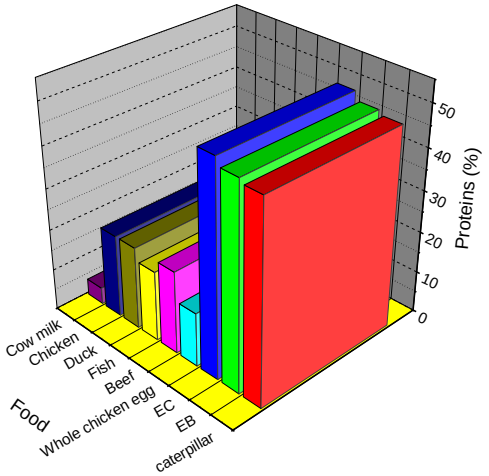

Figure 3: Protein concentration of common foods compared to that of studied samples of caterpillars

DISCUSSION

This study shows that caterpillars sold in Kinshasa markets have high proteins contents (47 to 50 %). This confirms results reported by Kouřimská and Adámková [4] that indicated a protein content range of 14 to 77 % for some insects. But these proteins concentration are higher than that found by Banjo et al [5] for caterpillars from Nigeria. These differences may be due to variations in the dietary habits of the insects or as a result of different ecotypes. This study confirms that caterpillars are a good source of protein. In fact, compared to protein concentration of some foods (Fig 3: Duck (20%), Chicken (20%), Whole chicken eggs(13%); Fish (17%); beef (20%) etc) [1-3] , carterpillars are better source of proteins and can be used to compensate the lack of proteins for low income population. In DRC, powder of dried caterpillars is added to the infant nutrition to improve its protein content.

The determination of water concentration of food products is important because water is an excellent medium of microbial cultures. Thus, a high water concentration of food indicates a risk of its alteration [4]. Water concentration of the three samples of caterpillar under investigation is under 10% indicating that these insects could be well conserved. The lowest water concentration was found in E_C samples (9.37%).

The analysis of ashes permits to evaluate the total quantity of the mineral salts in foods, the studied samples indicates high rate of ashes E_C (3.99%), E_B (3.91%) and E_A (3.60 %). The determined concentration of calcium, magnesium and phosphorus showed that these cartepillars samples can be used as source of mineral elements to compensate for nutritional deficiencies.

For a Congolese population with a high rate of malnutrition, lipids content and high energetic value of caterpillars samples is a good indication for the use of these insects as food. As it is indicated in table 2 E_C that possess higher concentration of lipids (14.16g) has also higher energetic value (420 Cal/100g of caterpillars). It can also noticed that it is also this sample that possess the higher concentration of proteins.

The presence of fibers in the caterpillars is bound to the nature of their food. They generally eat the leaves and the cloths of the trees. Generally, the fibers are not digested by the human organism, but they play an important role in the intestinal transit of food. The sample E_B show the highest concentrations of fibers [6,15].

CONCLUSION

A survey made on caterpillars sold in Kinshasa markets and the chemical analysis done on theses insects showed that all the samples of caterpillars have high nutritive potential and can be used as source of proteins. Further analysis is necessary to determine other content of these caterpillars.

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