SUPPLEMENT TABLET FROM SARGASSUM

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ABSTRACT

Sargassum is abundant in Panay Island but its utilization is quite few. This study aimed to make use of Sargassum as source of supplement tablet and its effectiveness was tested on white mice. This study determined the calcium and potassium content of Sargassum using Titrimetric Micro Method and Flame Photometric Method, respectively. It was also conducted to determine the effects of the supplement tablet on the growth of the white mice and to compare the growth of the white mice taking the tablet and those who served as the control.

Laboratory analysis showed that Sargassum contains 4.74% calcium and 2.6% potassium. When administered to white mice as supplement tablet, the white mice receiving the tablets grew faster compared to those who are only having an ordinary diet. The white mice subjected to the tablet had a 5.545% mean weight increase after two weeks while those who served as control had a decreased mean weight of 2.03%.

Statistical analysis was used to determine the effect of the supplement on the weight gained of the white mice. T-test (α=0.05) for unequal sizes determine that the white mice subjected to the tablet had a significant weight gain after two weeks of treatment compared to those who were not given the supplement tablet.

This research paper entitled "SUPPLEMENT TABLET FROM SARGASSUM" submitted by Karen Joy Baraquia and Tarhata May Luningning Eulogio in partial fulfillment of the requirements in Science Research II has been examined and recommended for acceptance and approval.

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This research paper is accepted and approved in partial fulfillment of the requirements in Science Research II.

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CHAPTER I

INTRODUCTION

A.) Background or rationale of the study

Seaweeds or "halamang dagat" is a red-to-brown plant-like organism of the sea that provides nourishment for man. Aside from being consumed as food, seaweeds are utilized as a raw material for the manufacture of industrial products such as alginate, agar and carrageenin (Follosco, 1991).

Nowadays we use extracts from certain seaweeds as stabilizer gelling agents or emulsifier in thousands of everyday products from pet foods to dental moulds.

Cloth dyes, toothpaste, salad dressing flavored milks, cosmetics, welding rods, and pizza topping are just a few of these. Agar, a jelly substance found in some red seaweed, is irreplaceable as a medium on which to culture fungi and bacteria for medical testing and research in microbiology (http://www.botany.uwc.ac.za/Envfacts/seaweeds/, maintained and develop by Collins).

Many claims have been made for the effectiveness of seaweeds on human health. It has been suggested among other things, that seaweeds have curative power for tuberculosis, arthritis, colds, influenza, worm infestation and may even improve one's attractiveness to the opposite sex (Stein and Borden, 1984).

B.) Statement of the problem

- Is it possible to produce a supplement tablet, which is rich in iodine, calcium and potassium from Sargassum?
- Can minerals from Sargassum supplement the diets of white mice?

C.) Objectives of the study

- To determine the calcium and potassium content of Sargassum.
- To determine the effects of supplement table on the growth of white mice in terms of increase in weight after two weeks.
- To compare the percent increase in weight of white mice taking the supplement tablet and those who serve as control.

D.) Significance of the study

Many different and vital minerals are found within the body. There are four main minerals---calcium, phosphorus, iron and iodine that are very important. We need much of these, and for that reason they must be always be included in the diet.

Calcium plays an important role in the biochemistry of most organisms. In the human body, which is about 2% calcium by weight, about 99% of this calcium occur in the bones and teeth and the remainder in body cells and fluids. This remainder, however, is essential to muscle contraction and hence to cardiac function. Calcium ions are also essential in transmission of nerve impulses and in blood coagulation.

The body must continually take potassium throughout life. Potassium is very essential for plant growth and for human and animal nutrition. If potassium were to be cut off completely, most mammals would be dead in less than two months.

Iodine is an essential micro constituent in the human body, which contains an average of 14 mg (0.00049 ounce) of the element, concentrated mostly in the thyroid gland. The thyroid gland secretes iodine-bearing hormones, especially thyroxines, which are essential for maintaining normal metabolism in all the body's cells. Where insufficient iodine is present in the food supplies, as in North America's Great lakes region, The Netherlands, and most mountainous areas of the world, the main source of iodine table salt to which potassium iodine or other iodizing chemicals have been added. Iodine deficiency leads to endemic goiter and myxedema (http://www.britanica.com/bcom/eb/article/8/0,5716,43638++1+ 42681,00. html?query=iodine).

The tablet we made contains a large amount of these three minerals---iodine, potassium and calcium. The supplement tablet is a great source of supplements, is cheap and easy to prepare.

E.) Scope and Limitation of the Study

This study used mainly Sargassum as a source of calcium, potassium and iodine for making a supplement tablet. This supplement tablet is intended for human consumption but at this initial stage, the effectiveness of the tablet was first tested on white mice. The white mice were given supplement tablet for two weeks, after which, their gains in weight (grams) were recorded. The study was conducted at Philippine Science high School Laboratory from the month of June to September 2001.

F.) Definition of terms

Potassium--- plays a key role in muscle activity and is active in the process of moving substances in and out of cells

Calcium----- minerals essential for bones, teeth, muscle contraction, cardiac function, blood coagulation and transmission of nerve impulses

Iodine------ mineral usually found in seawaters, seaweed, and underground brines, and is used especially in medicine, photography, and analysis

Calcium content--- amount of calcium accumulated in a sample

Potassium content--- amount of potassium accumulated in a sample

Iodine content--- amount of iodine accumulated in a sample

Percent increase in weight---weight final minus weight initial divided by weight initial

Sargassum---specimen used in making the supplement tablet

Seaweed---are any of the red, brown and green species of plant like organism that grow in the marine environment

Supplement tablet---tablet that supplement the diet of the white mice

Chapter II

REVIEW OF RELATED LITERATURE

Seaweeds are any of the red, brown and green species of plant like organism that grow in the marine environment (Cordero, 1986). According to Lerman (1986). Seaweeds contain chlorophyll and an assortment of additional pigments spanning the visible spectrum from blue to red. These pigments enable them to capture light energy to begin photosynthesis. Seaweeds are the primary producers in the marine food web. They are the most useful marine resources left that can bring incalculable benefits to terrestrial life (Cordero, 1987).

Taxonomic Classification:

(http://www.imbari.org/-onn/botany/browns/jacquic/taxonomy.html)

KINGDOM: Protoctista

DIVISIONS: Heterokontophyta

CLASS: Phaeophyta

ORDER: Fucales

FAMILY: Sargassaceae

GENUS: Sargassum

Why is taxonomy of Sargassum difficult?

Sargassum morphology is highly plastic with environmental and temporal factors creating variation between and within population of the same species.

Many descriptions in the literature are not complete or based on variable characteristic such as blade size and shape, making it difficult or impossible to determine the species.

Uses of seaweeds: (Arzel, 1984):

***DOMESTIC

Fuel:

Seaweeds were dried to be used as fuel during winter. On Batz Island, shore weeds gather on September were reserved for this purpose. This seaweed was sometimes ground and combined with cow manure. The resulting mixture was formed into flat cakes, stuck into the walls of houses, and left to dry.

Food for human consumption:

In general, authors who write of seaweeds as food for human consumption refers to use by northern population. In Brittany, human consumption of seaweeds is restricted to a very particular use Chondrus crispus dried and bleached, is boil in milk. As it cools, it jellifies and is similar to flan or custard.

Animal feed:

Cattle-weed was widely used as a feed for livestock. According to Dizorbo (1974), cows roaming on Batz Island and Soin Island sought out this seaweed to graze on. Sauvageau also observed this in 1920 and remarked that the inhabitant of Quessant even created paths through the rocks so that their animals could reach the seaweed without the risk of breaking their legs. *Palmaria* is even used as food in stables of Sein (Richard, 1958).

During World War I, military authorities hoped to use dried seaweed to replace oats and fodder, then in scarce supply. Experiments showed that *Focus* could indeed be used just as wee add seaweeds to meal to livestock feed as source of vegetable protein today.

Fertilizer:

In the past, because farmers kept few animals and were unable to accumulate large quantities of manure, it became customary to use seaweed as a fertilizer. Seaweed of the genus *Focus* was most highly prized. Seaweed arrived from every coastal area to provide fertilizer or local agriculture.

***INDUSTRIAL USES

Glass production:

Soda is one of the ingredients used in synthesis of glass. Wood ash was gradually replaced as a source of soda by the ash of certain coastal plants of the Salicaceae family. By the end of the 17th century, glassmakers replaced these plants with seaweed ash.

Iodine:

In 1012, Coutois experiments with seaweed ash in the processing of salt pepper, discovered a new substance, which he named iodine. Its therapeutic uses were soon discovered.

Alginates:

Although Stanford first isolated algin in 1883, it was not until early 20th century that a small-scale algin industry was created at Pleubian in the Coles_du_Nord region. This industry was relatively unimportant until the disappearance of iodine factories.

Carrageenates

Carrageenates are colloidal substance, which appeared on the market after 1885-1890. The current reduced harvest of seaweed cannot meet the needs of the carrageen industry, which now relies on import.

According to Anzaldo (1987), the seaweed industry has relied on the gathering of wild seaweeds to fill its raw material requirements. Lately, in an attempt to find other sources of food, medicine, fertilizer and animal feed the Philippine government has boldly embarked in a program of tapping its marine resources. One of these is the marine macro algae or seaweeds.

Seaweed production has shown to be a highly profitable alternate source of livelihood for coastal communities. It requires low capital inputs but with high returns on investments. It is alsc labor intensive and therefore offers good opportunities for the employment of labor resources in coastal areas. Seaweeds farming fits very well the tradition and cultural values of the coastal inhabitants (Follosco, 1991).

Social and Economic Benefits:

Seaweed on marine algae constitutes the major marine resource of the country. The high income derive from seaweed farming coupled with the many job opportunity it generates has also help maintain the relatively peace and order condition in the province (Anzaldo, 1986).

BIOLOGICAL ROLE OF POTASSIUM, CALCIUM AND IODINE

***Potassium

Potassium is essential to life. Involved in active transport, the process of moving substances I and out of cells, it constitutes about 0.6 percent of the atoms in human body. About 99 percent of the body's potassium lies within the cells. Sodium and potassium ions help to regulate osmotic pressure and acidity, or pH levels. Potassium plays a key role in muscle activity and the transmission of nerve impulses. It is also involved in cellular enzyme function. An abnormally high level leads to a heart attack. Such changes in level, which are controlled by the kidneys, can result from various diseases (Grolier Encyclopedia of Knowledge, 1993).

***Iodine

Iodine is never found in nature uncombined. It is sparingly present in seawater as iodine ion, I-, to the extent of approximately 5o milligrams of iodine per ton of seawater. Appreciable quantities are found in a number of natural brines. Iodine occurs in animals and plants, generally in very small amounts, but very abundantly in seaweeds. Dispersed as a trace element in rocks, iodine is not sufficiently concentrated to form independent miracles. A formerly important source of iodine for commercial preparation is the saltpeter or nitrate deposits of Chile, in which iodine is present as solid iodates, especially calcium iodate, $Ca(IO_3)_2$. A French manufacturer of saltpeter from seaweeds, Bernard Courtois, discovered (1811) iodine in water that was used to extract the soluble material from seaweed ash. Since that time, in France and Great Britain and, more recently, in Japan, iodine has been recovered from seaweeds.

(http://www.britannica.com/bcom/eb/article/8/0,5716,43638+1+42681,00.html)

The principal use of iodine is in the health sciences. Almost from the year of its discovery it has been used to prevent goiter. An alcoholic solution of iodine has been used as a disinfectant although iodine complexes now predominate in this application.

Iodine complexes with surfactants are used in common sanitizers. Radioactive iodine, has found important use in tracer studies, including studies of the thyroid gland (Grolier International Encyclopedia, 1991).

High iodine content is found mainly in brown algae. The brown algae Laminaria religiosa has a high iodine content of up to 11,580 ppm. The algae of the genera Sargassum (brown) and Laurencia (red) commonly found in the Philippines water have high iodine content of more than 3,900 ppm.

***Calcium

The human body is 2 percent calcium. The major source of calcium in the human diet is milk and milk products. Rickets occurs, especially in infants and children, when lack of vitamin D impairs the absorption of calcium from the gastrointestinal tract into the extra cellular fluids (http://www.britanica.com/bcom/eb/article/5/0,5716,189155+1+18627,00.html?query=calcium).

Calcium is a major mineral essential for healthy bones and teeth. There are several minerals known to be essential to the human body and which must be obtained from food. The major minerals (calcium, magnesium, phosphorus, sodium, chloride and potassium) are needed in the greatest quantities or are present in large amounts in the body. The three main functions of minerals are as constituents of the skeleton, as soluble salts which help control the composition of the body fluids, and as essential adjuncts to the action of many enzymes and other proteins (http://www.vegansociety.com/info/info09.html).

Chapter III

METHODOLOGY

A. Gathering and Preparation of Samples

Sargassum samples were gathered from Tando, Nueva Valencia, Guimaras. They were placed in large garbage bags and were transported from Guimaras to Philippine Science high School Science Research Laboratory.

The researchers thoroughly removed all foreign matter from Sargassum especially adhering soil or sand (not excessive washing to prevent leaching). The samples were exposed to air to dry then they were oven-dried for about six hours. The samples were then grounded using a mechanical grinder.

B. Preparation of Sargassum Tablets

The materials used in the tablet making were 250mL beaker, stirring rod, hot plate, distilled water and moulders which resembled the shape and size of a tablet. Ten grams of the ground samples were put in the beaker, and then 70mL water was added. The mixture was placed on the hot plate for fifteen minutes with constant stirring. Then, it was placed on the moulders and left to cool and hardened. Ten grams of the Sargassum sample made 82 tablets.

C. **Calcium, Iodine and Potassium Analysis**

The researchers let a chemist did the calcium and potassium analysis due to the lack of time, facilities and expertise. The method used for determining the calcium and potassium content is titrimetric micro method and flame photometric method respectively (See procedures C.1 and C.2).

C.1 Calcium Analysis *by Titrimetric Micro Method*

Two grams of sample was weighed and placed into small crucible and was ignited in furnace at 500-550 degree. The ash in hydrochloric acid (HCl) (1+4) was then transferred to 100 ml beaker. 5 ml HCl was added and made to evaporate by drying on steam bath for silicon dioxide (SiO_2) to be dehydrated. Residue was moistened with 5 ml HCl. Then 50 ml water was added to the residue. It was then heated for a few minutes on the steam bath and then transfered to 100ml volumetric flask. It was let cool quickly to room temperature. After it cooled, it was diluted to volume, shaked and filtered to remove the first portion of filtrate.

Fifteen ml aliquot was pipeted into conical-tip centrifuge tube containing 2 ml saturated ammonium oxalate $(NH_4)_2C_2O_4$ solution and dropped Me red (dissolve 1 g Me red in 200 ml alcohol). 2 ml acetic acid (HOAc) (1+4) was added. Then the tube was rotated for the contents to mixed thoroughly. Ammonium hydroxide (NH_4OH) (1+4) was added while rotating tube from time to time until solution was faintly alk. Then few drops of the HOAc were added until color became faint pink (pH 5.0). The tube was rotated so last bit of liquid in conical tip has required color.) It was let to stand for about 4-5 hours. Then it was placed in the centrifuge for 15 minutes. (Pipet should be firm lump of tube.) Supernate was removed using suction device taking care not to disturb pipet. Two ml HH_4OH (1+49) was added to wash the pipet and the tube was rotated to break up pipet. (It was necessary to jar tube sharply.) It was centrified for ten minutes. The supernate was removed again. It was wash with reagent as before. Pipet was washed for three times.

After the last supernate was removed, two ml sulfuric acid (H_2SO_4) (1+4) was added to the tube. The pipet was broke up using a steam bath. It was heated to 80-90 degrees and titrated in tube with 0.02N potassium permanganate ($KMnO_4$). The liquid was rotated during titration to attain proper end point. When tube cooled to below 60 degrees during titration as indicated by slow reduction of $KMnO_4$, it was reheated in steam bath for a few minutes. Complete titration was then done. Blank on identical volume H_2SO_4 was also performed in similar tube heated to same temperature to determine volume $KMnO_4$ solution necessary to give end point color. This value was subtracted from buret reading. (1 ml 0.02N $KMnO_4$ = 0.0004000 g Ca). Values were report as % Ca.

C.2 Potassium analysis *by using Flame Photometric Method*

❖ Reagents

a.) Potassium stock solution---1000 ppm potassium. 1.907 g dry

KCI was dissolved in H_2O and diluted to 1L.

b.) Sodium stock solution ---1000 ppm sodium. 2.542 g dry NaCI was dissolved in H_2O and diluted to 1L.

c.) Lithium stock solution---1000 ppm lithium. 6.108 g LiCl was dissolved in H_2O and diluted to 1L.

d,) Ammonium oxalate stock solution--- 0.24 N. 17.0 g (NH4)2C2O4 was dissolved in H_2O and diluted to 1L.

e.) Extracting solutions --- Using internal standard method, volume LiCl stock solution was diluted to 1L.

❖ Preparation of Standard Solutions

Appropriate aliquot of stock solution was diluted and series of standards containing K in stepped amounts (including 0) was prepared to cover instrument range. And also Li and NH oxalate (if required) in same concentrations as in corresponding extracting solutions.

❖ Sample Extraction

Portion of finely ground and well- mixed sample was weighed and transferred to Erlenmeyer of at least twice capacity of volume of extracting solution that was used. The measured volume of extracting solution was added to stopper flask and was shaked vigorously at frequent intervals greater than or equal to 15 minutes. It was filtered thru dry, fast paper and combined filtrates. Filtrate was used for determination.

❖ Determination

All glassware were rinsed in sodium determination with dilute nitric acid (HNO_3), and then followed by several portions of water. Solutions were protected from air-borne sodium contamination.

Instrument was operated according to manufacter's instructions. Instrument was permitted to reach operating equilibrium before it was used. Portions of standard solutions were aspirated toward end of warm-up period until reproducible readings for series were obtained.

Standards, covering concern range of samples involved, were operated at frequent intervals within series of sample solution determination. This operation was repeated with both standard and sample solution enough times to result in reliable average reading for each solution. Curves from readings of standards were plotted, and %potassium was calculated.

D. Effects of Sargassum Tablets on Body Weight of White Mice

Fourteen white mice were used to test the effectiveness of the supplement tablets made from Sargassum. They were divided into two groups with each group composed of seven white mice. Each group was placed in different cages and labeled according to its treatments. The first group was given the supplement tablet and the other was used as control. All fourteen white mice were given a similar diet of feeds twice a day, except for that the seven experimental mice had an additional Sargassum supplement tablet on their diet.

The researchers got the initial weights of the white mice before it was subjected to the treatments. The treatment lasted for three weeks. The white mice were fed at seven o'clock in the morning and seven o'clock in the evening. The weights of the white mice were observed every week. All observations were recorded.

E. Statistical Test and Research Design

The mean and standard deviation were used as descriptive statistical tools. T-test for unequal sizes at $\alpha 0.05$ was used for comparing the growth of white mice subjected to the tablet and the control.

CHAPTER IV

RESULTS ANS DISCUSSION

A. Calcium, Iodine and Potassium Analysis on Sargassum

Using Titrimetric Micro Method and Flame Photometric method, laboratory analysis showed that Sargassum contain 4.74% calcium and 2.6% potassium respectively. According to the review of related literature, Sargassum has high iodine content of more than 3900 ppm.

B. Effects of Sargassum Tablets on Body Weight of white Mice

This study was conducted to see if the supplement tablet from Sargassum has a significant effect on the weight of white mice after two weeks of administering the Sargassum supplement tablet. This study further observed the appetite of white mice that are given the tablet.

The researchers measured the individual weights of the white mice after each week. The results obtained showed that the supplement tablet from Sargassum has an effect on the body weight of the white mice. It was observed that the white mice subjected to the supplement tablet generally increase their weights by 4.545%. On the other hand, the white mice that are not given the tablet lose weight after two weeks of observation. Results of the study are presented in tables 1 & 2 for the first week and 3 & 4 after the second week.

Table 1. Percent increase in weight of white mice not given Sargassum tablets after seven days

Control Mice	Initial weight	Final weight	Percentage increase in weight (%)
1	84.0	83.2	-0.95
2	86.0	85.0	0.00
3	86.8	86.5	-0.36
4	87.3	Dead	---
5	86.3	86.0	-0.35
6	85.0	Dead	---
7	87.8	87.5	-0.34
Mean	**86.03±1.742**	**85.64±2.673**	**-0.4±0.118**

Table 2. Percent increase in weight of white mice administered with Sargassum tablets after seven days

Experimental mice	Initial weight	Final weight	Percentage increase in weight (%)
1	84.5	86.0	1.78
2	86.9	87.3	0.46
3	87.0	88.5	1.72
4	85.2	89.0	4.46
5	86.7	88.1	1.61
6	87.4	89.2	2.06
7	83.0	83.2	0.24
Mean	**85.81±2.651**	**87.33±4.512**	**1.76±1.901**

Table 3. Percent increase in weight of white mice not given Sargassum tablets after fourteen days

Control Mice	Initial weight	Final weight	Percentage increase in weight (%)
1	84.0	82.1	-2.26
2	86.0	83.8	-1.41
3	86.8	84.0	-3.23
4	87.3	Dead	---
5	86.3	85.5	-0.97
6	85.0	Dead	---
7	87.8	85.8	-2.28
Mean	**86.03±1.138**	**84.24±1.488**	**-2.03±0.875**

Table 4. Percent increase in weight of white mice administered with Sargassum tablets after fourteen days

Experimental mice	Initial weight	Final weight	Percentage increase in weight (%)
1	84.5	89.1	5.44
2	86.9	89.8	3.34
3	87.0	90.9	4.48
4	85.2	89.8	5.40
5	86.7	90.1	3.92
6	87.4	91.5	4.69
7	83.0	Dead	---
Mean	**85.81±1.329**	**90.20±0.863**	**4.545±0.825**

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary:

The researchers were able to determine the calcium and potassium content of Sargassum tablet. The calcium content of Sargassum is 4.73% while its potassium content is 2.6%. The researchers also were able to determine the effect of the Sargassum supplement tablet on the body growth of white mice. After two weeks of observation, the results acquired proved that the white mice given the tablet supplement had a significant weight increase compared to those who were not given the table (Test, $\alpha 0.05$).

Conclusions:

The researchers concluded that:

1. Supplement tablet from Sargassum contains a large amount of iodine, 4.73% of calcium and 2.6% of potassium. These three minerals are essential for the body.
2. There is a significant effect on the increase in weight of white mice subjected to the supplement tablet.
3. The mean percentage weight increase of the white mice that have received Sargassum after two weeks taking

the tablet is 4.545% and for those who are not is -2.03%. It only shows that the white mice subjected to the supplement tablet grew faster compared to those who were not given the tablet.

Recommendation:

The researchers recommended that further studies be done related to this research. It is suggested that further chemical analysis on Sargassum will be done. It is also suggested to identify the hazardous components of Sargassum if there were any. More high-tech instruments should be used to do the chemical analysis to obtain more précised results. It is also recommended to prolong the duration of the study to supplementarily study the effectiveness of the tablet. Lastly, the researchers recommend to use other test organism other than mice.

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PLATES

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