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Post Harvest Treatments and Heavy Metal Content in the Egg Mass of Wedge Seahare *Dolabella auricularia* (Lightfoot, 1786)

Ador R. Pepito[1,2], Gloria G. Delan[1], Hector C. Abdon[1],
Ma. Helian A. Lamayo[1], Ricardo S. Aballe[1] and Roberto C. Lamayo[1]
[1]Cebu Technological University-Carmen Campus
[2]Institute of Fish Processing Technology, College of Fisheries and
Ocean Sciences, University of the Philippines Visayas, Miag-ao, Iloilo
*Corresponding author: ador_riverapepito@yahoo.com

ABSTRACT

The egg mass or *"lukot"* of the wedge sea hare *D. auricularia* has been collected by gleaners from the wild of which its safety as food for human is not yet ascertain particularly the presence of heavy metals. The said egg mass has been consumed as food but prior to its consumption, these are usually subjected to post-harvest treatment. Thus, this study assessed the effect of the different post- harvest treatment with fresh as control (T1), with vinegar (T_2), boiling (T_3) and the combination of boiling and vinegar (T_4). Results show that the heavy metals determined from the treated egg mass were chromium, cobalt, copper, lead, nickel, gold, mercury and manganese and are expressed in terms of mg metals/kg sample. It further shows that in terms of chromium all samples have less than 0.60, cobalt has less than 2.0, copper has less than 0.10, gold has less than 0.30, and lead has less than 1.50. In terms of the effect of post-harvest treatment, nickel in T_1 has less than 0.30, while T_2 has 0.66 (±0.07), T_3 has 0.56 (±0.05), T_4 has 0.41(±0.07). In terms of mercury, it has 187(±33) for T_1, 383 (±5) for T_2, 123(±26) for T_3 and 185(±42) for T_4. In terms of magnesium, T_1 has 0.67 (±0.05), T_2 has 0.66 (±0.66), T_3 has 0.55(±0.08) and T_4 has 0.41(±0.10). Results indicate that the egg mass of the wedge sea hare contains heavy metals but most of them had an amount lower than the prescribed standard levels, except the amount of mercury.

Keywords: food safety, "lukot", seafood products, boiling and vinegar

INTRODUCTION

In the Philippines, heavy metal contamination is attributed to improper waste disposal mine tailing spills and chemical run-offs (Greenpeace, 2007). According to Munoz-Olivas and Camara (2011) heavy metals are classified as: potentially toxic (*e.g.* aluminum, arsenic, cadmium, lead and mercury), probably essential (*e.g.* nickel, vanadium, cobalt) and essential (*e.g.* cooper, zinc, selenium). Any of these metals can destroy life when concentrate in the body above acceptable levels (Ozuni *et al.,* 2010).

Majority of the known metals and metalloids are very toxic to living organism and even

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those considered are essential can be toxic if present in excess (Mudgal *et al.,* 2010). This was supported by Lanre-Iynda and Adekunle (2012) that heavy metals, if present even in very low concentration, have the capability to cause human health problems. These metals in the form of inorganic compounds from natural and anthropogenic sources continuously enter the aquatic ecosystem where they pose a serious threat because of their toxicity, long time persistence, bioaccumulation and biomagnifications in the food chain (Martinez-Lopez *et al.,*2005). Studies shows that many of the invertebrates are generally more sensitive to heavy metals than either fish or algae (Bat *et al,* 2000).

The wedge sea hare *Dolabella auricularia* belongs to gastropoda family that inhibits shallow tropical shoreline, eats red and green algae and sea grass, it lays a gelatinous egg mass in tangled form which are usually attached or cemented on seagrass, algae or any substrate (Calumpong, 1979). The egg mass locally known as "*lukot*" of the wedge sea hare *Dolabella auricularia* is one of the seafood products available in the Island Province of Cebu and has been traditionally consumed as food since time immemorial. Fish and other fishery products has been recently found to be better in terms of protein content than in beef or pork (Solidum *et al.,* 2013). Since the egg mass of the wedge sea hare has been consumed as food, it is imperative that the safety of its consumer should be the primordial concern of every individual. According to Ersoy *et al.* (2006) the consumption of seafood will impose hazards on human since many metals and metallic compounds found in the marine environment pose risk to human health.

The egg mass of the wedge sea hare has been collected as food from the wild and whose sources and not so known to its consumer in terms of its safety. In order to prevent harmful exposure of the consumer to toxic metals and to ascertain the egg mass in terms of suitability as seafood products, there is a dire needs to determine its heavy metals content and the possible effects of post harvest treatment to it, thus this study was directed towards characterizing the post harvest treatment and the heavy metal content in the egg mass.

MATERIALS AND METHODS

Sample Collection

Egg masses of *D. auricularia* were collected from the coastal areas of Danao City and Carmen, Cebu during the lowest tide in the morning. They were harvested fresh from the sources and were cleaned of debris and placed in a tray lined with paper cloth to remove the excess moisture before being placed in ziplock cellophane bag. Packed samples were then placed in a styrofoam box lined with crushed ice and transported to the laboratory for analyses.

Preparation of Post-Harvest Treatments

The samples were divided into four (4) lots and were immediately added with crushed ice in a proportion of 1:1 (w/v). These samples were subjected to the following treatments such as:

Treatment 1 = Fresh sample (as control) - The sample was used in its fresh native state.

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Treatment 2 = Samples treated with 4.5% acetic acid. Acid was prepared with 4.5% acetic acid at a ratio of 1:1 (w/v). Samples were allowed to stand for 20 min. and drained to remove the acid.

Treatment 3 = Samples heated at 100^{0}C - The samples were boiled in water (100^{0}C) for 5 min. at a sample: water ratio of 1:2 (w/v). The sample were drained to remove surplus water and were cooled at room temperature.

Treatment 4 = Samples treated with a combination of acid and heat. The samples were treated with acetic acid at a sample: acid ratio of 1:1 (w/v) and were allowed to stand for 20 min. The samples were drained to remove the acid and placed into boiling water using the same ratio as in Lot C. These were boiled for 5 min, drained and cooled at room temperature.

Heavy Metals Analyses

Seaweed samples were air-dried and ground. An aliquot of each sample was taken and weighed at approximately 5 grams in a beaker using an analytical balance. All samples were prepared in duplicates. The beakers were then transferred to the fume hood for acid digestion. The samples were then added with 10 ml of HNO_3 followed by 1 ml of H_2O_2 and heated over a hotplate at 200^{0}C for 30 minutes. The samples were then allowed to cool, transferred quantitatively to a 50 ml volumetric flask and diluted to mark. The samples were introduced to the Atomic Absorption Spectrophotometer (Shimadzu AAS-6300) for quantitative analysis (Standard Method 2005, APHA AWWA WEF 21st Edition).

RESULTS AND DISCUSSION

Results of the heavy metals analyses are shown in Table 1. As shown, it was found out that the egg mass of the wedge sea hare contains some heavy metals of low concentration. The presence of some heavy metals in the egg mass is not surprising considering Dungo-an, Danao City is near the dry-docking facilities. This is similar to the study of Delan *et al* (2012) that the *Caulerpa lentillefera* taken from the same sources contain heavy metals from the same sources also. It is noteworthy to mention that most of the heavy metals in the egg mass are of low quantity as shown in Table 1.

Chromium is presently common in most of the effluent streams when compared to other heavy metals. It occurs in a number of oxidation states such as trivalent chromium, Cr (III) and hexavalent chromium, Cr (VI). But among the two chromium states, hexavalent chromium, Cr (VI) is considered as the major environmental concern. Chromium toxicity in humans include metabolic acidosis, acute tubular necrosis, kidney failure and death. Recent studies shown that chromium is a potential carcinogen therefore exposure to this heavy metal is strictly monitored. Results show (Table 1) that chromium content in the egg mass is of low concentration and therefore it possess no hazards to consumer as far as chromium is concerned.

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Table 1. Heavy metals content in the egg mass expressed in mg/kg samples.

Heavy Metals	T_1	T_2	T_3	T_4
Chromium	< 0.60	< 0.60	< 0.60	< 0.60
Cobalt	<2.00	<2.00	<2.00	<2.00
Copper	<0.10	<0.10	<0.10	<0.10
Lead	<1.50	<1.50	<1.50	<1.50
Mercury	187(±33)	383(±5)	123(±26)	185(±42)

Legend: T_1- fresh sample; T_2– treated with vinegar; T_3- boiling; T_4– combination of T_2 and T_3

Cobalt is a naturally occurring element that has properties similar to those of iron and nickel. It is widely spread in the environment on low concentrations. Cobalt can enter in the body by breathing an air and drinking a water containing cobalt. It is both beneficial and harmful to human. It becomes beneficial if it forms part of vitamin B12 which is essential to maintain human health. It will also increase red blood cells production. Cobalt become harmful when you are exposed to radioactive cobalt, since the cells in the body can become damaged from gamma rays that can penetrate the entire body, even when one do not touch the radioactive cobalt. Certain level of exposure to cobalt gives varied health effect to human. According to the ATSDR (2004) effects on the thyroid were found in people exposed to 0.5 mg cobalt/kg. Table 1 show that the concentration of the cobalt in the egg mass is less than 2.00mg/kg sample. This indicates that moderation in the consumption of the egg mass should be observed by the consumer to avoid some health issues.

Copper is a naturally-occurring metallic elements that occurs in soil at an average of about 50 parts per million and is essential nutrients for human and animals in small amount. Copper is a components of several enzymes necessary for normal metabolic functions in human. The Recommended Daily Allowance (RDA) of copper for adults is 1 to 1.6 mg per day (ATSDR, 2004). Results of the study indicate that the copper content in the egg mass is lower compared to the prescribed standard limit.

Lead is known to induce reduced cognitive development and intellectual performance in children and increased blood pressure and cardiovascular disease in adults (Commission of the European Communities, 1991). FAO –WHO (1990) established a provisional tolerable weekly intake of lead as 25µg/kg body weight for humans, which is equal to 1,500µg/g lead/week for a 60 kg person. Result indicates (Table 1) that the lead content in the egg mass is very much low compared to the standards.

Mercury is one of the heavy metals known to be a latent neurotoxin compared to other metals like lead, cadmium, copper and arsenic. It was hypothesized that higher dietary intake of mercury from consumption of fish increase the risk of coronary heart disease (Salonen *et al*., 1995). FAO-WHO (1972) sets standard for mercury consumption amounting to 300µg/week for a 60 kg person. In the case of the mercury content in the egg mass, it was found out that is it much higher compared to the allowable limits and therefore consumption of it should be done

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moderately.

CONCLUSIONS AND RECOMMENDATION

Based from the results of the study, the egg mass really contains heavy metals. However, most of the heavy metals present were found in lower amount compared to the prescribed standards. Thus, it is recommended that one should be cautious of its consumption. Moreover, there is a need to do further study about the presence of heavy metals using egg masses obtained from different sources to verify the extent of similarities in heavy metal content and its amount.

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