STUDY ON NUTRITIONAL AND ELEMENTAL ANALYSIS OF THE SEAWEEDS OF NORTHERN SAMAR, PHILIPPINES

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ABSTRACT

The purpose of the study: In this work, the nutritional and elemental analysis of seaweeds in Northern Samar is analyzed.

Methodology: The seaweeds of Northern Samar are collected from intertidal zone, and it was brought back to the College of Science for taxonomic identity. The nutritional and elemental content of the seaweeds were determined

Main findings: Based on the results obtained a total of 39 species belonging to eighteen (18) families of seaweeds were recorded from different coastal towns in Northern Samar, Philippines. The results revealed that for seaweeds with the economic value the nutritional and elemental content is comparable to the unknown seaweeds with no economic value.

Implications: The results of bioavailability of nutrients of this study might be the basis that unknown seaweeds with no economic value can be used directly in the diet and promote health advantage.

Originality/Novelty of study: The seaweeds of Northern Samar are not properly documented in comparison with other marine flora. The results demonstrated that some species of seaweeds collected in Northern Samar with no economic value could also accumulate non-essential elements. Further studies would surely be a great contribution to our local food and pharmaceutical industries.

Keywords: seaweeds; Northern Samar; nutritional; metal bioavailability

INTRODUCTION

The seaweeds of Northern Samar are fairly well-studied floristically, relative to other places in the Philippines. Seaweeds are economically important, both currently and potentially, but there has not been a thorough listing of the species of seaweeds and its nutritional and elemental analysis recorded in Northern Samar.

Today, the population is increasingly becoming aware of the importance of consuming healthy foods. People have increased the use of seaweeds in different industries (cosmetic, pharmaceutical and fertilizers), it is also known for its contribution to the nutritional requirement of the human diet (Parada, 2007). Seaweed is an ideal source of fiber, polyunsaturated fatty acids, vitamins, proteins and minerals (Shaefer, 2007). Seaweed bioaccumulates essential elements such as Co, Cr, Mo, Ni, Se, V, Mg, Ca, Fe and I at higher rates than land vegetation (Rao, 2007). But as a result of environmental pollution, seaweed can also concentrate not essential elements such as As, Pb or Cd. Depending on the concentration of metals and their bioavailability ratio from seaweed, seaweed can accumulate metals at levels several thousand times higher than those found in the surrounding seawater (Sartal, 2007).

This work, therefore, aims to document the seaweeds of Northern Samar and the bioavailability of nutrients and elemental content was analyzed. The result of this work would be a great contribution to the variety and potentials of Northern Samar's seaweeds.

METHODOLOGY

Standards and reagents: Instrumentation employed in this study includes the UV-Vis spectroscopy (UNICO Spectrophotometer 1205E) for the nutritional analysis and the elemental analysis Atomic absorption spectroscopy (AAS) were used.

Area of study: Seaweed samples and seawater were collected at low tide from different coastal areas in Northern Samar. Northern Samar is one of the three provinces comprising Samar Island (the other two are Samar and Eastern Samar provinces, it is bounded by the Pacific Ocean on the east, the San Bernardino Strait on the north, Samar Sea on the west, and the Samar and Eastern Samar provinces on the south, ranks thirty-fifth (35th) in size among the 74 provinces of the
Philippines and accounts for practically 1.2 percent of the total land area of the country. There are many clean sandy beaches and outcrops in the vicinity, and the area is not impacted by industry, but only several runs off from nearby villages and rice plantation. The geology of the Northern Samars’ landscape is wide and varied, ranging from rocks and sandstones. The study sites are located on relatively sheltered beaches.

**Seaweed collection and preparation:** Seaweeds were identified and collected at low tide from the intertidal zone. Samples of seaweed from various locations on the sampling site were collected. The samples were washed on site in seawater to remove any sand. Samples were transported in seawater to the laboratory and were washed twice with distilled water and blot dried. The samples collected within each species were combined to give composite batches. Each composite batch was then divided into 3 replicates. Samples were oven dried at 60°C for 24 hours, then subsequently ground and sieved to a smaller particle size. The samples were stored at room temperature in airtight bottles until required for analysis.

**Nutrient composition analysis of seaweeds:** The nutritional value (protein, fat, carbohydrates, fiber and ash) of the sample seaweeds were analyzed using AOAC official method (Sartal, 2013). The crude protein content (N X 4.38) of the samples was estimated by the macro Kjeldahl method, the fat was determined by extracting a known weight of powdered seaweeds using a Soxhlet apparatus, the ash content was determined by gravimetric analysis and the total carbohydrates content were quantified using spectrophotometer at 490 nm (Bolton, 2012).

**Total metal determination:** Total metal determination was performed using Atomic Absorption Spectroscopy (AAS). Seven elements (Cr, Co, I, Fe, Zn, Pb, and Se) have been quantified, and standard solutions were used to correct possible matrix effects and signal drift.

**RESULTS AND DISCUSSION**

The Northern Samars’ seaweed flora recorded in this study comprises 39 species collected from different coastal areas as presented in Table 1. The results revealed that the relatively low number of brown algae in the Northern Samar flora is in agreement with other findings which demonstrated that the proportion of species of brown algae in a seaweed flora is low in tropical regions on a global scale (Bolton, 2012). A higher proportion of green algae collected in Northern Samar is similar to many tropical floras of other countries (Ryan, 2012).

### Table 1. Species Composition of Seaweeds in the Coastal Areas of Northern Samar

| Family        | Species          | Family        | Species          |
|---------------|------------------|---------------|------------------|
| Ulvaceae      | Ulva fasciata    | Udoteaceae    | Avrainvilla obscura |
|               | Ulva lactuca     | Halimedaceae  | Chorodesmis fastigiata |
|               | Ulva reticulate  |               | Halimeda incrassata |
| Galaxauraceae | Galaxaura oblongata |             | Halimeda opuntia |
| Sargassaceae  | Turbinarian decurrens | Dicyotaceae | Padina minor |
|               | Turbinarianoides |               | Padina japonica |
|               | Tubinaria ornata | Dasyycladaceae | Neomeris annulata |
|               | Sargassum kushimatense | Cauclanthaceae | Hypnea valentia |
|               | Sargassum crassifolium | Rhodomelaceae | Acanthopor haptociformes |
|               | Sargassum gracillimum |             | Acanthophoramuscosoides |
|               | Sargassum cristaefolium | Peyssonelialeae | Carpolestis somosana |
|               | Sargassumbinder | Chnooselliaceae | Hydroclathrus clathratus |
|               | Sargassum hemiphylum |             | Colpomenias isingiosa |
| Caulerpaeae   | Caulerpa serratula | Cladophoraceae | Chaetomorphacrasa |
|               | Caulerpa microphylla | Siphonocladiaceae | Boodlea composita |
|               | Caulerpa racemosa | Dicyotaceae | Dictyotidichotoma |
| Gracilariaceae | Gracilaria salicornia | Gelidiales | Gelidiuma laevisora |
|               | Gracilaria firma | Rhodomelaceae | Laurencia papillosa |
|               | Gracilaria edulis |             | Laurencia carillaginea |
|               |               |             | Laurencia tronoi |

Among the 39 species of seaweeds collected in different coastal towns in Northern Samar, *Hydroclathrus clathratus* species is present in all sampling sites. *Hydroclathrus clathratus* species is without economic value to the people of Northern Samar. The results of the nutritional content analysis of the different species of seaweeds were presented in Table 2. Several nutrient determination analyses were done includes protein, fats, fiber, total carbohydrates and ash content. The results revealed that...
the several seaweeds which they do not consider to be edible also contain a comparable protein, fat and ash content to the commonly known seaweeds like Ulva reticulate known to be edible as presented in Table 2. In general, the different nutrients content in known seaweeds were comparable to the unknown seaweeds found in Northern Samar.

Table 2. Proximate analysis of nutritional content of seaweeds species (mg/100g)

| Species               | Crude protein | Minerals (ash content) | Fat    | Dietary fiber | Total carbohydrates |
|-----------------------|---------------|------------------------|--------|---------------|---------------------|
| Hydroclathrus clathratus | 0.831         | 0.956                  | 0.524  | 0.539         | 0.834               |
| Ulva reticulate      | 0.873         | 0.867                  | 0.624  | 0.523         | 0.675               |

The bioavailability of elements evaluated in the different species of seaweeds reveals that for the seven (7) elements quantified in different species of seaweeds, results have shown that the collected species contain a considerable amount of essential elements (Fe, Se, and Zn), but some species can also accumulate non-essential elements (Cr, Co) as presented in Figure 1.

CONCLUSION

The key objectives of this study were to carry out nutritional and elemental analysis of the different species of seaweeds in Northern Samar, Philippines. Seven elements have been quantified in different seaweed species. Results have shown that essential and non-essential elements were present in the collected samples. In conclusion, it is clear that the documentation of the species of seaweeds in Northern Samar can produce useful information, which can add significantly to our knowledge of biodiversity, biogeography and our ability to conserve marine biota. The results of bioavailability of nutrients and elemental content of this study might be the basis that unknown seaweeds with no economic value can be used directly in the diet and promote health advantage.
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*Karina Milagros R. Cui-Lim, Maria Judy M. Somoray, Ma. Lourdes C. Alvarez*- they are responsible for the nutritional and elemental analysis

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*Olga DG. Unay*- responsible for some statistical evaluation of results