

КРАТКОЕ СООБЩЕНИЕ

ON THE USE OF SELENIUM IN IODINE DEFICIENCY DISORDERS

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ABSTRACT. Many people worldwide suffer from goiter, cretinism and intellectual deficit due to Iodine deficiency by absence of this element in diets that leads to impaired function of the thyroid gland, delay in growth and severe mental retardation. Selenium is essential in the metabolism of the iodothyronine, to convert the prohormone tetraiodothyronine to the active form triiodothyronine. The selenocysteine protect the thyroid hormone synthesis. Jumil *Euchistus sufultus* S forest bug consumed in Mexico has both elements. The aim of this paper is to analyze iodine and selenium in this insect, captured at Guerrero State (2016) and profile samples of iodine by titration with thiosulfate and selenium by Atomic Absorption Spectrophotometer. Data obtained were Iodine 0.72 µg/100g and selenium 57 µg/100 g. In conclusion thyroid disease and severe mental retardation caused by iodine deficiency can be prevented by intake of two or three insects a day.

KEYWORDS: iodine deficiency, prophylaxis, selenium, natural source, edible insects.

INTRODUCTION

Iodine is an essential component of the thyroid hormones, which are required for normal calorogenesis, protein synthesis, intermediary metabolism, thermoregulation, reproduction, growth, development and neuromuscular function. Iodine can be found in small amount in water, some plants and few animals such as Jumil edible insects surviving on them (Ancona, 1932; Morrón, Terrón, 1980). Lack of iodine in soil and water occurs mainly in mountainous regions and in many flood plains (Morrón, Terrón, 1980). Maternal iodine deficiency causes teratogenic effects in children, referred to as endemic cretinism, with symptoms of dwarfism, hypothyroidism, neuromuscular disturbances, increased embryonic and postnatal mortality, deafness and mental retardation, all of these affects economic productivity among many other important social consequences (Melo, et al., 2004; Reyes, et al., 2005). In adults, thyroid disease is presented at long-standing iodine deficiency that induces thyroid enlargement and nodule formation that sometimes become permanently and without of normal control. Jumil, forest bug edible insect is available in some states of Mexico and is consumed by cultural tradition since ancient times (Castelló Yturbide, 1986; Menzel, D'Alusio, 1998).

Inorganic soil selenium is utilized by plants for

the synthesis of selenomethionine, which is incorporated into plants proteins. When humans and Jumil forest bug insects consume these proteins the selenomethionine released in digestion is used non-specifically for the synthesis of tissue proteins. Humans and insect also convert selenomethionine to selenocysteine, which is incorporated selectively into enzyme glutathione peroxidase. Proteins that include a selenocysteine residue are called selenoproteins. The objective of this research is to determine the role of iodine and selenium in human metabolic processes, assess the iodine and selenium content in Jumil forest bug and inform population the benefits provide consumption of this insect in human health.

MATERIALS AND METHODS

Jumil forest bug adults emerge in autumn, and winter seasons, in different habitats wherever there is a shelter, food and a suitable nearby environment. Guerrero state was monitored to evaluate available resources of the Jumil insect as well as the time for collection. Insects were available found since November to March among the fallen leaves or under the rocks. Samples were manual collected at the first week of November and kept in a glass container labelled and taken to laboratory in the University to determine nomenclature and Metal analysis (Morrón, Terrón, 1980; Ross, 1982). Moisture content

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was measured by drying samples in an oven a 60 °C.

Samples were powdered separately in a Willey Mill to 60 mesh size, to eliminate organic matter by incineration at 600 °C in a muffle furnace and ashes dissolved in dilute HCl. Iodine were analyzed by liberation of free iodine from insects powder by addition of H₂SO₄, excess of KI is added to help solu-

bilize the free iodine, and then titrated with thiosulfate. In the titration step, Iodine from insects is consumed by sodium thiosulfate (Osborne, Voogt, 1978; AOAC, 1995; Nielsen, 2010). And selenium was analyzed by atomic absorption spectrophotometer.

RESULTS

Table 1. Insects *Euchistus sufultus S*, year availability

Season	Winter			Spring			Summer			Autumm		
Months	J	F	M	A	M	J	J	A	S	O	N	D
<i>Euchistus sufultus S</i>	X	X	X	–	–	–	–	–	–	–	X	X

Table 2. Nomenclature of *Eushistus sufultus S*.

Class	Insecta
Order	Hemiptera
Family	Pentatomidae
Genus	<i>Euchistus</i>
Specie	<i>Sufultus S.</i>
Generic name	Jumil

Morón, Terrón, 1980

Table 3. Dietetic requirements for Iodine and Selenium elements by RDA and content in Jumiles

Gender/Age	RDA Iodine	Iodine/Jumil	RDA Selenium	Selenium/Jumil
Males/25–50	120 µg	0.72 µg/100 g	40 µg	57 µ/100 g
Females/25–50	150 µg	–	70 µg	–

RDA Recommended Dietary Allowance.

DISCUSSION AND CONCLUSION

Jumil insect can be found mainly in autumm, winter and early spring, in mountainous regions, among dead leaves on soil biomass (Table 1, 2). It is easy to collect manually; they are very low in moisture (26%), which means that contents are concentrated (Ancona, 1932). Iodine deficiency is a severe global problem with an estimated population of one billion at risk, because they live in environment where the soil has been deprived from iodine (Table 3). Iodine disorders are among the most common of humankind (Arthur, et al., 1999). One of these clinical forms is creatinism, when the mother is limited in her own production of thyroid hormone by insufficient iodine ingest. The effect begins in early fetal life and becomes most apparent later, when the neonate may be permanently impaired, especially with regard to neuromuscular and cognitive attainment. Also, a reduced iodine supply produces a compensatory increase in iodine clearance by the gland medi-

ated by increased secretion of thyroid stimulating hormone (TSH), consequently grow of the thyroid goiter occurs and can readily be detected; goiter may obstruct the trachea and esophagus. Activation and metabolism of thyroid hormone requires of three seleno-enzymes, the iodonthyrine deiodinases (St. Germain, Galton, 1979; Berry, et al., 1991; Stanbury, Dun, 2001; Vitamin and mineral requirements in human nutrition, 2004). This in liver is the major enzyme that converts T₄ to triiodothyronine T₃, and is responsible for most circulating plasma T₃ levels. In selenium deficiency, decreased DII activity results in lower T₃ levels. Selenium dependent deiodinases are also found in specialized tissues, such as brain, pituitary, brown adipose tissue and skin. Its principal physiologic role is for local intracellular production of T₃. In conclusion, thyroid hormone is essential to development, the main secretory product of the thyroid gland, thyroxin T₄, it is converted to the principal metabolically active, species triiodo-

thyronine T₃, and seleno-enzymes are essential in this process. Jumil insect has both iodine and selenium. Therefore consumption of it can provide both elements to prevent these metals deficiency (Recommended Dietary Allowances, 1989; De Mayer, et al., 1997; Sounde, 2001; Vitamin and mineral requirements in human nutrition, 2004).

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ИСПОЛЬЗОВАНИЕ СЕЛЕНА ПРИ ЙОДОДЕФИЦИТНЫХ РАССТРОЙСТВАХ

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РЕЗЮМЕ. Множество людей во всем мире страдает от зоба, кретинизма и умственной неполноценности, связанных с дефицитом йода из-за отсутствия этого элемента в рационе, что приводит к нарушению функций щитовидной железы, задержке роста и тяжелой умственной отсталости. Селен играет важную роль в метаболизме йодтиронина, преобразуя прогормон тетраiodтиронин в активную форму – триiodтиронин. Селеноцистеин обеспечивает синтез гормонов щитовидной железы. Тело лесного клопа *Euchistus sufultus* S, употребляемого в Мексике в пищу, содержит оба эти элемента. Целью настоящей работы был анализ содержания йода и селена в этих насекомых, собранных в штате Герреро (2016), и в профильных образцах сравнения. Содержание йода определяли титрованием с тиосульфатом, содержание селена – методом атомно-абсорбционной спектrophотометрии. Полученные результаты по йоду – 7,2 мкг/кг, по селену – 570 мкг/кг. Таким образом, заболевания щитовидной железы и тяжелая умственная отсталость, вызванные дефицитом йода, могут быть предотвращены путем приема двух или трех насекомых в день.

КЛЮЧЕВЫЕ СЛОВА: дефицит йода, профилактика, селен, природный источник, съедобные насекомые.