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MOLLUSCS: THEIR USAGE AS NUTRITION, MEDICINE, APHRODISIAC, COSMETIC, JEWELRY, COWRY, PEARL, ACCESSORY AND SO ON FROM THE HISTORY TO TODAY

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Abstract:*The present study has evaluated the usage and properties of the mollusca phylum from the history to today. Many types of molluscs are eaten worldwide, either cooked or raw due to their rich nutritional value. Furthermore, they are used as pearl, cowry and accessory materials, for tools like household dishes, cooking pots and utensils such as a spoon, cutlery, scoops, spatulas, etc. Some of them are destructive and caused ecological damage, some serve as intermediate hosts for human parasites; some can cause damage to crops. Mollusc meat is known to be highly nutritious and salutary owing to its high content of essential amino acids, proteins, fatty acids, vitamins, and minerals. In addition, some of the bioactive compounds including antiviral, antimicrobial, antiprotozoal, antifungal, antihelminthic and anticancer products are producing by molluscs as medicines. The largest edible snail is African land snail Achatina achatina mostly consumed by African people. Molluscs were very prominent dishes during the Roman Empire due to their aphrodisiac effect. Some mollusc species include zinc and essential amino acids which keeping up body energy and boost sex drive as an aphrodisiac, arrange immune system and makes bones stronger. Pearls are highly esteemed bivalve products containing nacreous deposit composed of 82 - 86% calcium carbonate (aragonite crystals), 10-14% organic substance conchiolin and 2-4% water. Cowry is amarine snail from genus Cypraea dwelling on mostly in coastal waters of the Indian and Pacific oceans and used instead of money. Money cowry* (*Cypraea moneta*)*, a 2.5cm yellow species, has served as currency in Africa.*

Keywords: *Molluscs, Nutrition, Medicine, Cowry, Pearls,*

1. Introduction

Phylum Mollusca is divided into seven classes; Aplacophora, Polyplacophora, Monoplacophora, Gastropoda (Prosobanchia, Opisthobranchia, Pulmonata), Bivalvia (Protobranchia, Lamellibranchia, Septibranchia), Scaphopoda (tusk shells) and Cephalopoda (Nautilodea, Ammonoidea, Coleoidea). This phylum is the second largest phylum in numbers of species containing

over 128.000 described species. They are ecologically widespread, dwelling on marine, freshwater, terrestrial habitats, as well as gastropods, are successfully adapted to land. They can be great variety in body size, roughly from 1 mm to 18 m. Many sorts of molluscs such as clams, scallops, snails, squids, whelks, cockles, mussels, octopus, oysters, periwinkles, and winkles are consumed by humans from historic times to today. Mankind has been deliberately culturing molluscs as food for a long time and the earliest known records of someone farming molluscs for food come from Roman Empire.

2. Usage Areas of Molluscs and Their Benefits to Mankind

2.1. Nutritional contribution of molluscs for human diets

Human beings have eaten snails for thousands of years and nowadays snails are considered to be common food consumed by millions of people worldwide, particularly in European countries [1, 2]. Additionally, the cephalopods which include the cuttlefishes, squids and the octopus are generally operated for food fishes in most part of the world. In most of the countries, oysters and mussels are used in the dishes and eaten as an aperitif meal. The largest edible land snail is the giant African land snail *Achatina achatina* mostly consumed by African people. It can weigh up to 900 g and measure up to 40 cm from snout to tail. In Turkey, *Helix aspersa, Theba pisana, Eobania vermiculata, Cantareus apertus, Helix asemnis, Helix cincta*and *Helix lucorum* are commercially important edible snails and mostly exported to France, Greece, Germany, Italy and Spain [3-5]. Snail meat (escargot) is not only tasty but also has several advantages over others: quite a low lipid rate and calorie values versus rich mineral, essential amino acid and fatty acid content, especially polyunsaturated fatty acids (PUFA). With higher omega-3 fatty acid content, snail meat is found being a factor affecting higher lifespan and lower cancer rate in most of the countries. Calcium, magnesium, zinc, copper, manganese, cobalt, and iodine are the predominant minerals of molluscs' flesh [3-5].

2.2. Products and metabolites obtained from molluscs as medicines

Molluscs used directly as a food source may also contribute to the prevention of disease by providing essential nutrients, as well as immuno-stimulatory compounds and other secondary metabolites with direct biological activity [6]. Most of the molluscs are the source of lipid bioactive compounds offering a variety of nutraceutical and pharmaceutical applications [6]. Among them, the PUFA omega-3 fatty acids such as eicosapentaenoic acid, (C20:5ω3), and docosahexaenoic acid (C22:6ω3) are known for their beneficial effects on human health [4, 5, 7]. These PUFA ω3 fatty acids are widely known for their capacities on cardio protection. They reduce triacylglycerol and cholesterol levels and have anti-inflammatory and anticancer effects. Numerous experiments on these animals confirmed the cancer preventive properties of PUFA ω3 fatty acids from marine sources [7, 8].

The deadly venoms of some Cone shells (Conidae) are today being used to help victims of strokes and heart disease, and to produce a revolutionary new drug for chronic pain control called Ziconotide. An extract from the hard clam *Mercenaria mercenaria L*. is a strong growth inhibitor of cancers in mice. The drug is called Mercenine. Ground and processed oyster shells are used as calcium supplements both for humans and animals. Paolin, a drug made of abalone juice, is an effective inhibitor of penicillin-resistant strains of bacteria such as *Staphylococcus aureus, Streptococcus pyogenes, Salmonella typhus*. Oyster juice has been found to have antiviral effects and may be made into a drug eventually [9]. The venom of Cone snails used for hunting their prey can be dangerous, even lethal for humans. The venom is a neurotoxin and being studied for use in medicine.

Since its toxin paralyzes the prey, it is being used to help patients with chronic pain, and it also shows promise in treating epilepsy in the future [9].

2.3. Aphrodisiac effect of bivalves

The interactions between man and snails have been recognized from the earliest times. These interactions became very prominent during the height of the Roman Empire when it was a common practice to eat snails in the courts of the Emperor where they are used as an aphrodisiac [10]. The researchers have analyzed bivalve molluscs, particularly oysters and realized that they are rich in rare amino acids which trigger sex hormones level increasing. Most of the edible oysters are known as aphrodisiac sources. *Aplysia dactylomela*, a species of local sea slug is also aphrodisiac effect in the human body [11]. In some traditional place, people consume *A. dactylomela* raw to warm up their bodies before going to the sea [12]. Furthermore, it is believed that *A. dactylomela* contains a high level of steroids hormones [13]. On the other hand, oysters are rich in zinc, which is one of the essential minerals and might have been associated with improving sexual potential in men. Adequate zinc is needed for sperm production and hormone metabolism. Oyster efficacy is yet to be scientifically validated before claiming that oysters have the aphrodisiac effect due to their pharmacological properties [14].

2.4. Cosmetic industry uses molluscs for products

Snail and slug have been used sporadically as skin treatments since the time of the Ancient Greeks. Hippocrates reportedly recommended the use of crushed snails to relieve inflamed skin and some 20 years ago as well as the potential of snail slime was noted by Chilean snail farmers who found that skin lesions healed quickly, with no scars, when they handled snails for the French food market. This investigation resulted in the production of "Elicina", a Chilean snail slime-based product [15]. In 2010, Aqua Cell Renew Snail Cream, claiming that its 70% snail extract, soothes regenerates and heals skin. Snail slime based products are claimed to be the new miracle face-fixer in the U.S where they are used to treat acne, reduce pigmentation and scarring, and combat wrinkles [15]. Slugs are used in Italy to treat dermatological conditions. Mucus collected from a slug is rubbed onto the skin to treat dermatitis, inflammations, acne and to promote wound healing and used for the treatment of warts. Mucus from a live slug is first rubbed onto the wart and then the slug is hung out in the sunshine to dry out and die. It is believed that once the slug has dried up, the wart disappeared [16].

2.5. Pearls as precious jewelry obtained from molluscs

Conchifera is the subphylum of molluscs that produce pearls. Although none of the molluscs within the Conchifera subphylum can produce pearl-like formations, actually Bivalvia class of mollusc is the outstanding group for the formation of pearls. Meanwhile, some gastropods and cephalopods species also produce pearls. Although the shell of each mollusc is significant for identification of pearl formation, it is actually the inner soft body (mantle) of the mollusc that scientifically defines the species for the pearl. Black pearls are very expensive and come from *Pinctada margaratifera* showing a wide range of color and luster, which are the most important characteristics determining their commercial value. This variation is probably to be influenced by both environmental and genetic factors. The latter may depend on the recipient oyster, but professional grafters commonly consider that the color and luster of pearl is often related to the phenotypic properties of donor oyster [17].

Pearls are highly esteemed bivalve product containing nacreous deposit composed of 82 - 86% calcium carbonate (aragonite crystals), 10-14% organic substance conchiolin and 2-4% water. They are produced when a tiny particle of sand or grit is trapped between the mantle and the shell; the animal forms a protective cover around the irritant. The substance used to form this covering, the pearl, is made from the iridescent material that lines the interior of the shell. It is called nacre or aragonite. Some of the pearls used as valuable jewelry are made by natural pearl oysters and freshwater mussels, however, most of the ones traditionally sold are cultured and not wild [18].

2.6. Ancient money cowry and accessories from mollusc shells

Cowry comes from genus *Cypraea*, family Cypraeidaea and has hard humped thick, colorful and glossy shell. It occurs dominantly in coastal waters of the Indian and Pacific oceans. The 10 cm golden cowry (*Cypraea aurantium*) was traditionally worn by royalty in Pacific Islands, and the money cowry (*Cypraea moneta*), a 2.5 cm yellow species, has served as currency in Africa and elsewhere [19]. Cowry is called the kabttaj (Maldives), kauri (Bengal), kaudi (Hindi), kaoli (Chinese), kavari (Martha) and cowry (English) and it is believed that it has been the first universal money. It has lasted longer than any other in human history so far. Prior to being globally distributed on a large scale, it was a scare and valuable item. Imitations of this shell have been made of wood, stone, jade, other semi-precious stones, bone, bronze and even silver and gold. Marco Polo told of the cowry being used as currency in many regions across Eurasia. Today, cowries are still used as currency in Ethiopia and other remote corners of Africa [20].

Additionally, mollusc shells are sometimes used as ornaments in homes and workplaces being decorative items as well as valuable habiliments in tribes by ladies and men. Furthermore, they are used as accessory materials, for tools like household dishes, cooking pots and utensils such as a spoon, cutlery, scoops, spatulas, etc. Some shells are often collected because of their great beauty. The more rare and beautiful the mollusc, the more coveted is its shell. Unfortunately, collectors usually kill these species so as to get its shell. This has resulted in many of the rare and unusual mollusc's species becoming endangered.

2.7. Byssus from bivalve processed for valuable thread and fabric

Mussels attach to the substratum by means of a byssus, which is an extracellular, collagen structure secreted by the foot. It is believed to be the finest fabric known to Egypt, Greece, and Rome. If treated properly with lemon juice and spices, the remarkable material shines when exposed to the sun. It is also incredibly light, for this reason, the wearer cannot even feel it touching the skin. It is said to be as thin as a spider web, resistant to water, acids, and alcohols. Byssus fibers produced by mussels are tough biopolymers composed mainly of proteins and water. These natural biopolymer fibers have been intensively studied owing to their mechanical and adhesive properties. The extraordinary strength, unmatched toughness, and extensibility of byssus fibers allow mussels to withstand the large and repetitive forces produced by waving and crashing. They are composed of three collagen proteins that make up the bulk of the thread core. Their toughness is considered six times greater than that of the human tendon collagen and comparable with that of Kevlar and carbon fibers [21]. Nowadays, rare fabric production from byssus in some places is present, however, the cost of the fabric and thread are very expensive.

2.8. Cleaning the water for better environment via bivalves

Each oyster filters about 30 to 50 gallons of water a day. Think of how much water a whole bed of those awesome bivalves is cleaning, which makes these not only tasty creatures but good for the environment ones as well. In many lakes, rivers, seas and water pools, the bivalves filter the water and make them as a clean environment for other living creatures. Mussels and clams are clean up the polluted waters by microorganisms. Bivalves serve as tiny water filtration systems, constantly sieving the water around them in their hunt for a meal of bacteria or microscopic algae known as phytoplankton. As they filter water, their tissues absorb some of the chemicals and pathogens that are things like protozoan, herbicides, pharmaceuticals and flame retardants [22].

2.9. Qualified dyes, ink and glues obtained from molluscs

In ancient times, dyes were made from various molluscs. The most famous was from *Bolinus brandaris*, a gastropod, from which Tyrian or imperial purple was obtained. Its common name is the purple dye Murex. Purple was indeed extracted from the marine gastropod mollusc "murex", which has a spiny shell and lives near the coasts of Mediterranean Sea, length up to 8 cm for the largest species. To extract the dye, shells were broken and the molluscs were macerated in basins. The obtained dye could vary from pink to violet through crimson by using different sun-drying times. Because of resistance to the dye and difficulty in harvesting the animal, purple fabrics were expensive and highly estimated. They were only used for the cloth of noblemen, kings, priests, and judges. The purple color, similar to blood, became a sign of temporal and spiritual power. Under the Roman Empire, the chief commanders of the armies wore the "paludamentum", a purple coat. However, nowadays, the main component of the dye can easily be obtained through chemical synthesis [23].

Recently, the threads that some mussels (Mytilidae) use to attach themselves to rocks, piers, and other hard surfaces are being tested as possible glue in surgery [9]. Additionally, many cephalopod molluscs living in low-light or dark conditions, including the deep sea produce ink, actually for hunting and protection. The ink sac is present at hatching, so even at a small size and young age. Cephalopod ink is composed of secretions from two glands. The ink sac with its ink gland produces a black ink containing melanin, and most of the cephalopod ink comes from this part. A second organ, the funnel organ, is a mucus-producing gland that is much more poorly studied [24].

2.10. Inspiration from molluscs for surgical studies

Scallops have rings of bright blue eyes around the edges of their shells, though they can actually only detect light and dark. However, their eyes have inspired research into various ways of seeing and optical devices Since the axons of the nerve cell of cephalopods are larger than other creatures, many experiments related to nervous system disorders are conducted on these axons. Side effects of some medicines are determined by trying on mollusc species and then their usage is presented and controlled.

The new adhesive combines the positively charged polymers found in slug go with hydrogels, forming a bond, and the resulting substance is a strong adhesive that can stick to skin, cartilage, arteries, and other types of living tissues without the issues that current medical glues have. Currently, used products can be easily dislodged, can be toxic to certain tissues, and may become brittle. The new glue shows greater strength than the current generation of surgical adhesives, and crucially, (can stretch to 14 times its original size before failing), and sticks slowly over a period of time, which

facilitates easy repositioning if needed. Also, the new product demonstrated low toxicity to living tissue. The adhesive is not commercially available yet but shows the incredible potential in something as insignificant as a garden slug [25].

3. Conclusion

Molluscs are extremely important members of many ecological communities, ranging in distribution from terrestrial mountain tops to the hot vents and cold seeps of the deep sea. They can range in size from twenty-meter long giant squid to microscopic aplacophorans, a millimeter or less in length, that live between sand grains. Besides having tasty nutritional parts, molluscs often have valuable hard parts as shells and pearls. These creatures have been important to humans throughout history as a source of nutrition, biomolecules, secondary metabolites, cosmetics, medicine, jewelry, tools, pearls, currency, musical instruments, fabric and etc. In recent times, we have heard alarming news about these creatures. If serious measures related to their protection are not taken, a majority of these creatures can be exhausted in the future.

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