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A Research Proposal Presented to AMA International University Kingdom of Bahrain

Pura B. Andeng

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Clams samples were collected along the seashore of Tubli in the Kingdom of Bahrain where they are abundantly found. The collected clams were transported to the Biochemistry laboratory of the College of Medicine of AMA – International University of Bahrain for analysis. The spectrophotometer was used to determine the elemental composition which were limited to the analysis of calcium, chlorides, magnesium, sodium, iron and zinc.

Results show that the elemental composition of the clam on calcium, magnesium, sodium and chloride were found to contain higher composition as compared to the normal elements found on daily serving of clams which may be due to the nature of substrate found in the area where the edible clams were collected while the composition of potassium, copper and iron was found to be lower than the normal elemental component of daily serving of clams which means that these elements are not that much in the area where the clam samples were collected considering that clams are considered scavengers. Lastly, the analysis on zinc was found to have same concentration when compared to the normal elemental composition on clams. This indicates that chlorides in the area where the samples were collected are minimal knowing that chloride is one of the major inorganic anions present in water and sewage which is responsible on the salty taste produced by chloride concentration and depends upon the chemical composition of water.

The microbial test results show that the collected clams were contaminated with fecal coliforms and cocci coliforms so proper handling and cooking it properly is one of the remedies in patronizing the clams.

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I. The Problem and its Background

a) Introduction

The sea is home to a diverse array of seashells in which one of them are bivalves such as clams making up many of the most often found seashells. The actual shells are just half of the existing shells because they exist as bivalves containing two parts. They usually attach themselves on hard surfaces along seashores and others burrow themselves on sand so others may allow growing more and attached at the sand surface.

The terms given to short-bodied animals that live in shells, usually beside the seashores are clams. It is normally found along the seashores and across the coastal banks of the Atlantic and Pacific Ocean. The binomial name for Clams is maxima and it fits to the Bivalvia class in the family Veneridae. The word clam is frequently used to discuss to fresh water mussels and other freshwater bivalves as well as marine bivalves. However most of the species of Bivalvia are thought out to be palatable, some of them are too small and not all of them are considered edible. The shell of a clam can be connected by axis joint and can be divided into equal valves. It is beneficial and good for human health since it is a rich source of many important nutrients like phosphorous, calcium, potassium, protein, iron and other vitamins needed by the body. As regards to the nutritive health benefits value of consuming clams, it results for a sensible healthy decision as they contain negligible fat and are omega-3 fatty acids rich. Comparing the protein level with red meat clam is very much lower with very few calories.

Clams act as a beneficial source of phosphorus for the body which is the nutritional value needed for bones and teeth development and supports the body in consumption of vitamins. It is also a good source of iron for the body as some researchers claim that clam is much higher in iron as compared to other sources like beef. It is then good for persons who are suffering from iron deficiency.

The presence of potassium in clam supports the body in sustaining blood pressure and normalizing heart movement, besides with other body progressions.

Vitamin A is also loaded in clams which are needed by the body to preserve strong, fit and healthy skin and also stimulates foresight, developmen good for the health needed to preserve healthy blood dietary fat in the human body.

Clams can be classified as scavengers since they make use of their taps siphons to wrench in and then sieve tiny units of organic matter and some inorganic materials from the nearby water source which shared to almost all clams in attaining their food; they are filter feeders. It is therefore necessary to assess the elemental composition of these edible clams for the safety of the consuming public.

Since clams are collected from coastal banks the possibility to be infected with wastes on organic and elemental pollutants present in the seawater is likely to happen, hence this experimental study has been conceived. It is for this reason that the researcher seeks to experiment on the microbial load and assess elemental composition of clams if it is safe to consume.

The hard clam (Mercenaria mercenaria) is the one utilized in the study which is known to be named as quahog or quahaug. It is a round clam or hard-shelled clam which is a marine bivalve mollusk. History says that this was first eaten by natives of the eastern shores of North America to the Yucatán Peninsula. It is one of many unrelated edible bivalves which in the United States are frequently referred to simply as clams, as in the expression "clam digging". Older literature sources may use the systematic name Venus mercenaria; this species is indeed in the family Veneridae, the venus clams. (Wikepedia 2012).

This study aimed to determine the presence of microbes and assess the macro-elemental composition of edible clams collected at Tubli area in the Kingdom of Bahrain. Specifically, it sought to answer the following questions :

1. *What are the elemental compositions of the edible clams in the Kingdom of Bahrain?*
2. *What are the concentrations of the assessed macro-elemental composition of the clams under study?*
3. *Are the concentration of the assessed elemental composition of the edible clams Under study comparable to the standard elemental composition of clams?*
4. *Are the edible clams under study positive with microbes?*
5. *What pathogenic and coliform organisms through bacteriological parameters are found/present in the edible clams?*

i. *Significance of the Study*

Clams are collected along the Atlantic, Gulf and Pacific shorelines providing slightly diverse varieties of basic clam varieties. These clams may be soft-shelled or hard-shelled. Soft-shelled clams have a long, elastic andchewy sap that extends beyond the edge of their shells but hard- shell are of opposite. The palatable parts of the clams are the tap in which the clam absorbs water while its footis use to push itself over the sand and the muscle is the one responsible in opening and closing the shell. Irrespective of size, the flesh is sweet, being somewhat chewy and elastic and rich source of vitamin A, minerals and omega-3 fatty acid.

Wikipedia 2007 says that hard clam has many alternative common names such as Quahog clam, round clam or chowder clam. These clams were taken from the marine floor at the north coast of Iceland. It was lately confirmed that they can tribe up to 405 years which are now accepted as the longest living animal in the world.

These hard clams have different names according to marketspecialists in which are usually based on their sizes. The smallest legally harvestable clams are called count-necks followed with the next size aslittle-necks, then top-necks followed by cherrystones, and the largest size are called quahogs or chowder clams.(Wikipedia 2012).

It is firmly believed that nature offers considerable possibilities as vast source of food supply with all the healthy nutrients but the quality must be taken into consideration. Since clams can just be collected for free in the country, it is high time to determine the presence of microbes in it and to assess its elemental composition so as for people to become aware whether it is safe to consume or not. This research has been conceived based from the personal experience of the researcher on serious stomach problems may have been due to consumption of the clams. Testimonies from other friends were also taken who experienced the same; thus, this research was conducted.

This research would benefit the following entities

Future researchers: This could serve as guide for related studies in determining which month of the year will clams be free from microbes because this may not be observed on whole year round.

Health workers: The result of this research would warn the consuming public due to its contamination withsome microbes which can affect the health of the populace though the nutritive value are of significance.

Local populace: This study could provide idea on the nutritive value other than its contamination which may not be observed in all year round. This study can provide information on the nutritive value which is an alternative to the costly foodstuff packed with macro-elements found in these clams.

This study would also help proper authorities, health workers, vendors from wet markets, farmers, housewives and the consuming public to become aware of the macro- elemental composition and the nutritional value of clams and to warn the public if it is not safe to consume or not. As often said, prevention is better than cure. Furthermore, it would help housewives to choose cheap alternative and safe source of minerals, vitamins and other macro-elemental composition from clams needed for human growth.

ii. *Scope and Delimitation*

This study was limited in assessing the macro-elemental composition like calcium, potassium, magnesium, copper, iron, sodium, zinc and chlorides of edible clams in the Kingdom of Bahrain and compare the result with the standard nutritional value contained in a normal clam. The determination on the presence of microbes was also done on the clam sample. The assessed elemental composition was only limited to the compositions above because other nutritive components of clams cannot be analyzed by the spectrophotometer available in Biochemistry laboratory of the University. Clams were collected along seashores in Tubli, Kingdom of Bahrain which was done first week of June 2013. The collected clams were brought to the Biochemistry laboratory at the College of Medicine of AMA University for analysis.

b) *Research Paradigm*

The following paradigm was conceptualized this way for better illustration of the study.

Input	Process	Output
Collected clams	Experimented and Analyzed in the laboratory	Safe edible clams Information on the elemental composition

II. Review of Related Literature

Clams is of the kingdom animalia, subkingdom metazoa of phylum mollusca, class bivalvia, subclass heretodonta of order veneroida of family mactridae and of species M. mercenaria.

Clams are either soft-shelled or hard-shelled and there are about 15,000 different species of clams worldwide in which a hard clam Mercenaria *mercenariais* one of them. Practically, clam meat is soft white but their shells range in many colors with shades of cream, yellow, brown and red-brown. The shells are attached by a muscular axis which the clam uses to close its shells firmly when exposed and threatened. Clams burrow into the sand through their foot, and a double-tubed siphon that functions rather like a tube, one tube taking in water from which they extract oxygen and filter small organic particles which serve as their food while the other tube serves to expel water and other excretory waste products. The siphon or tubes ventures from the end parallel the foot and may be joint in a single column referred to as the neck.

The hard-shelled and edible clam (Mercenaria mercenaria), is known to have different local names. Others call it quahog orquahaug which is a marine bivalve mollusk. This shell was first eaten by natives of the eastern shores of North America to the Yucatán Peninsula because of its nutritional value setting aside the macro-elemental, minerals and vitamins packed in this naturally available marine resource. This hard clam is found elsewhere over the pacific marine water and along Gulf coastal shorelines which can live up to 400 years. It is one of many unrelated edible bivalves which in the United States are frequently referred to simply as clams. (Roger, et.al.1975).

Hard clams are quite ordinary and this class of shell has also been introduced and farmed on the Pacific coast of North America, Great Britain and continental Europe. It reproduces sexually by females and males shedding gametes into the water.

According to Kraeuter, J. N. and M. Castagna (2001), this hard clam can be found in restaurants known as raw bars or clam bars specialized in serving littlenecks and topnecks raw on an opened half-shell, usually with a cocktail sauce with horseradish, and often with lemon. The meat of these different sizes of hard clam can be made into different menus like the littlenecks are steamed and dipped in butter. Littlenecks are often found in-the-shell in sauces, soups, stews, clams casino or substituted for European varieties such as the cockle in southern European seafood dishes. The largest clams, quahogs or chowders and cherrystones having the hardest meat, are used as clam chowder, clam cakes and stuffed clamsor they can be minced and mixed into other dishes.

Edible clams (Mercenaria mercenaria) are smooth and have unclearly heart-shape, comes in three sizes and somewhat salty flesh. It is rough and frequently used for attraction or "bait" and cooked in broth (chowder) which got its popular name as chowder clam. (Wikipedia).

Though greatest of the varieties of Bivalvia are considered edible, some of them are too small and not all of them are considered edible. The meat of a clam is highly nutritious and a powerful storehouse of many essential nutrients required by the body, especially phosphorus, potassium, protein, vitamin A and iron. It is low in fat, thus conveying it suitable for fitness conscious people. But the amount of accrued metals and other components must be taken into consideration.

Manley et al., (1984) said that heavy metals restrain evolution in a variety of mollusks species. Sericano et al. (1995) also said that bivalvemollusks collect many pollutants within their tissue and shell has led to their use as bio-monitor of hydrocarbons and heavy metals in which same findings were observed by Bourgoin (1990) and Phillips & Rainbow (1993) who mentioned that in marine and estuaries water same method of pollution may take place. In contrast it is known that the accumulated heavy metals and hydrocarbons on tissues of pearl oysters that upon exposure on these compounds can cause toxic effects on other bivalve mollusks which was confirmed on a study conducted by Kennedy et.al. in 1996.

A research conducted by Rutgers on bivalve at the Haskin Shellfish Research Laboratory in Tuckerton, New Jersey said that clams can live to roughly seven years and they make use of their sap to wrench in and sieve the tiny small particles of organic substances from the immediate water source which is their usual activity to gather food for survival. They can therefore be regarded as filter feeders. As such it is then crucial to the consuming public to just consume such clams considering their nature of obtaining their food. It is for this reason that that the researcher is interested to determine the microbial load of the edible clams available in the Kingdom considering the activities in the nearby shorelines like the metal processing undertaken by the Aluminum Industry where toxic metals like lead, chromium, zinc and mercury can be one of their waste materials. Other than this is the extraction of petroleum products in which we know well that drilling and refining is done in all neighboring Gulf countries and toxic metals can also be one of the wastes generated.

The meat of clams (Mercenaria mercenaria) have sweet flavor that makes it possible to turn to strips possible for broth, sushi and others which can be coat and rolled with bread cramps and served as clam strips similar to the one promoted and commercialized by the Howard Johnson's franchise.

According to Natalie Stein (2011), the nutritional value of clams can have protein, negligible amount of fat, omega- 3 fatty acids, carbohydrates and omega-6 fatty acids, vitamins A, B6, B12, C, E, K, folate, niacin, thiamin, and some minerals.

Clams being minimal in fat and high in omega-3 fatty acids make up an admirable heart-healthy food and operates also as decent source of phosphorous which is required by the body for appropriate formation of teeth and bones for which the consumption of vitamins are supported. But since clams are gathered along coastlines its possibility to be contaminated with chemical impurities prevailing in the aquatic marine and also in fresh water is feasible. Hence, this study was conducted to assess the microbial load and elemental composition of clams.

III. Research Methodology

This chapter presents the discussion of the procedures used in determining the presence of microbes and in assessing the macro-elemental composition of edible clams (Mercenaria mercenaria) in the Kingdom of Bahrain.

a) *Materials Equipment and Glass Wares*

The materials used were two receptacles, bucket, prewashed bottle, hot plate, beakers (45-80mL), watch glass, atomic absorption spectrophotometer, petri dishes, micro-pipets of different volumes, 0.1mL (units) graduated cylinder, 6 oz. (160 ml) dilution bottles, glass slides, sterile swabs, inoculating loop, rubber stoppers or plastic screw caps, petri dish containers, Bunsen burner, refrigerator, water bath, incubator, auto-clave, dilution blanks and microscope.

The following regents used in the study were: deionized water, reagent blanks and standard reagents of calcium, potassium, magnesium, cupper, iron, sodium, zinc and chloride. Nutrient agar and Staining reagents like crystal violet, saffranin, 80 % ethyl alcohol and gram iodine were also included.

i. *Experimental Design*

This study made use of descriptive design which is limited on the presence of macro-elemental composition and determining the presence of microbes on edible clams in the Kingdom of Bahrain.

ii. *Extraction and Chemical Analysis*

a. *Gathering of Samples*

Fresh clams were gathered along the seashore of Tubli in the Kingdom of Bahrain where they are found abundantly. The freshly collected clams were washed with sea water from where they were collected to be sure that the present characteristics of the clams are maintained and to remove some unwanted component of the clams. These were brought to the Biochemistry laboratory at the College of Medicine – AMA International University of Bahrain for analysis. The meat of the clams were the subject utilized in the study.

b. *Elemental Determination of Clam Meat*

Thirty grams of the clam meat were removed from their shells and homogenized in a blender. The supernatant liquid from the clam meat mixture was the one utilized for the elemental determination with the use of the spectrophotometer available in the Biochemistry laboratory. The following were the macro-elements analyzed.

Determination of Calcium

Three cuvettes were labeled 1, 2 and 3, respectively. To each cuvette 0.5 ml each of calcium base reagents was added. To cuvette one (1) 0.01 ml of the calcium standard solution was added while same volume of the homogenized clam meat was added to cuvette two (2). Nothing was added to cuvette 3 which served as control. The cuvettes with content were incubated at 370C for 1 minute in the spectrophotometer then the results on the absorbance of the standard reagent and clam sample against the reagent blank at

550 nm wavelength within sixty minutes was recorded. The collection of data was done in three trials and the average was computed and recorded.

Determination of Potassium

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of potassium blank reagent was measured and was placed in the three separate cuvettes. To cuvette 1, 0.1 ml of potassium standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while cuvette number three was added with same volume of distilledwater which served as blank or control. The cuvettes and content were incubated at 300Cfor five minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam meat sample against the reagent blank at 580 nm wavelength within sixty minutes was recorded. The collection of data was again done in three trials and the average was also computed and recorded.

Determination of Magnesium

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of magnesium blank reagent was again measured and was placed in the three separate cuvettes. To cuvette 1, 0.1 ml of magnesium standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while nothing was added in cuvette number three which served as blank or control. The cuvettes and content were incubated at 37oCfor three minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam meat sample against the reagent blank at 520 nm wavelength within 180 minutes and data was recorded same as above.

Determination of Copper

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of copper blank reagent was measured and was placed in the three separate cuvettes. To cuvette 1, 0.1 ml of copperstandard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while nothing was added in cuvette number three which served as blank or control. The cuvettes and content were incubated at 37oC for five minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam sample against the reagent blank at 520 nm wavelength within 30 minutes was observed in 3 trials and recorded.

Determination of Iron

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of iron blank reagent was again measured and was placed in the three separate cuvettes. To cuvette 1, 0.1 ml of iron standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while nothing was added in cuvette number three which served as blank or control. The cuvettes and content were incubated at 370Cfor three minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam meat sample against the reagent blank at 520 nm wavelength within 180 minutes .was observed in 3 trials and recorded.

Determination of Sodium

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 2.5 ml of sodium blank reagent was measured and was placed in the three separate cuvettes. To cuvette1, 0.5ml sodium standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while cuvette number three was diluted with same volume of distilled water which served as blank or control. The cuvettes and content were again incubated at 300C for ten minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam meat sample against the reagent blank at 420 nm wavelength within thirty minutes was observed and recorded.

Determination of Zinc

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of zinc blank reagent was measured and was placed in the three separate cuvettes. To cuvette 1, 0.1 ml of zinc standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while nothing was added in cuvette number three which served as blank or control. The cuvettes and content were incubated at 370C for five minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam sample against the reagent blank at 520 nm wavelength within 30 minutes was observed and recorded.

Determination of Chlorides

Three cuvettes were again taken and labeled 1, 2 and 3, respectively. 0ne ml of chloride blank reagent was measured and was placed in the three separate cuvettes. To cuvette 1, 0.01ml chloride standard reagent was added and same volume of the homogenized clam meat was added in cuvette 2 while nothing was added on cuvette number three which served as blank or control. The cuvettes and content were incubated at 300C for five minutes in the spectrophotometer. Results on the absorbance of the standard reagent and clam meat sample against the reagent blank at 500 nm wavelength within thirty minutes was observed and recorded.

iii. *Microbial Determination*

a. *Sterile Techniques*

All the glass wares needed in the experiment were sterilized using the autoclave which were done at the Biochemistry room at the College of Medicine.

b. *Growth Media*

The YED standard (Yeast Extract and Dextrose) were used as the normal development medium. It is called a "complex" medium because it is prepared from regular elements (yeast) and its correct chemical structure is not identified. Two grams of the extract from yeast was mixed with four grams of anhydrous dextrose and four grams of agar-agar. The mixture was dissolved in 200 milliliter of purified water. The mixture was heated and brought to boiling to dissolve the yeast, anhydrous dextrose and agar-agar and was poured in a three sterilized petri dishes and were kept in the incubator.

c. *Growth Temperature and Development Rates*

The media were incubated about 30ºC to have best possible progress for the strains. Temperatures above 30ºC should be avoided. The incubated cultures were kept in the dark area to reduce light viability of the cells to obtain ideal development for the red pigment to progress. The plates were covered with plastic bags with small opening to allow enough oxygen to maintain aerobic respiration to materialize.

d. *Spreading Cells*

Quantifiable pour plating technique was use in the study. There were 1 to 10 dilution sequences of yeast cell suspensions. From these suspensions 0.1 ml was measured carefully with the use of a pipet which was poured to a sterilized tube containing 0.9 ml of sterile water. The tubes were swirled to allow the cells to be suspended and entire contents of the tube was poured onto the surface of the agar medium which was tilted and rotated to the plate to distribute the suspension evenly over the surface of the agar ready for isolation of the colonies.

e. *Isolating Single Colonies*

Short and single streak of cells (about 2 cm long) were done near the edge of the agar in a petri dish prepared with the use of sterile swabs and these were overlapped with a subsequent streak at an angle of roughly 15 degrees. The cells from the first streak were loitered onto the fresh agar and this was repeated by numerous and parallel streaks with the same toothpick. Another new sterile swab was taken and the process was repeated starting from the end of the last streak. The sequence was repeated until the entire plate has been covered. The population of the duplicated cells is those that are generated from a single parent cell taken from yeast.

f. *Estimating the Number of Yeast Cells in a Culture*

The estimation on the number of colonies from yeast cells in a culture was done and viewed in an electronic microscope and the electronic counter chambers was also used. The data gathered were observed and recorded.

g. *Microscopic Examination of Yeast*

The plates were viewed using an electronic microscope. The low-powered objectives (10x) was used because high powered objective ones get too close to the agar and can cause mist to get through the lens of the microscope. Observation was done and recorded.

IV. Presentation, Analysis and Interpretation of Data

This chapter presents the data gathered on the macro-elemental assessment and microbial analysis of edible clams in the Kingdom of Bahrain.

Clams samples included in the study were collected along the seashore of Tubli in the Kingdom of Bahrain where they are abundantly found. These were kept in plastic container previously washed with the sea water in the area to be sure not to alter the present characteristics of the clams. The collected clams were transported to the Biochemistry laboratory of the College of Medicine of AMA –International University of Bahrain for analysis. The spectrophotometer was used to determine the elemental composition of the clams which were limited to the analysis of calcium, chlorides, magnesium, sodium, iron and zinc which are the only elements that can be done with the use of the spectrophotometer available in the laboratory. The microbial test was also done following the standard procedure in microbial analysis.

Thirty grams of fresh clam meat was homogenized in a blender and the supernatant liquid of the mixture was the one used in the elemental analysis of calcium, chlorides, potassium, magnesium, sodium, iron and zinc with the use of the spectrophotometer. The homogenized clam meat were then added with the different reagent blanks and reagent standards of the different elements tested then absorbance of the edible clam against the absorbance of the standard reagents were observed, computed and recorded.

The microbial test was also conducted in the biochemistry laboratory and results were again analyzed and recorded.

a) *Elemental Composition of the Clams*

Determination of the elemental composition of clams was found to be present and the computed concentrations are shown in table 1.

Table 1 : Elemental Composition (mg) compared to the Normal Composition of Edible Clam based from Health Benefits of Eating clams.

Element Detected from clam meat	Trial 1 on Elemental Composition (mg)	Trial 2 on Elemental Composition (mg)	Trial 3 on Elemental Composition (mg)	Average Elemental Composition (mg)	Normal Elemental Composition of Clams (mg)
Calcium	111.27	97.64	106.72	105.21	104
Potassium	70.62	69.71	70.17	70.17	71.3
Magnesium	21.53	21.31	21.53	21.46	20.4
Copper	0.75	0.73	0.80	0.76	0.8
Iron	31.7	32.15	29.89	31.25	31.7
Sodium	149.49	147.0	144.95	147.15	127
Zinc	3.1	3.1	3.1	3.1	3.1
Chloride	12	12.73	12.73	12.89	5.0

The analysis on the elemental composition which was based from the thirty gram clam meat used reveals that they vary in concentration as compared from the results computed on daily serving of 227 grams of clams. (Health Benefits of Eating Clams, 2010)

Calcium is one of the many minerals in the body which can be found in a number of food sources like clams and other dietary supplements necessary for bodily functions like muscle contraction, blood vessel expansion and contraction, secretion of hormones and enzymes and instinct transmission.

The result of the spectroscopic analysis showed that calcium was present and computed to contain an average of 105.21 milligram or 1.16% higher as compared to 104 milligram normal calcium content.

Potassium was also analyzed and found to be present from the edible clams and computed to have an average composition of 70.17 milligram which is 1.58 % lower than the normal composition which is 71.3milligram of potassium.

Potassium is an essential nutrient in the body which functions as a mineral and the world's seventh most abundant metal. It is an essential nutrient in the human body and functions in many bodily systems and uses an estimated 20 to 40 percent of resting energy just to move potassium through cells. This much energy expenditure requires a readily available and nutrient rich in which clam is one of them to sustain life.

Magnesium and Copper were also detected to be present on the clam which was computed to have an average of 21.46 milligram against 0.80 milligram on daily serving of clams for magnesium while copper was found to contain an average of0.76 milligram which is almost same as the normal component of copper which is 0.80 milligram.

Magnesium plays an important role in energy production and management in human body. Severe and prolonged magnesium deficiency can lead to delirium and hallucination. Cupper which is a trace element is also an essential for human body for the proper functioning of organs and metabolic processes. Clams being a good source of magnesium and copper should be considered but its handling and cooking preparation should be done properly.

The elemental composition on Iron, sodium and zinc was also done which was computed to have an average composition of 31.25, 147.15 and 3.1 milligrams respectively against the normal composition of clam based on normal composition of clam which is 31.7, 127.0 and 3.1 milligram separately.

Iron is one of the most abundant metals in the earth's crust. Iron is an essential element in human nutrition. Estimates of minimum daily requirement for iron depend on age, sex, physiological status and iron bioavailability and range from about 10 to 50 mg/day (Philippine National Standards for Drinking Waters, 1993).

Sodium is an equally important electrolyte that helps maintain the balance of fluid in a person's body. It normalizes the amount of water in and around the body cells and helps regulate blood pressure.

Zinc is also an equally important trace element because it is found in every tissue in the body and is directly involved in cell division. It is a powerful antioxidant, helping to prevent cancer and directly involved in proper endocrine function and the maintenance of ideal hormone levels.

Lastly, analysis on chloride was done and computed to have 12.89 milligram on average composition against 5.0 milligram composition on normal clam.

The chloride ion is formed when the element chlorine gains an electron to form an anion (negatively charged ion) Cl^-. The chloride ion and its salts such as chloride are very soluble in water. It is an important electrolyte found in all body liquids accountable for sustaining acid/base stability, transferring nerve impulses and controlling fluid in and out of cells. Knowing clams to be a good source of sodium and chloride, this naturally available food source can be considered but again its handling and cooking preparation should be done properly (Nutritional Value of Clams).

b) Bacteriological Analysis

Clams and other bivalves require greater attention because these may contain pathogenic microorganisms and toxins from the water where they were collected which are harmful when eaten raw or partially cooked.

Results can be seen from figure 2 that bacilli of rod shape appearance are indication that the collected clams were positive of fecal coliforms. Rod or stick-shaped bacteria are called bacilli which include E. coli and Salmonella which are cholera causing bacteria. Fecal coliforms are groups of coliform bacteria that are present in sewage disposals. The presence of fecal coliform bacteria indicates that a pathway exists from waste sources such as animal feedlot run-off, septic tank or spool leakage.

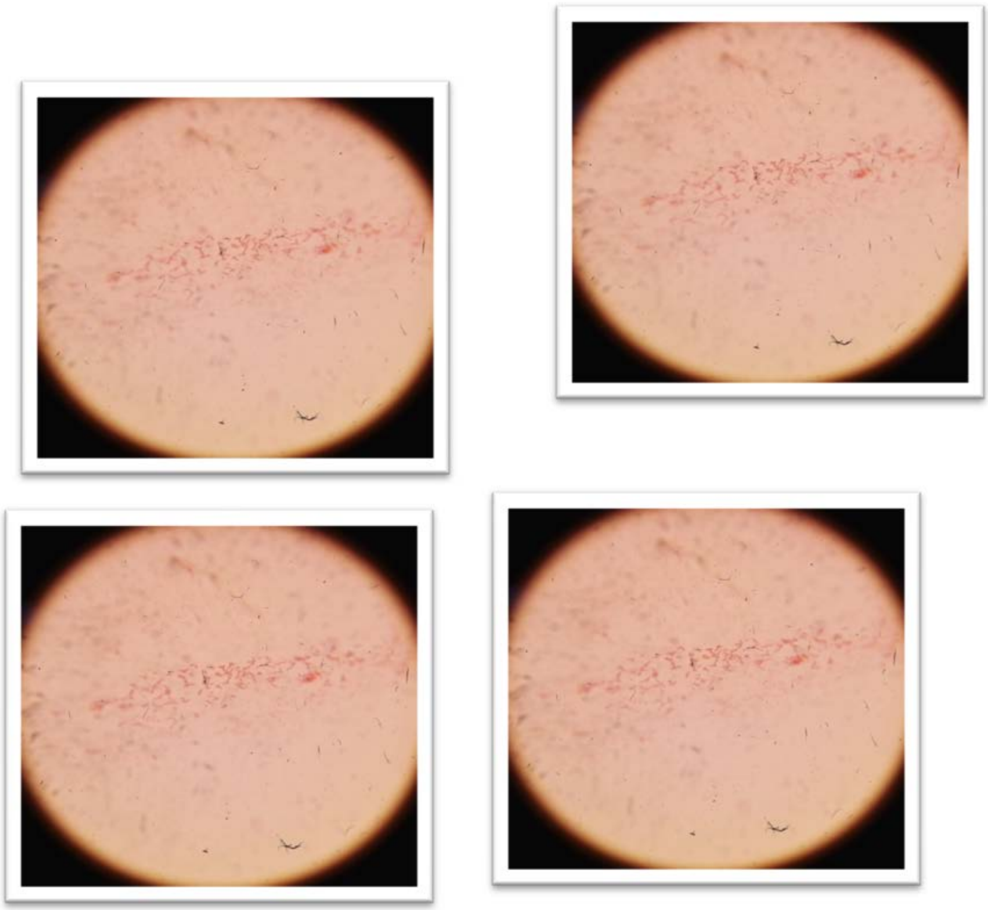

Figure 2 : Identified Rod Shape Bacilli from Edible Clam

Cocci was also observed on the clams as seen by the morphological description identified thru the help of one of the medical doctors in the College of Medicine as shown in the figure 3.

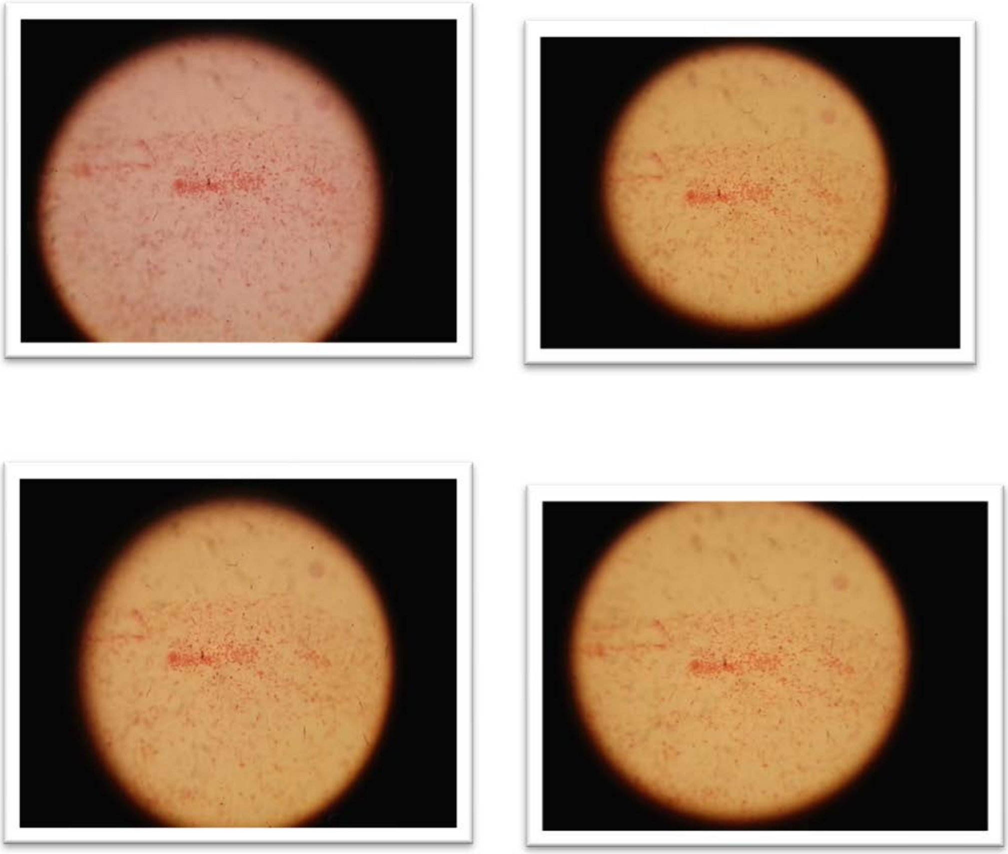

Figure 3 : Identified Cocci Microbes from Edible Clam

These spherical bacteria causes various infections in animals which includes gram-positive cocci Staphyloco-ccus aureus, Streptococcus pyogenes and Streptoco-ccus pneumonia while Gram negative cocci includes Neisiseria gonorrhea and N. meningitidis. These genera of bacteria are not related to one another though they share common ecology as human parasites. Though cocci were observed from the clam meat it is not conclusive as to what gram positive or gram negative was identified.

IV. Findings, Conclusions and Recommendations

a) *Summary of Findings*

The purpose of this study was to determine the elemental composition of edible clam and to determine the microbes present on it. The clams were collected along the seashore of Tubli in the Kingdom of Bahrain. Post-harvest procedures for marine bivalves like clams are designed to maintain the quality of these bivalves which requires proper handling and greater vigilance because these products can concentrate pathogenic microorganisms and/or toxins from the water where they are collected which to harmful to the consuming public.

The analysis on the elemental composition and bacterial determination were done during the second to third week of June 2013 in the Biochemistry laboratory of the College of Medicine at AMA International University.

The study made use of the supernatant liquid of the homogenized 30 grams of clam meat while the microbial determination made use of the swabbing technique in determining the presence of microbes.

The elemental composition was analyzed using the spectrophotometer available in the Biochemistry laboratory. It was observed that calcium; potassium, magnesium, sodium, iron, zinc and chloride were found on the clam meat.

The elemental composition of the clam meat was also compared with the normal elemental composition based on daily serving of clam and found out that Calcium Magnesium, sodium and chloride were found to contain higher elemental composition as compared to the normal elements found on daily serving of clams which may be due to the nature of substrate found in the area where the edible clams were collected.

The analysis on the elemental composition of potassium, copper and iron was found to be lower than the normal elemental component of daily serving of clams which means that these elements are not that much in the area where the clam samples were collected considering that clams are considered scavengers.

Lastly, the analysis of zinc was done and found out that same concentration was analyzed when compared to the normal elemental composition on clams. This indicates that chlorides in the area where the samples were collected are minimal knowing that chloride is one of the major inorganic anions present in water and sewage which is responsible on the salty taste produced by chloride concentration and depends upon the chemical composition of water.

Microbial test was also carried out in the analysis revealing that the collected clams were found to be contaminated with fecal coliforms and positive with cocci pathogens. The identification of the cocci present on the clam samples were not undertaken.

b) Conclusions

The following conclusions were derived from the findings:

1. That the edible clams contain calcium, potassium, magnesium, cupper, Iron, Sodium, Zinc and Chlorides.
2. That the average elemental composition on calcium, magnesium, sodium and chlorides are higher in concentration while potassium, iron and zinc was found to have lower concentration as compared to daily composition of clams per serving. Zinc was found to have same concentration which is comparable to the normal chloride composition in a normal clam.
3. The collected clams were found to be contaminated with fecal coliforms and cocci coliforms so proper handling and cooking it properly is one of the remedies in patronizing the clams.

c) Recommendations

The following recommendations are given based on the findings and conclusions of the study:

1. Collection of the clams in other sites should also done and subject to same analysis.
2. Other nutritional value of the clams gathered on same site should also be analyzed and compare it with the standard nutritional value based on daily serving of clams.
3. Microbial test on the water samples used in washing the collected clam samples should be done which may be the cause of fecal contamination.
4. Continuous monitoring on the microbial test is done on clams where they are abundantly found since fecal contamination may not be present in the area for the whole year round.

References Références Referencias

a) Books

1. Waldbusser, G.G., E.N. Powell, and R. Mann (2013). Ecosystem effects of shell and behavior of the hard clam Mercenaria mercenaria.
2. Kingsley, David H. (2012). Food Environ Virol. Published online 2012 November 20. PMCID: PMC3590410.
3. Natalie Stein (2011), Nutritional Value of Steamed Clams, Demand Media.
4. Stern Bonnie R. et al. (2007). "Copper and Human Health: Biochemistry, Genetics, And Strategies For Modeling Dose-Response Relationships.
5. Journal of Toxicology and Environmental Health. Part B 10: 157–222.
6. Encyclopedia Americana. Americana corporation, Volume 28 and 29, 1993."Vadopalas, B. & J. P. Davis. 2004. Optimal chemical triploid induction ingeoduckclams, Panopeaabrupta, by 6-dimethyl-aminopurine.Aquaculture 230:29–40.
7. Kraeuter, J.N. and M. Castagna (eds)., 2001. The Biology of the Hard Clam. Elsevier Science, Amsterdam. 772 pp. ISBN 0-444-81908-8Google Books.

b) Journals

1. Journal of Microbiologican Methods. 2013; 93(3):161-167.
2. International Journal of Environmental Research and Public Health. 2013; 10(4):1586-1597.
3. Journal of Toxicology and Environmental Health.2012; Part B 10: 157–222.
4. Journal of Shellfish Research. 2012. 30(3):761-769. 2011.
5. Journal of experimental Biology. 2012. doi: 10.1242/jeb.082909.
6. Journal of Toxicology and Environmental Health. Part B 10: 157–222.
7. SRAC Publication No. 4902.May 2010.Shellfish Handling Practices –Shrimp and Molluscs.

c) Electronic sources

1. http://info1.cfsan.fda.gov/shellfish/sh/shellfis.cfm - Certified shellfish shippers
2. http://www.floridaaquaculture.com/processing/handleintro.htm
3. http://www.floridaaquaculture.com/publications/VVriskreduction.pdf
4. http://www.livestrong.com/article/457637-side-effects-of-intraveneous-sodium-chloride/
5. www.textbookofbacteriology.net
6. www.LabMedica.com