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PROPIEDADES NUTRICIONALES DE LA HORMIGA SANTANDEREANA (*ATTA LAEVIGATA*)

NUTRITIONAL PROPERTIES OF THE SANTANDEREANANT (*ATTALAEVIGATA*)

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RESUMEN

La hormiga Santandereana (*Atta Laevigata*), habita en algunas regiones de los departamentos de Colombia en particular los de Santander y Casanare, esta especie es utilizada como fuente alimentaria por las poblaciones de estas zonas. Por lo anterior, se evaluó la composición nutricional de esta especie, los resultados muestran contenidos de grasa 20.45 g / 100 g, proteína 22.5 g / 100 g, humedad 40.42 g / 100 g, cenizas 1.01 g / 100 g, cobalto 0.20 ppm, hierro 0.08 g / 100 g, calcio 0.06 g / 100 g, potasio 0.36 g / 100 g y magnesio 0.19 g / 100 g, la caracterización de los ácidos grasos metilados (FAME), fueron determinados por cromatografía de gases y los componentes mayoritarios fueron: ácido Oleico

45.55 g / 100 g, alfa linolénico 20.25 g / 100 g, ácido mirístico 16.59 g / 100 g, ácido palmítico 7.44 g / 100 g, ácido linolénico 6.49 g / 100 g, acido gamma linoléico 3.39 g / 100 g y EPA 2.26 g / 100 g, evidenciando un elevado contenido nutricional.

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Palabras clave: Nuevos procesos, aprovechamiento de recursos, hormiga, composición nutricional.

ABSTRACT

Santandereana Ant (*Atta Laevigata*), lives in some regions of the departments of Colombia in particular those of Santander and Casanare, being used as a food source by these populations. Therefore, the nutritional composition of this species was evaluated, determining some minerals and fatty acids with the following results: fat 20.45 g / 100 g, protein 22.5 g / 100 g, 40.42 moisture g / 100 g, ashes 1.01 g / 100 g, cobalt 0.20 ppm, iron 0.08 g / 100 g, calcium 0.06 g / 100 g, potassium 0.36 g / 100 g and 0.19 g / 100 g, the characterization of the methylated fatty acids (FAME), were determined by gas chromatography and the main components were: oleic 45.55 g / 100 g, 20 alpha-linolenic acid 25 g / 100 g, myristic acid 16.59 g / 100 g, Palmitic acid 7.44 g / 100 g, linolenic acid 6.49 g / 100 g, 3.39 g / 100 g gamma linoleic acid and EPA 2.26 g / 100 g, demonstrating a high nutritional content.

Key words: New processes, use of resources, Ant, nutritional composition.

INTRODUCTION

Insects are a renewable, abundant and nutritious natural resource which can be used in the human diet as a complement in food. It is known that the Aztec peoples consumed a great variety of vegetables, vertebrate and invertebrate animals (Sánchez-Peña, 2005). Likewise, it has been determined that the digestibility in the dry material "in vitro" of edible insects is high and ranges between 95.94 and 33.00%, taking into account that the percentage of digestibility of protein fluctuates between 97.83 and 77.86%, which indicates that insects have highly digestible protein components (Hernández *et al.,* 2004), having a higher caloric value than beef, chicken, fish or soy (Granados et al., 2013).

According to the Food and Agriculture Organization of the United Nations (FAO), eating insects is recommended "as a possible solution to hunger in the world", taking into account that climate change and water scarcity could complicate food production and that in 2030 the world will have to feed more than 9,000 million people, noting that insects are nutritious with high in protein, fat and minerals, thus they could be a "food supplement for malnourished children", producing fewer greenhouse gases than livestock (FAO, 2010).

Regarding the consumption of ants, reference is made to the consumption of chicatanas, in Huastusco, Veracruz Mexico (Landero *et al.,* 2005), in Colombia the ant (*Atta laevigata*), Santandereana ant or Culona which lives in the departments of Santander and Casanare where they are used as food by the inhabitants. This predilection passed from the aborigines to the current inhabitants, making this product known throughout the country and internationally, as an exotic food (Rueda & Stashenko 2004).

The objective of the work was to evaluate the nutritional properties of the Santandereana ant (*Atta laevigata*)..

MATERIALS AND METHODS

The ants were collected in the village of the municipality of San Gil (Santander), (6°33′18"N, 73°8′1"W). This collection was carried out according to the methodology used by Granados *et al. (*2013*),* where a device called a suctioner was used, basically composed of an anterior funnel that is easily disassembled, which is connected to a container where the ants are collected; a back, composed mainly of a tube with a protective mesh to prevent particles of earth, ants and stones from passing into the pump, which is connected to the equipment by a nipple at the back of the tube, creating vacuum and sucking the ants inside the container.

The carbon dioxide CO_2 was supplied in gaseous form in the suctioner after plugging the outlet of the suctioner (Granados *et al.,* 2013). As ants are accustomed to living in atmospheres charged with carbon dioxide, it was necessary to supply them with doses at 15% in order to be able to manipulate them easily.

The contents of ash, fat, carbohydrates, protein and minerals were determined according to the methodology described by Morilla and Delgado (2012).

The fatty acids were analyzed with respect to their composition by means of an instrumental technique of Gas Chromatography, coupled to Mass Spectrometry (GC/MS) in a GC/MS 7890A/5975C Agilent (USA) equipment at the interface with a selective mass detector HP5973 Network connected in line with an HP-MS ChemStation system and the NIST-2008 database. Conditions: HP-5MS 5% Phenyl Methyl Silox capillary column (30m x 250 µm x 0.25 µm), initial temperature 45 °C, transfer line temperature of 280 °C and injection volume 1.0 µL in Split mode (20:1), with injector temperature of 250 °C (Torrenegra et al., 2015). The identity of the components was assigned by comparison of the mass spectra obtained with those present in the database.

Statistical analysis

Results for three independent trials were expressed as mean ± standard mean error (SME). The MS Excel 2016 for Windows spreadsheet was used to organize the data

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RESULTS AND DISCUSSION

The physicochemical analyses obtained can be seen in Table 1.

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Table 1. Physicochemical analysis of the Santanderean ant (*Atta laevigata*)

Analysis	Result
Sodium g / 100 g	0.76 ± 0.05
Calcium g / 100 g	0.06 ± 0.55
Zinc g / 100 g	0.04 ± 0.33
Iron g / 100 g	0.08 ± 0.10
Potassium g / 100 g	0.36 ± 0.05
Magnesio g / 100 g	0.19± 0.05
Cobalt (ppm)	0.20 ± 0.33
Moisture g / 100 g	40.42 ± 0.10
Ashes g / 100 g	1.01 ± 0.05
Fat g / 100 g	20.45 ± 0.01
Protein g / 100 g	22.45 ± 0.25

Likewise, the high nutritional value of the Santander ant was verified, especially in the levels of proteins, fats and minerals. When making a comparison with other foods in the Colombian diet, it can be inferred that this product has a high nutrient content. One of the most important items when reporting food nutrition information is the fat content present, according to the FDA.

The nutritional content of insects depends on their life stage (metamorphic stage), their habitat and their diet. However, it is widely accepted that insects provide high-quality protein and nutrients compared to meat and fish (Ramos-Elorduy & Viejo-Montesinos 2007). Insects are especially important as a food supplement for malnourished children because most insect species contain elevated levels of fatty acids (comparable to fish). They are also rich in fiber and micronutrients such as copper, iron, magnesium, phosphorus, manganese, selenium and zinc, and pose a reduced risk of transmission of zoonotic diseases (diseases transmitted from animals to humans) such as H_1N_1 (avian influenza) and BSE (mad cow disease) (FAO, 2013).

The identification of components and percentages of abundance by CG/ME are reported in Table 2.

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Table 2. Major components of fatty acids in the Santander ant (*Atta laevigata*)

Fatty acid	Percentage (g / 100 g)
Myristic acid	16.59 ± 0.10
Palmitic acid	7.45 ± 0.33
Oleic acid	45.55 ± 0.05
Linolenic acid	6.49 ± 0.10
Alpha-linolenic acid	20.76 ± 0.07
Gamma linoleic acid	3.39 ± 0.05
EPA	0.26 ± 0.10

The majority compound found was oleic acid with a percentage of relative abundance of (45.55 g / 100 g).

Rueda and Stashenko used two methods of extraction of fatty acids present in the ant "culona", of which, the technique transesterification in situ turned out to be more sensitive, simple, fast and economical, compared to the conventional method. Likewise, it was reported that oleic acid (C18:1), is the most abundant with 45.55%, this value correlates with those reported by Rueda and Stashenko (2004), therefore, the Santander ant is an autochthonous natural source, rich in unsaturated fatty acids, which have been shown that being components of the membrane of different types of cells influence their functions. In the nervous system, omega-3 acids affect neurotransmission. In some mental illnesses such as depression, higher amounts of pro-inflammatory cytokines derived from arachidonic acid (omega-6) have been observed.

In some mental illnesses such as depression, higher amounts of pro-inflammatory cytokines derived from arachidonic acid (omega-6) have been observed. Neurotransmission is improved when neurons have docohexaenoic acid. The effects of such cytokines also induce the formation of atheromas in the circulatory system and the development of cancerous tumors, which are reduced by increasing the consumption of omega-3 acids. For other diseases such as diabetes and osteoporosis, research is continuing to clarify the possible beneficial effect of the consumption of omega-3 fatty acids (Coronado *et al.,* 2006).

CONCLUSIONS

The Santanderean ant (*Atta laevigata*), is an economical, nutritious and natural source with a high nutritional content, so it is considered promising to be used as human food.

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REFERENCES

Coronado M, Vega S, Gutiérrez R, García B, Díaz G. Los ácidos grasos omega-3 y omega-6: nutrición, bioquímica y salud. REB. 2006; 25(3): 72-79.

FAO. 2010. Forest insects as food: humans bite back. Bangkok.

FAO. 2013. Future prospects for food and feed security. Disponible en www.fao.org/forestry/edibleinsects/en/

Granados C, Acevedo D, Guzmán L. Tostado y harina de la hormiga Santandereana "*atta laevigata*" Biotecnología en el Sector Agropecuario y Agroindustrial. 2013; 11 (1): 68 – 74.

Hernández, O., Aldama, R.G., Díaz AJ. Insectos Comestibles. Centro de Investigaciones Biológicas de la Universidad Autónoma del Estado de Morelos. 2004. http://hypatia.morelos.gob.mx/no4/insectos_comestibles.htm Accesado: 17 febrero 2022.

Landero TI, Murguia GJ y Ramos EJ. Estudio etnográfico sobre el consumo de las "chicatanas" (Hymenoptera:Formicidae) en Huatusco, Veracruz, México. Folia Entomológica Mexicana. 2005; 44(002): 109- 113.

Morillas-Ruiz, JM., Delgado-Alarcón, JM. Análisis nutricional de alimentos vegetales con diferentes orígenes: Evaluación de capacidad antioxidante y compuestos fenólicos totales. Nutr. clín. diet. hosp. 2012; 32(2):8-20.

Ramos-Elorduy J., Viejo-Montesinos JL. Los insectos como alimento humano: Breve ensayo sobre la entomofagia, con especial referencia a México. Bol. R. Soc. Esp. Hist. Nat. Sec. Biol. 2007; 102 (1-4): 61-84.

Rueda, E. D. y Stashenko E. Extracción y análisis de ácidos grasos presentes en la hormiga “Culona” (*Atta laevigata*). 2004. Tesis de Química, Universidad Industrial de Santander – UIS-, Colombia.

Sánchez-Peña, S. (2005). New view on origin of Attine ant–fungus mutualism: Exploitation of a preexisting insect–fungus symbiosis (Hymenoptera: Formicidae). Annals of the Entomological Society of America. 98 (2):151–164.

Torrenegra M, Granados C, Osorio M, León G. Method comparison of hydrodistillation microwave radiation-assisted (MWHD) front hydrodistillation (HD) in the extraction of essential oil of *Minthostachys mollis*. Inf. Tecnol. 2015;26(1): 117-122.