

## THE BEZOAR STONE: A PRINCELY ANTIDOTE, THE TÁVORA SEQUEIRA PINTO COLLECTION – OPORTO

### BEZOARI U KOLEKCIJI TÁVORA SEQUEIRA PINTO U OPORTU (PORTUGAL)

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#### SUMMARY

*Bezoar stones, once used as universal antidotes and panaceas, but currently regarded as costly and useless medicines of the past, are a major milestone in the history of toxicology. Arabic physicians had been using bezoars in medicine from the 8<sup>th</sup> century onwards. In the 16<sup>th</sup> century, the Portuguese controlled bezoar trade from India, and the Portuguese doctors Garcia de Orta, Amatus Lusitanus, and Cristobal Acosta introduced the medicinal use of Oriental bezoars to European medical literature. Some criticism aside, leading European doctors prescribed bezoars mainly as powerful antidotes. Five bezoars that now adorn the Távora Sequeira Pinto Collection in Oporto testify to the allure and glory of bezoars at the height of their golden age, when they equalled the splendour of gems and noble minerals that dominated the Eastern and Western lithotherapy.*

*The end of the 18<sup>th</sup> century marked the end of ancient panaceas. This article focuses on the therapeutic and apotropaic use of bezoars.*

**Key words:** bezoar; Arabic medicine; history of toxicology; history of medicine; history of art

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## INTRODUCTION

Bezoars are tightly packed, partly digested agglomerations of hair or vegetable matter; hence the names tricho- or phytobezoars. Trichobezoars may weigh up to 2.7 kg and are most commonly associated with neuropsychiatric patients. Phytobezoars are almost always seen in patients who have undergone the Bilroth I or II gastrectomy, especially when accompanied by vagotomy.

Hypochloridia (diminished antral motility), and incomplete mastication are the main predisposing factors, as well as diabetic gastroparesis. Most bezoars cause no symptoms, although postprandial fullness, nausea and vomiting, peptic pain, and gastro-intestinal bleeding may occur. Usually bezoars are detected with x-rays and may be mistaken for tumours. At endoscopy, bezoars display an unmistakable irregular surface and may range in colour from yellow-green to gray-black. Diagnosis is confirmed if endoscopic biopsy finds hair or plant material. Bezoars have also been demonstrated by abdominal ultrasound and CT scan [1].

As they are mainly produced by mammals, bezoars are also a veterinary problem. The word has its origin in Farsi: *pad* means to expel, *zahr* means poison. In ancient Persia, bezoars were believed to have powerful magical and apotropaic properties.

## BEZOAR STONES IN ANCIENT PERSIA

Bezoar stones are perhaps the most exquisite animal medicines that came from the East. Cyril Elgood, a historian of Persian medicine, describes them as the best gift to European medicine [2]. The history of the stone is long and glorious. It was used in the East before Islam, as it is mentioned in ancient Hebrew writings as *Bel Zaard* (The Master) [3]. Ancient East had a particularly high regard for precious stones and their medicinal properties. Eastern lithotherapy established itself as one of the most outstanding therapeutic areas.

Arabic medical literature had been referring to bezoars since the 8<sup>th</sup> century, mainly as *alexipharmaca*. Yuhannā Māsawayh (777-857), known in Latin Europe as Mesuë, Mesuë Senior, Janus Damascenus or Serapion, was one of the first who mentioned its use. His father was a pharmacist. He ran a medical school in Baghdad and was the court physician to Caliph Harun al-Rashid. His works had a great impact on Western medicine. Nine Latin editions of his works in the British Museum are dated from 1462 to 1623 [4].

Relying on anonymous sources, he described the bezoar as an alexipharmic against lethal poisonings and dangerous scorpion and snake bites, mainly used in Syria and India [5].

Rhazes (855-925), the greatest Iran-born practitioner of medicine in Islam, successfully combined his knowledge of chemistry with medicine. He wrote almost two hundred treatises on medicine, science, and philosophy. His book, *Kitab al-Asar (Book of Secrets)* was a major work on mineralogy. He was the first to classify his *materia medica* according to animal, vegetable, and mineral origin [6]. Rhazes mentions the use of bezoar (*Bezabar*) as an antidote together with viper theriac and mithridate [7]. Theriac was an elaborate mixture of countless ingredients and was based on mithridate, which itself was composed of fifty-four ingredients, according to the ancient encyclopedist Pliny the Elder (A. D. 23-79) [8].

Most Arabic authors wrote on bezoars. One of the most important is Abu al-Rayhan Muhammad ibn Ahmad al-Biruni (973-after 1050), a Shiite born in Persia, who lived in India, where he learned Hindu and was acquainted with Sanskrit literature. He was a mathematician, philosopher, astronomer, geographer, and encyclopaedist. His remarkable treatise *Kitab al-Jamahir fi ma'rifat al-jawahir (Book on the Multiple Knowledge of Precious Stones)* is devoted exclusively to gems, minerals, and metals. Al-Biruni collected material from Greek, Roman, Syriac, Indian, and Islamic sources and complemented it with his own observations. Here is what he says about the bezoar:

*«As a matter of fact, this stone should have been the costliest among stones, for, whereas jewels are things of the body and adornment, and are of no use in body ailments, the bezoar stone guards the body and the soul and saves them from being harmed.»* [9].

Al-Biruni cited the descriptions of bezoars by previous authors and listed different methods of testing its quality. Some bezoars are described as pale stones with white and green hues. They were associated with India and China. Others are described as white, yellow, green, dusty, and abrasive. Other stones had a similar appearance. Al-Biruni also instructs how to distinguish true bezoars from forgeries. He recounts stories about bezoars and provides an extremely accurate description of its physical characteristics, provenance, geographic region of the goat from which it came from, and factors that conditioned its production within the animal's entrails. He offers etymological explanations and describes how bezoars are formed in stags (and goats) that eat snakes. Apparently, by eating snakes the animals

acquired tolerance to snake poison. Al-Biruni describes the “animal bezoar” as an elongated acorn or unripe date, with a peel like an onion, and something like green grass of blackish to green hue in the centre [10].

One of the first mentions of the bezoar stone in European scientific literature dates back to around 1140 A.D., in the work of Ibn Zuhr or Avenzoar in the Latinised version (1091-1161), an Arab physician of Seville [11].

Bezoars and precious stones were highly prized by Persian, Arab, and Jewish physicians as antidotes. Referring to Ibn Zuhr (Avenzoar), Moses Maimonides (1135-1208), born from a Jewish family in Cordoba during the period of Muslim Al-Andaluz, claimed that emeralds were highly effective against all poisons as they induced emesis, just like *terra sigillata*. This efficiency was equalled only by bezoars and ethrog seeds, as follows:

*«The efficacy of the following three remedies has been proven by experience beyond a doubt for all types of animal, vegetable and mineral poisoning: ethrog seeds, emerald and animal bezoar.»* [12].

He noted that the bezoar was not mentioned by Galen. His description of bezoars is similar to Al-Biruni's: acorn-shaped, dark green concretions of several layers. About its origin, he provided one mythical and one empiricist explanation:

*“Some people say that it is found in the eyes of rams in the East; others say that it is found in their gallbladder and this is true”* [13].

He reported about a mineral bezoar found in Egypt that had many colours. However, his experiments with this stone against scorpion bites showed that it was not efficient. The efficiency of the bezoar of animal origin, on the other hand, was proved by its use as powder mixed with in oil, when applied as a plaster on the site of the bite, or drank in a beverage [14].

The first Persian monography devoted entirely to bezoars was written by Imád-ul-Din, who collected the opinions of all the earlier writers on the subject. The true stone was described as a calculus found in the belly of a wild goat that inhabited the north-east corner of Persia [5].

## BEZOARS IN EUROPEAN MEDICINE

In 1485, inspired by the German *herbarium* a German physician Johann Wonnecke von Caub or Johannes de Cuba (Latin name) published *Hortus Sanitatis*(*Gart der Gesundheit* in German or *Garden of Health* in English) with

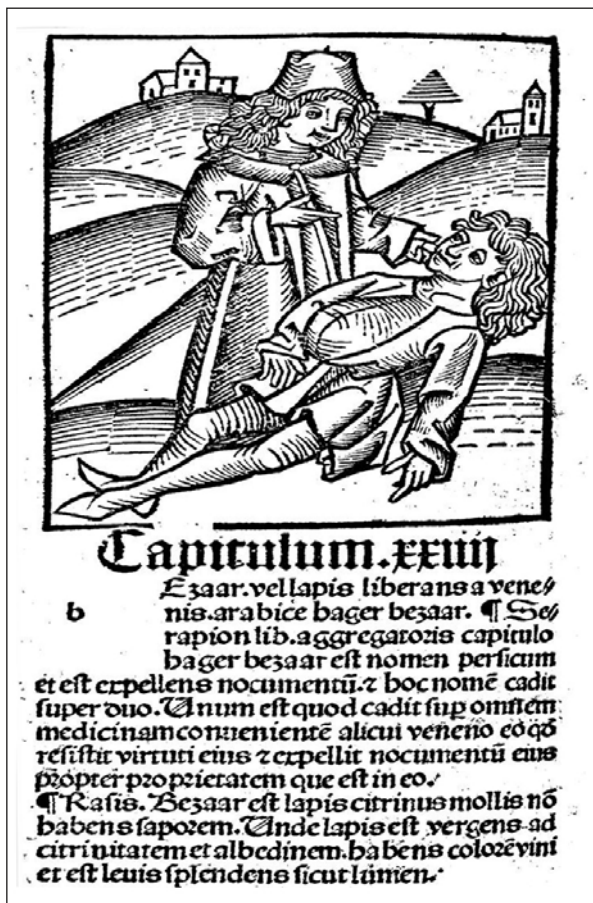


Figure 1 – A poisoned man treated with bezoar. Johannes de Cuba, 1491

Slika 1 – liječenje otrovanog muškarca bezoarom. Johannes de Cuba, 1491

Peter Schöffer as publisher. At the time, it was the leading therapeutic treatise of the Middle Ages, as it contains a large number of ingredients introduced by Arabic authors. It mentions the bezoar stone among new ingredients in reference to Serapion and Rhazes and explains the Persian origin of the word and its properties as an antidote [16] (Fig. 1).

The Italian doctor and botanist Pietro Andrea Mattioli or Matthiolus (1501-1577), the most important 16<sup>th</sup> century translator of Dioscorides, dedicated an extensive chapter to the medicinal use of precious stones and earths. Drawing on Arabic medical literature, he described the bezoar stone as a powerful antidote [17].

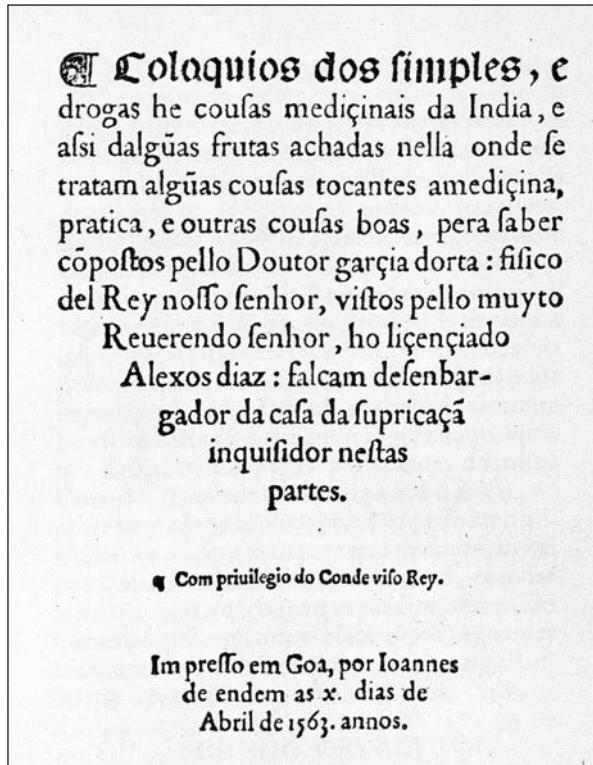


Figure 2- Garcia de Orta, 1563 title page. Private collection (46)

Slika 2 – Garcia de Orta, naslovnica iz 1563. Privatna zbirka (46)

## THE PORTUGUESE AND ORIENTAL BEZOARS

After the arrival of the Portuguese explorer, Vasco da Gama (c. 1460-1524) to Calicut, India in 1498, the Portuguese settled in Goa and started to trade numerous exotic products. Bezoars were amongst the most exotic until the 18<sup>th</sup> century, as they seduced the nobles and kings and allegedly protected them from poisoning and evils.

The first printed book by a Portuguese Jewish physician Garcia da Orta (1490-1568) gathered an extensive body of new material. He learned so much about local pharmacological ingredients and Asian medical traditions that he could compete with local physicians for the attention of their wealthy patients [18].

The bezoar stone was first mentioned by Orta in *Colloquy 17* as the best treatment of a very serious disease, *Mordexi Seco* (Cholera morbus), and was

described to act as an analeptic, restoring severe fluid loss and alleviating haemodynamic shock due to severe diarrhoea [19].

In *Colloquy 45* Orta described the bezoar (*Pazam* in Farsi) as an onion-like, layered formation around a small straw in the paunch of the male goat from Khorasan and Persia. Orta also reported on bezoars from Ormuz, Cow Island (*Ilha das Vacas*), near Cape Comorin and Malacca that were used against poison and melancholia.

He reported that all wealthy persons in India had been taking bezoars (10 grains in rose water) after purging every morning for five days in March and September to preserve youth. Bezoar stones were also useful as a powder for poisonous wounds, poisonous bites, and open plague pustules. The bezoar was said to protect against plague and to cure it and to treat very virulent measles [20].

Modern medical science has reached a consensus that plague (Black Death) was mainly bubonic, spread by rodents, chiefly rats. The medieval explanation blamed it on the contact with reptiles, snakes or serpents in particular. The snake was believed to be as much infective as curative. In the medieval Europe, a theriac containing viper meat was the most prized and the most expensive of all medicines used to prevent and cure plague [21].

In *Colloquy 58*, Orta mentions a stone found in porcupine gallbladder: clear vermilion, bitter to the taste, and with a touch like French soap [22].

João Rodrigues de Castelo Branco (1511-1568) was a Portuguese Jewish physician born in the city of Castelo Branco, who studied Medicine at the University of Salamanca and indulged in the study of medicinal plants and herbs. He practiced medicine in Lisbon for a short while and then left for Antwerp in 1534, where he lived for seven years. During his stay, he wrote commentaries on Dioscorides' Books I and II, on plants from Portugal, and on the pharmaceutical ingredients brought by the Portuguese from the newly discovered lands. He never returned to Portugal because of the persecution to Jews by the Inquisition established in Portugal by King John III in 1539. He later changed his name into Amatus Lusitanus [23].

Amatus reported on bezoar import from India. He cited the Arabic physician, Avenzoar, who testified to the efficacy of bezoar stones in his treatise *Theisir*. Once, when he thought that he was dying, he managed to recover through the use of that antidote. The medicine was prepared by dissolving the weight of three barley grains of bezoar in five ounces of pumpkin water.



Figure 3 - Amatus Lusitanus. 1553 title page. Library of the Faculty of Medicine, University of Lisbon. (47)

Slika 3 – Amatus Lusitanus, naslovnica iz 1553. Knjižnica Medicinskog fakulteta Sveučilišta u Lisabonu (47)

Another patient suffering from jaundice because of excessive bile activity took the antidote to fight and eradicate the condition. Bezoar stones were also used to treat malignant fevers and to induce vomiting and sweating. Amatus also reported on the successful use of a bezoar (*lapis bezoarticum*) against sublimate poisoning. The stone was taken from the stomach of an Indian goat and induced powerful emesis (together with unicorn horn? scrapes and oil). After vomiting, he also used theriac, sour cider, Cretan scorzonera, and a concoction made of emeralds, *terra sigilata*, and Armenian earth [24] (Fig. 3).

Cristovão da Costa or Cristobal Acosta (c. 1525-1593), also a Portuguese physician, born in Cape Verde, provided interesting information on bezoars, which he considered most effective against all kinds of poisons when taken





Figure 4 - Cristobal Acosta, 1578 title page. Library of the Faculty of Medicine, University of Lisbon

Slika 4 – Cristobal Acosta, naslovnica iz 1578. Knjižnica Medicinskog fakulteta Sveučilišta u Lisabonu

orally or applied to the skin. Bezoars had different shapes, colours, and sizes. Some would have the shape of nuts or walnuts, others resembled eggs, while some were triangular or looked like chestnuts or cylinders. Their colour varied from dark-green to aubergine, from yellowish to light green. Acosta also provides new information and a description of bezoars brought from Peru. (Fig. 4). His While one of his etymologies of the word and the explanation of its origin in goat entrails is similar to Orta's, Acosta also provides interesting etymological alternatives that derive the word "bezoar" either from *Pazam* (the animal that engenders it) or *Belzahar* or *Badzahr* (bezoar stone) or from the corruption of the word "bazaar" (which suggests the meaning "market

stone"). Acosta was also concerned with forgeries. He conveyed some ways of distinguishing the real from fake stones. The stone was found easily in Persia, Arabia, and China. It was used against all kinds of poisoning, quartan fevers, severe febrile diseases, leprosy, scabies, itching, measles, cholera, all the pestilent and contagious diseases, and melancholy. It was also beneficial for the weak and debilitated. The use of bezoars to facilitate parturition, to expel the secundines, and to clean the neonate is also mentioned. They also helped in the treatment of ascariasis, serpent and other poisonous animal bites, poisonous wounds, and empyema. Acosta also observed that Moors prized the stone so much that only noblemen could afford it [25]. The virtues of the stone were appreciated by Acosta's contemporaries, Andres Mathiolo and Pedro de Olma.

### MONARDES AND THE OCCIDENTAL BEZOAR

Spanish botanist and physician from Sevilla Nicolás Monardes (c.1512-1588) presented bezoar stones from the recently discovered New World of the Central and South America, Peru mountains to be more specific. He also referred to a great quantity of forgeries due to the high demand of these fabulous stones and their price (Monardes 1574). The bezoars from Peru varied in shape and colour but were similar to the stones brought from India. The medicinal properties and use were also similar to the Indian bezoars, as described by Orta, Lusitano, and Acosta, and the stones were prescribed to treat heart diseases, all kinds of poisoning and animal poisonous bites, melancholy, pestilent fevers, scabies, itching skin diseases, empyema, quartan fever, and ascariasis. They were also used twice a year, after purging, to maintain health. In his final comment, Monardes noted that bezoars were useful in the treatment of all severe and strange diseases. They always helped and never harmed, he said [26].

The Flemish botanist and physician, Charles de Écluse or Carolus Clusius (1526-1609) translated the works of Orta [27], Acosta [28], and Monardes into Latin [29], the scientific language of Europe until the 19<sup>th</sup> century, spreading the knowledge of these authors and their contributions to medicine and pharmacy. The editions of these works include Clusius' annotations.

### BEZOARS AND THE EXPERIMENTALISM

In the 16<sup>th</sup> century, medical knowledge was regarded in the light of experiment. Anatomical studies replaced the darkness and superstition of the

previous centuries and gradually pushed back Arabic influence in Europe [30].

The scientist who was the most critical of the medicinal use of bezoars was Ambroise Paré (1510-1590) one of the most important surgeons of the 16<sup>th</sup> century. He distrusted medicines taken from ancient Egyptian mummies and bezoars. In 1575, he carried out an experiment to verify the effects of bezoars as antidotes. He convinced a cook that had been caught stealing silver cutlery to take poison and then treatment with the bezoar stone. Six hours after having taken the poison and the beverage containing the bezoar scraps, the poor cook died in terrible agony. Paré concluded that the bezoar stone was not effective in every case of poisoning, contrary to the widespread belief [31].

Physician and philosopher Andreas Bacci (1524-1600), who was very interested in the study of *rerum naturalia* (natural things, which usually meant unicorn horns, bezoar stones, and other animal products), reported higher therapeutic efficacy. He authored a work, dedicated to Emperor Rudolf II (1552-1612), about the medicinal properties of precious stones, including bezoars. The work, based on Theophrastus Lapidary [32] and the *Cyranides* [33] puts together the scientific knowledge and the tradition of magic and reports cases of successful use of the bezoar stone. He gives an account of a young prisoner who was given arsenic and then a beverage with the bezoar. The young man recovered completely and was set free [34].

Despite criticism, a learned professor and Swiss doctor Caspar Bauhin (1511-1582) wrote an extensive monograph on bezoar stones, in which he claims that doctors were forced to prescribe bezoars because the noblemen and bankers held them in great esteem. The demand for bezoars was such that the market was flooded with forgeries [35]. Caspar Bauhin cited the ancient authors who wrote on stones produced by animal tears, and summarised Arabic, Portuguese, and other contemporary medical literature on the characteristics of bezoars according to their animal, geographical, and mythical origin (in animal tears) and their therapeutic effects. Bauhin also studied Indian bezoars from Malacca, German bezoars, mineral bezoars and Occidental bezoars from Peru [36].

Despite widespread use, bezoars appeared as something extraneous and unfamiliar. Laurens Catelan (1568?-1642), a French apothecary, expressed the feeling of strangeness and the lack of consensus about their benefits [37].

In 1631, French physician Philebert Guybert (1579-1633) was very critical of the medicinal powers attributed to bezoar stones. He reviewed early Arabic, Portuguese, Spanish, and contemporary works, recalling Ambroise Paré and experiences from an experiment carried out on convicted criminals by Louis Guyon and Mattias Vuyzers. Poison was given to two convicts; one was given bezoar stone, and they both died. Guybert did not name the poison or the given amounts of either the poison or bezoar [38]. He did not use any systematic method to analyse bezoar properties and effects. His last argument was that bezoars were very expensive, enriching those who traded in them, and concluded that bezoars were unknown and foreign medicines. He advised that it would be safer to use common and proven remedies [39].

### BEZOARS IN MAGIC AND ART

According to the tradition of Greek medicine, the stones were to be administered internally or to be worn as amulets with magical properties [41]. Four protocols had been established as effective and involved touching the stones, wearing them, ingesting them in a drink, and looking at them [42]. These protocols were formulated in a poem by the French poet and monk Philippe de Thaon at the beginning of the 12<sup>th</sup> century [43].

Pur le tocher, pur le porter,	<i>Touching, carrying,</i>
<i>Pur le beivre, pur l'esgarder.</i>	<i>Drinking, regarding:</i>
Ces quatre maneres posad	<i>Four ways of achievement;</i>
Deus, grant signifiante [i] ad;	<i>God will grant fulfilment;</i>
E ço dirrai en autre livre,	<i>In another book I'll narrate</i>
Se Jhesu Christ me leissa vivre...	<i>If Jesus Christ allows my fate).</i>

By touching, carrying and looking at the magic use was called for. Drinking meant the pharmacological use. The stones were crushed into powder to make a beverage. Health was the *summum bonum*. To ensure this most precious of gifts, men, women, and children would resort to prayers, astrology, magic, and medicine [43]. The stones were carried on a ring, a bracelet or a necklace. The commonest use of precious stones and similar substances used in jewels was not against disease but against poison [44].

Bezoars, regarded as powerful amulets and talismans, became indispensable in maintaining health and protecting against poisoning. German physician Christoff Hyeble of Constance recommended in a letter to a wealthy

banker, Philip Edouard Fugger (1546-1615), that everybody should buy a bezoar, no matter the effort or cost [45].

### THE TÁVORA SEQUEIRA PINTO COLLECTION (OPORTO)

Portuguese art collector, lawyer, university professor, and businessman Álvaro Sequeira Pinto inherited his passion for India and the history of Portuguese expansion from his maternal grandparents. His rich collection includes Indo-Portuguese jewellery, consisting of exotic objects such as bezoars, unicorn horns, coconuts, and a Narwhal tooth. Indo-Portuguese furniture and Portuguese and Flemish paintings and sculptures are also part of his collection.

Jewellery making, being one of the oldest of the decorative arts, reflects deep human love of objects with intrinsic beauty and the superstitious need to reinforce human powers through things that are longer-lasting and more mysterious than Man [46].

Although the bezoars were not particularly beautiful, they were valued as much as gems and noble metals. Five Oriental bezoars from the 16<sup>th</sup>, 17<sup>th</sup>, and 18<sup>th</sup> century embellished with Indo-Portuguese filigree illustrate the glory of bezoars as exotic jewels and medicines. Oriental bezoars found in monkeys and porcupines (*lapis bezoar orientalis*) were the most expensive [47].

Bezoars were worn as amulets on pendants or set as the main stone in pieces of jewelry specially designed for nobles. From the 16<sup>th</sup> century onwards, bezoars and Goa stones were often kept in elaborate and costly spherical or ovoid gold and silver boxes, designed to hang on a chain or sit on a three-legged stand [48]. These artificial bezoars, invented by the Portuguese Jesuit Gaspar António in the middle of the 17<sup>th</sup> century, were as costly as the real bezoars [49].

Távora Sequeira Pinto's Oriental bezoar collection includes three pendants, a bezoar mounted on a gold filigree stand decorated with coral, and a bezoar in a silver filigree container. Their exact origin is unknown:

The first bezoar (Fig. 5) is shaped like a fruit. It has a brownish colour and irregular surface and is attached to four branches of beautiful Indo-Portuguese gold filigree. The upper part consists of two rows of small leaves, connected to a hanging loop. The filigree work is similar to a piece from the Kunshistorisches Museum in Vienna (catalogue no. KK. 996).



Figure 5 - Oriental bezoar mounted on Indo-Portuguese golden filigree pendant. 16<sup>th</sup> century. Size: height 9.4 cm, diameter 6.1 cm. Távora Sequeira Pinto Collection (Oporto)

*Slika 5 – Istočnjački bezoar na indo-portugalskom filigranskom privjesku iz 16. stoljeća. Dimenzije: visina 9,4 cm, promjer 6,1 cm. Kolekcija Távora Sequeira Pinto (Oporto)*

The second bezoar (Fig. 6) is also mounted on a very graceful, fruit-shaped pendant. The bezoar is brown.

The third bezoar (Fig. 7) is an irregular dark brown ovoid attached to a gold wire frame and a gold chain.

The fourth bezoar (Fig. 8) is whitish, mounted on a gold filigree stand, and decorated with a coral on the top.

The fifth bezoar (Fig. 9) is dark green and spherical, placed in a silver filigree container. The silver box is similar to two Goa stone containers kept in the Wellcome Trust in London (catalogue nos. A642467 and A642470, respectively) [50].



Fig. 6 - Oriental bezoar mounted on Indo-Portuguese golden filigree pendant in the form of a fruit. 17<sup>th</sup> century. Size: height: 5.8 cm, diameter 8 cm. Távora Sequeira Pinto Collection (Oporto).

*Slika 6 – Istočnjački bezoar na indo-portugalskom zlatnom filigranskom privjesku u obliku voća iz 17. stoljeća. Dimenzije: visina 5,8 cm, promjer 8 cm. Kolekcija Távora Sequeira Pinto (Oporto)*

Gold and silver were more than material on which the bezoar was placed or clamped. These noble metals had been used in medicine for their antiseptic properties and had been invested with a strong symbolic charge [51].

Coral was also appreciated since the Antiquity. Pliny describes coral as an adornment and a protective amulet among Indians and Celts. He also reported on its medicinal use in treating bladder troubles and fevers [52].

### CHEMICAL ANALYSIS AND CLASSIFICATION OF BEZOARS

The end of the 18<sup>th</sup> century saw the decline of unicorn horns, bezoars, gem electuaries, and other ancient panaceas like the theriac. The efficacy of the theriac was questioned by one of the best doctors of his time William Heberden (1710-1801), who published a satirical pamphlet “Anti-Teriaka” [53]. His critical analysis led to its abandonment [54]. Years later, French nobleman



Fig. 7 - Oriental bezoar stone pendant, attached to a golden chain. 17<sup>th</sup> century. Size: height: 6.4 cm, diameter 3.8 cm. Távora Sequeira Pinto Collection (Oporto)

*Slika 7 – Privjesak s istočnjačkim bezoarom na zlatnom lancu. 17. stoljeće. Dimenzije: visina 6,4 cm, promjer 3,8 cm. Kolekcija Távora Sequeira Pinto (Oporto)*



Fig. 8 – Oriental bezoar stone mounted on a golden filigree stand, decorated with a coral branch on the top. 18<sup>th</sup> century. Size: height 25.6 cm, diameter 9 cm. Távora Sequeira Pinto Collection (Oporto)

*Slika 8 – Istočnjački bezoar na zlatnom filigranskom stalku ukrašenom koraljnom granom. 18. stoljeće. Dimenzije: visina 25,6 cm, promjer 9 cm. Kolekcija Távora Sequeira Pinto (Oporto)*

and chemist Antoine-Laurent Lavoisier (1743-1794) challenged ancient beliefs and superstitions.

Lavoisier's friend Joseph Louis Proust, also a chemist and a pharmacist who lived in exile in Spain, was the first to report analytical findings on Peruvian bezoars in a letter to chemist and doctor Jean d'Arcet (1724-1801). He established their origin from the animals of South America such as llamas, tarugas, and guanacos. These bezoars were big, yellow, earthy, formed in concentric layers of varied thickness, rough and brittle in consistency, around a foreign body that could be a grain of sand or a leaf. They had a





Fig. 9 – Spherical oriental bezoar within a silver Indo-Portuguese filigree container. 17th century. Size: diameter of bezoar 6,5 cm; diameter of the container 9 cm. Távora Sequeira Pinto Collection (Oporto).

*Slika 9 – Okrugli istočnjački bezoar u indo-portugalskoj srebrnoj filigranskoj kutijici iz 17. stoljeća. Dimenzije: promjer bezoara 6,5 cm, promjer kutijice 9 cm. Kolekcija Távora Sequeira Pinto (Oporto).*

strong smell of amber. If burned, they smelled of animals and the remnants were a mixture of earth and charcoal. Reacting with sulphuric acid, these bezoars released selenite and phosphoric acid. Proust was told by a Spanish traveller that the natives took bezoars from animal bellies but he did not know how the bezoars were formed [55].

By 1831, bezoars were already classified according to their chemical composition. The bezoar was a formation that incorporated concretions in the intestines, gallbladder, gall ducts, salivary ducts, and pineal gland of animals. Ten varieties were described. Chemically, they mainly consisted of phosphates, resins, fibres, and hair [56].

Recently, R. van Tassel analysed the composition of bezoars from the Henri van Heurck collection. About 75 specimens of Occidental bezoars were brushite and/or whitelockite concretions (34 more or less complete concretions and 5 fragments), three were calcite concretions and 30 calcite pebbles. Seven more or less complete Oriental bezoars required further chemical analysis, described in detail. Ellagic acid was identified in all of them [57].

Ellagic acid is formed in the human body and the body of mammals, and is of vegetable origin. Ellagitannin, contained in fruit like cranberry, raspberry, and pomegranate have antioxidant, anti-mutagenic, anti-tumoral, and anti-carcinogenic properties, and can alleviate the symptoms of major chronic diseases [58]. These properties may be related to the use of Oriental bezoars to preserve youth, as described by Garcia de Orta [59].

### BEZOARS: ANCIENT AND CURRENT TOXICOLOGY

The end of the 18<sup>th</sup> century brought new scientific insights into the paradox of toxicology. The importance of the dose-response paradigm was clear to Paracelsus (1493-1541) and still remains a motto of toxicologists: "All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy " [60]. However, this concept was not understood immediately. Current management of acute poisoning requires intensive supportive therapy. Specific antidotes are seldom available. Few genuine antidotes exist in practice. Those antidotes that are available are life-saving. Its precursors were adsorbent clays used in the Antiquity [61]. Bezoars could also act as adsorbents or chelating agents. In a recent investigation, bezoar stones immersed in an arsenic-laced solution actually removed the poison. They differently but effectively reacted with two toxic compounds of arsenic, arsenate and arsenite. Arsenate was removed by being exchanged for phosphate in brushite, a crystalline structure found in the stones, and arsenite bonded to sulphur compounds in the protein of degraded hair, a key component of bezoars [62].

### CONCLUSION

Bezoars were costly medicines, very appreciated as antidotes by the Arabic authors from the 7<sup>th</sup> until the end of the 17<sup>th</sup> century. Bezoars were also used as amulets and were worked into fine pieces of jewellery. In the 18<sup>th</sup> century, chemical studies challenged ancient beliefs and superstitions. The establishment of more effective therapies and the chemical revolution led to the abandonment of theriacs, bezoars, and the Hippocratic therapies, and bezoars became beautiful relics of the past. However, some pharmacological activity has been confirmed in the treatment of poisoning in pre-scientific times.

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#### SAŽETAK

*Bezoari – nekad univerzalni protuotrov i panaceja, a danas smatrani skupim i beskorisnim lijekom iz prošlosti – imaju su značajno mjesto u povijesti toksikologije. Arapski su liječnici rabili bezoare u medicinske svrhe još od 8. stoljeća. U 16. stoljeću, kad su trgovinu bezoarima držali Portugalci, liječnici Garcia de Orta, Amatus Lusitanus i Cristobal Acosta predstavili su europskoj medicini primjenu istočnjačkih bezoara u terapijske svrhe. Zanimare li se određene kritike, vodeći su europski liječnici bezoare mahom propisivali kao snažne protuotrove. Pet izložaka iz kolekcije Távora Sequeira Pinto u Oportu svjedoči o privlačnosti i slavi bezoara na vrhuncu njihova zlatnog doba, kada su po cijenjenosti bili izjednačeni s dragim kamenjem i mineralima rabljenim u istočnjačkoj i zapadnoj litoterapiji.*

*Kraj XVIII. stoljeća donio je i kraj primjene antičkih panaceja. Ovaj je članak posvećen terapijskim i apotropaičnim primjenama bezoara.*

**Ključne riječi:** bezoar; arapska medicina; povijest toksikologije; povijest medicine; povijest umjetnosti

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