# Nutritional Values and Chemical Constituents of Stinging Spines of *Dasyatis* spp. Used in Traditional Medicine in Myanmar

Thein Gi Naing[1], Khin Mya Mya[2], Moe Moe Aung[3]

## Abstract

Powder of stinging spines of *Dasyatis* spp. were tested for the presence of macroelements, microelements, toxic elements and proximate analysis were also determined. Chemical analysis revealed the presence of calcium 26.55±0.1%, sodium 1±0.004%, magnesium 0.98±0.002%, chlorine 3.28±0.02 % and iron 0.001±0.0002% in the *Dasyatis* spp. respectively. Proximate analysis showed that *Dasystis* spp. contained moisture 5.04±0.014%, ash 69.30±0.014%, water soluble ash 68.95±0%, acid insoluble ash 28.55±0%, carbohydrate 0±0.001%, protein 32.40±0.04%, fat 0.5±0.0004% and fiber 0.51±0.002% respectively. Proximate analysis showed protein present in considerable amount and ash content was found to be high in this sample and chemical analysis showed calcium in highest quantity. Heavy metals were not found in this sample. Moreover, mineral and element contents were also examined with more reasonable concentration in these animal parts. On the whole, it indicated that these animal parts used in traditional medicines are harmless and even promote general wellbeing of those who are relying on these medicines. However, as these parts come of natural living assets, there is a need to consider synthetic materials as substitute since in the long run, might impose a threat to these living assets.

**Key words**: macroelements, microelements, toxic elements and proximate analysis

## Introduction

In Myanmar, stinging spines of *Dasyatis* spp. is also called Lake kyauksu: which are commonly used in Myanmar Traditional Medicine formulation (TMF). The stinging spine of *Dasyatis* spp. is ingreident of TMF-9 HsidulaHsei: ,TMF-10 Hsishwin Wan HnouHsei:, TMF-11 MoukeHse:i: and TMF-21 HsiHsei:phyu.

Ray species were caught at landing sites and fish markets in Hlaing Gyi (Ayeyarwady Region), Yangon (Yangon State), Dawei, Myeik and Kawthaung Towns (Tanintharyi Region), the villagers of Thayawtathangyi Island (Don Pale, Lin Long and Palawar Villages) and Langann Island (Langann Village) (also Tanintharyi Region) in Myanmar (BOBLME ,2015).

Spine characteristics of *D.pastinaca* were found to be average lengths, males 77 mm, females 72 mm; total serrationsaverages, males 112; females 86; pb/STL averages,males 74%, females 71%. Eight to 18 mm spaces on basesides; dorsal groove 85% spine length (Schwartz, 2007).

In Traditional Medicine in Myanmar, stinging spines of *Dasyatis* spp. was used by rulers of early Myanmar dynasties. The powder form of Lake kyauk su: has been given to remove toxin from the body and increased energy power, salty and cool in nature. It also used in the treatment of traditional medicine for fever with delirium, dysuria, chornic rheumatism, oliguria, kidney stone, fistula, gonorrhea, leprosy, venereal diseases in Myanmar traditional medicine (Ashin Nagathein, 1972).

The present study has been under taken to identify the animal source commonly used in Traditional Medicine in Myanmar and to investigate the nutritional values and chemical constituents of stinging spines of *Dasyatis* spp. used in traditional medicine in Myanmar.

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## Materials and Methods

### Study Period

The study period lasts from July 2017 to May 2018.

### Samples Collection

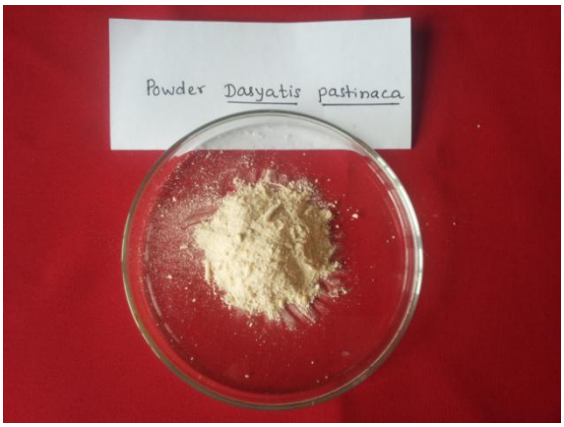
Stinging spines of *Dasyatis* spp. were purchased locally from Baja Hsei: zain (traditional medicine shop) which were collected from Myanmar coastal water have been recorded from Hlaing Gyi (Ayeyarwady Region), Yangon (Yangon State), Dawei, Myeik and Kawthaung Towns (Tanintharyi Region), the villagers of Thayawtathangyi Island (Don Pale, Lin Long and Palawar Villages) and Langann Island (Langann Village) (also Tanintharyi Region) Ngapli, Coco Island locations in Myanmar.

### Samples Preparation

The samples 150g of stinging spines of *Dasyatis* spp. were first washed thoroughly with distilled water and then washed with sterile water mixed, they were with 3cclime juice and washed with sterile water to remove the foreign matters and then sample is dried at drying condition in oven. One hundred and fifty grams of samples were crushed into smaller pieces and then make powder by blender. The powder was sieved using a stainless steel sieve to get fine powder and then sterilized for an hour in the air oven at 105ºC and stored in bottles prior to analysis. Proximate analysis, mineral composition and pharmaceutical product were carried out on dried powder. The Proximate analysis was carried out according to the extraction procedure of Association of official analytical chemistry (A.O.A.C, 2000).

### Determination of Elements by Energy Dispersive X-ray Fluorescence Spectrophotometer(EDXRF)

The elemental analysis of the powder and ash of *Dasyatis* spp. were carried out at the SPECTRO X- Lab, the M.G.A Petrochemical Lab Mandalay, Myanmar and Chemistry Department, West Yangon University. The determination of elements of the powder and ash of *Sepia* spp. and *Dasyatis* spp. were used by the FP- Pellets-121997ne1 method. X-ray fluorescence (XRF) plays an important role in elemental analysis.An EDXRF system consists of several basic functional components: an x ray excitation source, sample chamber, Si (Li) detector, signal processing and recording system.





Powder of stinging spines of *Dasyatis* spp. Ash of stinging spines of *Dasyatis* spp

Plate 1. Preparation of Powder and Ash of *Sepia* spp. and *Dasyatis* spp.

## Results

According to the findings of this study on these samples, higher concentration of ash and considerable amount of protein were investigated in these samples (Table 1 and Fig.1**).**

Total ash content was found to be (69.30 ± 0.014) followed by water soluble ash (68.95%) and acid insoluble ash (28.55%) (Table 2, Fig.4).

The result for the mineral analysis indicated that calcium is the most abundant mineral present in these samples. Sodium, magnesium and chlorine were found in reasonable amounts in these samples. The content of potassium and sulfur were found in small amounts (Table 3 and Fig. 2).

Aluminum, silicon, iron, copper and zinc were also found in reasonable amount in the powder of stinging spines of *Dasyatis* spp. Manganese was not found in this sample (Table 4 and Fig 3).

Arsenic, cadmium mercury and lead were not found in these samples (Table 5).

Table 1 Proximate composition of powder of stinging spines of *Dasyatis* spp.

| Sr No | Parameters | Value 1 (%) | Value 2 (%) | Value 3 (%) | Value 4 (%) | Value 5 (%) | Mean ±SD (%) |
|---|---|---|---|---|---|---|---|
| 1 | Moisture | 5.17 | 5.04 | 4.12 | 4.59 | 7.71 | 5.04±0.014 |
| 2 | Ash | 61.30 | 71.30 | 69.26 | 71.34 | 68.10 | 69.30±0.014 |
| 3 | Carbohydrate | 0 | 0 | 0 | 0 | 0.17 | 0±0.001 |
| 4 | Protein | 32.70 | 32.40 | 31.69 | 32.44 | 23.39 | 32.40±0.04 |
| 5 | Fiber | 0.51 | 0.51 | 0.51 | 0.51 | 0.15 | 0.51±0.002 |
| 6 | Fat | 0.50 | 0.43 | 0.49 | 0.40 | 0.48 | 0.5±0.0004 |

Table 2 Total ash, water soluble ash and acid insoluble ash contents of stinging spines of *Dasyatis* spp.

| Sr No. | Parameters | Quantity (%) |
|---|---|---|
| 1. | Total ash | 69.30±0.014 |
| 2. | Water soluble ash | 68.95±0 |
| 3. | Acid insoluble ash | 28.55±0 |

Table 3 Percentage of macroelements involved in powder stinging spines of *Dasyatis* spp.

| Sr No | Parameters | Value 1 (%) | Value 2 (%) | Value 3 (%) | Mean ±SD (%) |
|---|---|---|---|---|---|
| 1. | Magnesium(Mg) | 0.98 | 0.98 | 1.39 | 0.98±0.002 |
| 2. | Sodium (Na) | 0.67 | 0.67 | - | 1±0.004 |
| 3. | Calcium (Ca) | 26.55 | 26.55 | 47.94 | 26.55±0.1 |
| 4. | Chlorine (Cl) | 3.28 | 3.28 | - | 3.28±0.02 |
| 5. | Potassium (K) | 0.04 | 0.04 | 0.26 | 0.04±0.001 |
| 6. | Sulfur (S) | <0.000012% | <0.000012 | 0.68 | 0.68±0.004 |

Table 4 Percentage of microelements involved in powder stinging spines of *Dasyatis* spp.

| Sr No | Parameters | Value 1 (%) | Value 2 (%) | Value 3 (%) | Mean ±SD (%) |
|---|---|---|---|---|---|
| 1 | Aluminium (Al) | 0.01 | 0.01 | 0.31 | 1±0.002 |
| 2 | Silicon (Si) | 1.23 | 1.23 | 0.11 | 0.01±0.01 |
| 3 | Manganese (Mn) | 0.00 | 0.00 | 0 | - |
| 4 | Iron (Fe) | 0.06 | 0.06 | 0.10 | 0.001±0.0002 |
| 5 | Copper (Cu) | 0.00 | 0.00 | 0.01 | 0.0001±0 |
| 6 | Zinc (Zn) | 0.00 | 0.00 | 0 | - |

Table 5 Percentage of heavy metals involved in powder of stinging spine of *Dasyatis* spp.

| Sr No | Elements | Quantity 1 (%) | Quantity 2 (%) | Quantity 3 (%) | Mean±SD |
|---|---|---|---|---|---|
| 1 | Arsenic (As) | 0.00 | 0.00 | - | - |
| 2 | Cadmium (Cd) | < 0.00020 | < 0.00020 | - | - |
| 3 | Mercury (Hg) | - | - | - | - |
| 4 | Lead (Pb) | - | - | - | - |

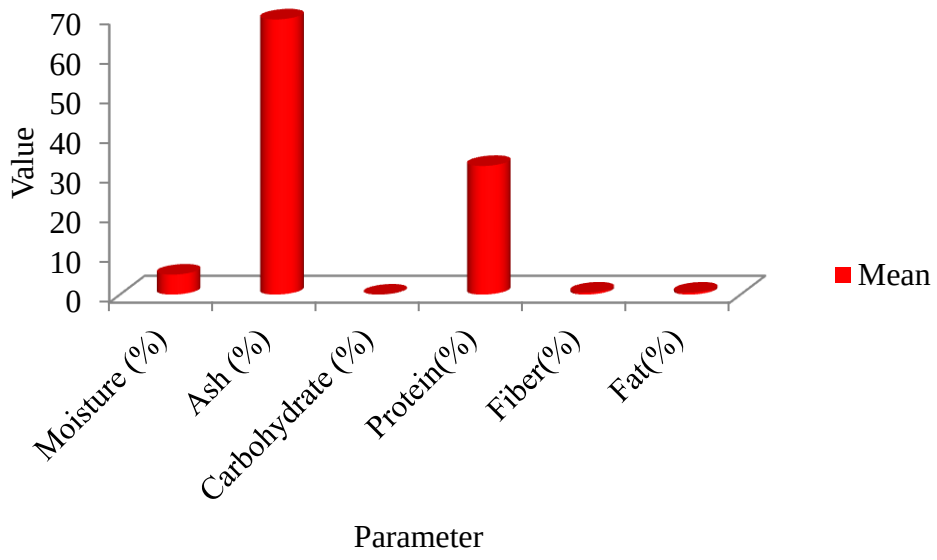



Fig. 1 Proximate composition of powder of stinging spines of *Dasyatis* spp.

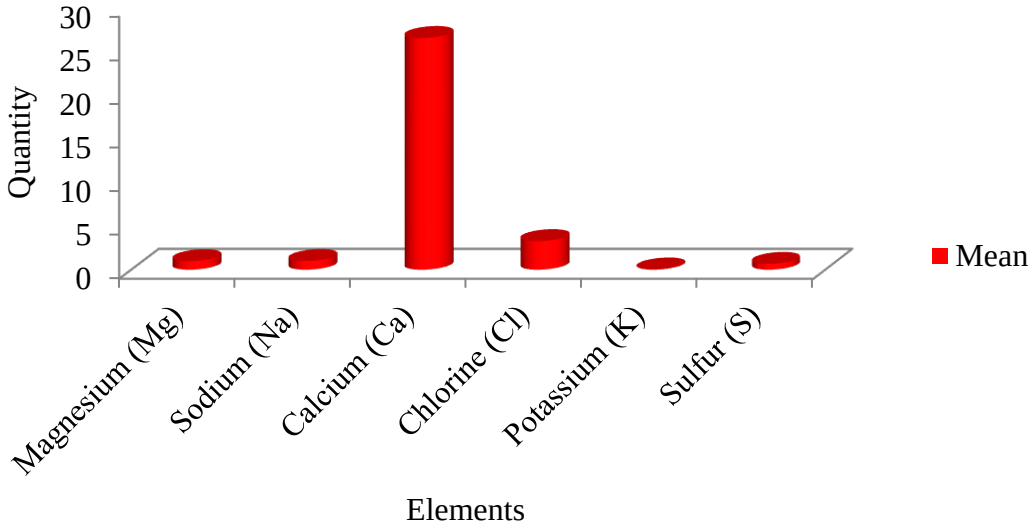



Fig. 2 Percentage of macroelements involved in powder stinging spines of *Dasyatis* spp.

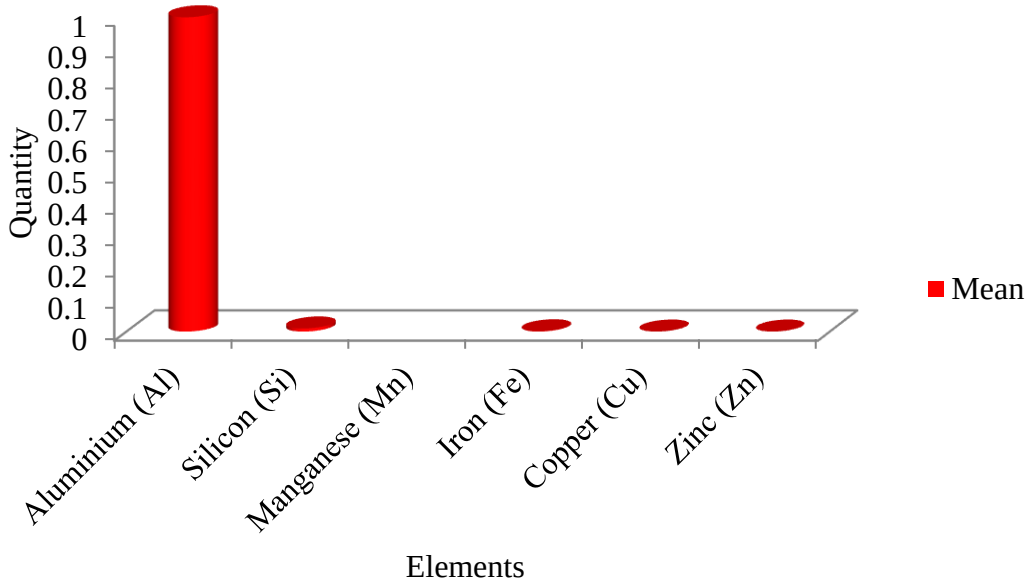



Fig. 3 Percentage of microelements involved in powder stinging spines of *Dasyatis* spp.

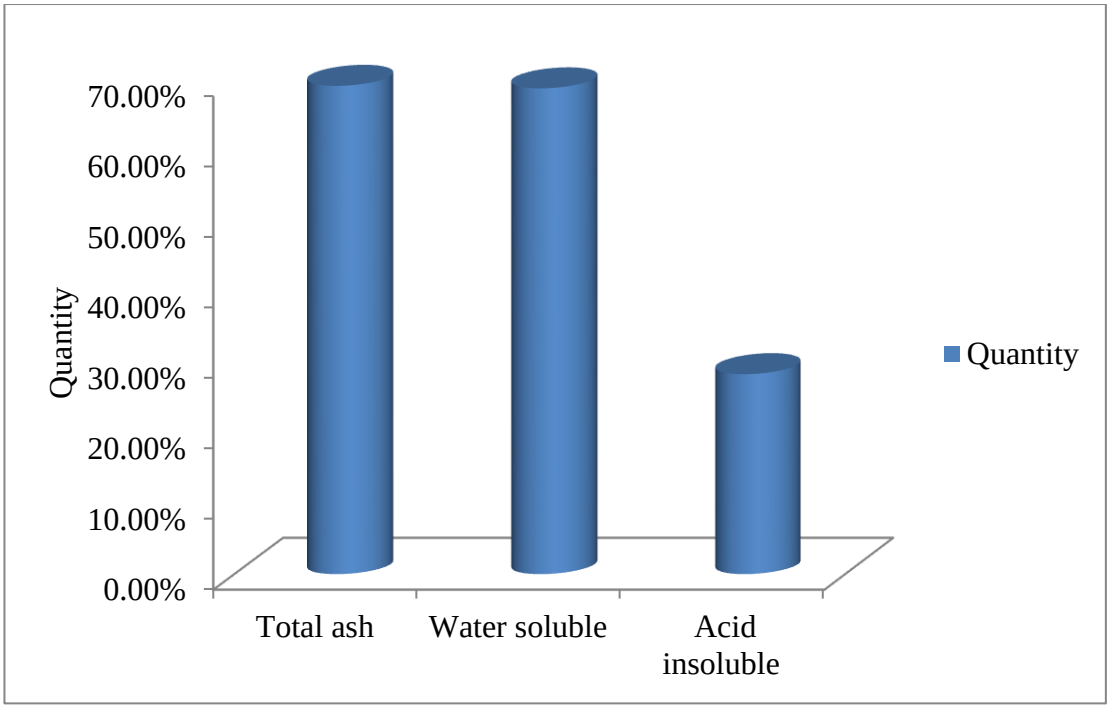



Fig. 4 Total ash, water soluble ash and acid insoluble ash contents of stinging spines of *Dasyatis* spp.

Dorsal view of Stinging spine of *Dasyatis* spp.

Ventral view of Stinging spine of *Dasyatis* spp.

Plate 2 Stinging spine of *Dasyatis* spp.

## Discussion

Carbohydrate, fiber and fat contents were found to be very low in the powder sample of *Dasyatis* spp. This confirms that sample is not a good source of fat. The contents of protein were found to be considerable amount in these samples. Protein provides essential amino acids, particularly important during growth and development, and it is a source of energy (Thomas *et al*., 2004). The content of ash was found to be highest in these samples. It is a reflection of total inorganic matter present in these samples and also indicates that these samples possess abundant minerals like calcium which are essential for good health (Oloyede, 2008).

The result for these minerals analysis revealed that the powder of stinging spines of *Dasyatis* spp. is a good source of macroelements. Especially calcium is the most abundant mineral present in these samples. The high content of calcium confirms its medicinal role in bone formation, calcium acts essential for the normal clotting of blood, by stimulating the release of thromboplastin from the blood platelets. Calcium is an activator for several key enzymes, including pancreatic lipase, acid phosphatase, cholinesterase, ATPases, and succinic dehydrogenase. Through its role in enzyme activation, calcium stimulates muscle contraction (i.e. promotes muscle tone and normal heart beat) and regulates the transmission of nerve impulses from one cell to another through its control over acetylcholine production. Calcium, in conjunction with phospholipids, plays a key role in the regulation of the permeability of cell membranes and consequently over the uptake of nutrients by the cell. Calcium is essential for the absorption of vitamin B12 from the gastro-intestinal tract (Reinhold, 1975).

Sodium and magnesium contents were examined and found to have reasonable concentration in this study. Sodium is an extracellular cation involved in the regulation of plasma volume and acid- base balance, nerve and muscle contraction. Magnesium like calcium stimulates muscle and nerve irritability (contraction), regulation of intracellular acid-base balance, and it also plays an important role in carbohydrate, protein and lipid metabolism (Reinhold, 1975).

Small concentration of potassium is present in this study. Chlorine and Sulfur were also found in more reasonable amount in these samples. They serve a vital function in controlling osmotic pressures and acid-base equilibrium. Chlorine also plays a specific role in the transport of oxygen and carbon dioxide in the blood, and the maintenance of digestive juice pH. Sulfur is

an essential component of several key amino acids. Sulfur is involved in the detoxification of aromatic compounds within the animal body (Reinhold, 1975). The presence of these essential minerals contributes to its medicinal values.

The element concentration was expressed as part per billion (ppb). However, for the convenience of this study the results were also expressed in percentage. Manganese and copper were not found in this sample. Aluminum, silicon, iron, copper and zinc were found in more reasonable amount in the powder form of stinging spines of *Dasyatis* spp. Manganese was not found in this sample. Zinc plays a vital role in lipid, protein, and carbohydrate metabolism. Iron plays crucial roles in haemopoiesis, control of infection and cell mediated immunity. Iron serves essential for oxygen and electron transport within the body (Reinhold, 1975).

Aluminum serves as antacids, astringents, buffered aspirin (Public health Statement, 2008). Silicon acts leukocyte activation, Coagulation and fibrinolysis cascades. It is not support microbiological growth (COLAS, 1995). The presence of these minerals encountered in powder form of internal shells of *Sepia* spp. and stinging spines of *Dasyatis* spp. can also be seen as a good source of health.

In this study arsenic, cadmium, mercury and lead were not found in these samples. Thus these samples have been found to be harmless to use as medicine.

Therefore The powder form of stinging spines of *Dasyatis* spp. has been given to remove toxin from the body, increased energy power, salty and cool in nature and as stated in Myanmar Traditional Medicine by Ashin Ngathein (1972), it can be used to treat fever with delirium, dysuria, chornic rheumatism, oliguria, kidney stone, fistula, gonorrhea, leprosy and venereal diseases.

Parts of these marine invertebrates are still used in the medicines of traditional medical practice and found to be effective and the results of chemical analysis also clearly indicated that, these parts are harmless and can be used safely and even promote the wellbeing of the users of traditional medicine however there is still a need to convert to synthetic materials because these raw materials currently in practice come from the natural living assets and might impose a threat in future.

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## References

A.O.A.C., 2000. *Official methods of Analysis* 17th Edn. Washington DC: Association of official Analytical Chemist,Washington. pp 920-978

Adverse Health Effects Of Heavy Metals In Children, 2011. Children's Health and the Environment WHO Training Package for the Health SectorWorld Health Organization. Available from: *www.who.int/ceh* (Accessed August 2016).

American Herbal Products Association, 2009. Heavy metal analysis and limits in herbal dietary supplement

Ashin Nagathein, 1972. Lake kyauksu, Tha, Nga, *HSEI: Abei Dan*., (5)2: 81-89

BOBLME, 2015. *Shark and Ray fisheries of Myanmar* - status and socio-economic importance BOBLME-2015-Ecology-18

Brian, R., Walker, B.R., Colleddge, N.R., Ralston, S.H., and Penman, I.D., 2014. *Davidson's Principle and practice of Medicine*. Churchill Livingstone Elsevier. pp 97-132.

Colas, A. Briquet, F, Thomas, X, 1966. *Silicone Silicones for medical use*, Dow Corning France - European Healthcare Centre. 1-9.

Day, F. (1884). *The Fishes of Great Britain and Ireland*. Williams and Norgate

FAO/WHO, 1998. Joint, Expert Consultation, *Vitamin and mineral requirements in human nutrition*. WHO Library Cataloguing-in-Publication Data, Bangkok, Thailand, pp15-85

Garcia, S.A.M., 2008. *Identification of Skates, Rays and Mantas Off the coast of São Miguel Island, Azores: preliminary study of potential tourist development*. University of the Azores. Retrieved on February 28, 2010

IBSS, Unknown. Mediterranean Fishes: *Dasyatis pastinaca* (Linnaeus, 1758). *http://atlases.* ibss.org.ua.

Ismen, A., 2003. Age, growth, reproduction and food of common stingray (*Dasyatis pastinaca* L. 1758) in Iskenderun Bay, the eastern Mediterranean. *Fisheries Research*, 60 (1): 169–176

Lythgoe, J. and G, 1991. *Fishes of the Sea: The North Atlantic and Mediterranean*. Cambridge, Massachusetts: MIT Press. ISBN 0-262-12162-X.

Martin, R. 1994. From Here to Maternity. ReefQuest Centre for Shark Research. www.elasmo-research.org.

Mineral, 2016. Medline Plus, National Library of Medicine. Available from: *https://eninwikipedia.Org.wikiminier*. (Accessed 20 August, 2017).

Neige, P., 2003. Combining disparity with diversity to study the biogeographic pattern *of Sepiidae. Berliner Paläobiologische Abhandlungen.* 3: 189–197.

Oloyede, O.I., 2008. Chemical Constituents of Cowry (Cyparicasamplomoneta), *Journal of Nutrition*, 7 (4): 540-542.

Public Health Statement, 2008.Aluminum, *Agency for Toxic Substances and Disease Registry*, 1-9.

Rainer.F., and Daniel,.P., 2009. *Dasyatis pastinaca* in FishBase.February 2009 version.

Reinhold, 1975.*Essential nutrients – Minerals: The nutrition and feeding of farmed fish and shrimp a training manual*, FAO: Food and Agriculture Organization. pp 1-15.

Schwabe, C.W., 1979. *Unmentionable Cuisine.*University of Virginia Press.p. 315. ISBN 0-8139

Schwartz, F. J., 2007. A survey of tail spine characteristics of stingrays frequenting African, Arabian to Chagos-Maldive Archipelago waters. *Smithiana Bulletin 8: 41-52*

Serena, F., 2005. *Field Identification Guide to the Sharks and Rays of the Mediterranean and Black Sea.* Food and Agriculture Organization of the United Nations.p. 68.

Serena, F., Mancusi, C., Morey, G. and Ellis, J.R., 2003. *Dasyatis pastinaca*. IUCN Red List of Threatened Species.Version 2008.International Union for Conservation of Nature.Retrieved January 18, 2010.

Shar, T., 2009. ID Guide: Common Stingray. An Illustrated Compendium of Sharks, Skates, Rays and Chimaera. Chapter 1: The British Isles. Part 1: *Skates and Rays*. Retrieved on February 28, 2010.

Smith, J.L.B., Smith, M., Smith, M.M., and Heemstra, P., 2003. *Smith's Sea Fishes. Struik.*

Suiyuan , S., 2014. Seafoods 7: Cuttlefish roe (乌鱼蛋)

Thomas L. H., Frank B. Hu, MD, 2004. The Effects of High Protein Diets on Thermogenesis, Satiety and Weight Loss: A Critical Review .*Journal of the American College of Nutrition*, 23(5) 373–385

Weiner, S. and Addadi, L., 1997. Design strategies in mineralized biological materials. *Journal of Materials Chemistry* 7(5): 689-702.

World Health Organization, 2011. *Quality control methods for medicinal plant materials*, WHO Library Cataloguing-in-Publication Data.pp 22-99.

Young, R, E., Vecchione, M. D.,Desmond T., 1998. The evolution of coleoid cephalopods and their present biodiversity and ecology".South African *Journal of Marine Science*, 20 (1): 393–420.