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Remedies of animal origin and their indications in Nikolaos Myrepsos' *Dynameron*

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ABSTRACT

Ethnopharmacological relevance: *Dynameron* is a Byzantine medical compendium, divided into 24 sections, in accordance with the letters of the Greek alphabet. Being the largest medical and pharmaceutical book ever written in Byzantium, *Dynameron* contains 2667 recipes intended to treat many pathological conditions. A lot of information convey to us through prescriptions. In addition to plants, Nikolaos Myrepsos proposes the use of many animals, animal parts and animal by-products, for the treatment of various diseases. This article presents for the first time a full account of the animal products included in *Dynameron*.

Aim of the study: In continuation to our previous studies, this paper focuses on the use of animal products in composite medicines described in *Dynameron*. An effort was made to trace down the use of similar or identical animal products in texts of earlier medical writers. Recording recipes with animals or animal products intended for use in everyday medical practice highlights the timeless belief in their healing properties.

Materials and methods: Our main source of material is the recent digital edition of Nikolaos Myrepsos' *Dynameron*. This huge treatise was written in the 13th century and reflects in many ways the long medical tradition of the Greek, the Hellenistic and the Roman eras, having also received influences from the *materia medica* of Arabic medicine. In addition, information from dictionaries and databases were cross-checked to confirm and classify the animals and their products and to identify them. For the various pathological conditions these products are meant for, we have used the current medical terminology.

Results: In the present study, we could identify the therapeutic use of 93 animals. In several instances, Myrepsos suggests the use of specific organs of an animal, and for that reason he includes in his treatise 16 anatomical parts of different animals. Moreover, *Dynameron* comprises also 34 animal by-products, such as milk and honey. Medicines of animal origin are used in recipes concerning diseases of the respiratory, the digestive, the cardiovascular and the urinary system, as well as gynecological diseases, and ailments of the eyes, the ears and the skin.

Conclusions: Of the 2667 recipes of *Dynameron*, 344 recipes contain medicines of animal origin, which can be detected in totally 769 citations. In addition, 626 citations for animal by-products are found in 268 recipes. Honey and milk are quoted in 2136 recipes, mostly as excipients. Dietary instructions are present on many occasions, reflecting the attitude for a healthy everyday life, similar to the modern beliefs pertaining to food as an essential factor for a good health.

1. Introduction

In continuation to our previous reports (Valiakos et al., 2015, 2017), the present study aims at the documentation and assessment of the information concerning the animal ingredients quoted in Nikolaos

Myrepsos' *Dynameron*, a huge therapeutic treatise containing 2667 recipes. Until recently, this important book was known due to its printed Latin translation (Fuchs, 1549) and due to a few Greek codices rescued to our days (Valiakos et al., 2015).

In our study, we used the book, a critical edition, which was

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eventually published in two volumes, and it is currently available also in a digitalized form with a German (Valiakos, 2019) or an English introduction (Valiakos, 2020a). *Dynameron* provides a lot of information concerning the treatment of many diseases and pathological conditions. Each recipe, in addition to the indication(s), contains information on the ingredients and instructions for their mixing in order to be used by the patient or the physician. Most of the ingredients are plants (Valiakos et al., 2015, 2017), but there are several recipes containing also minerals and ingredients of animal origin. Additionally, some ingredients are exotic products arriving to Byzantium through the commercial exchanges with remote areas in the periphery of the empire (Dalby, 2010).

Comparing the medicines of animal origin quoted in *Dynameron* with those described in previous medical texts, it is easy to recognize a continuation of use from the 2nd c. B.C. till the late Byzantine era.

As a matter of fact, also other medical writers, like Aelius Promotus, Oribasius of Pergamon, Aetius of Amida, Paul of Aegina and Alexander of Tralles, who collected and studied earlier treatises of medical interest, have given emphasis on information related to practical issues of daily life, such as nutrition and health. For example, comparative assessments of the quality of meat among various quadrupedal animals has been recorded, with references to the pig, the sheep, the cattle, the hare and the horse, which were consumed in Byzantium. Their scientific interest was also extended to the animals of the maritime world (De Vos, 2010).

The view that good health and medicine are primarily related to nutrition, first developed by Hippocratic physicians and elaborated further by Galen of Pergamon, has been adopted by the majority of Byzantine physicians. Moreover, the use of animal products in medicine and white magic in Byzantium, like almost in all societies, is evident and can be documented by several examples (Chroni, 2010).

In the 11th c., Simeon Seth, has paid a special attention to dietetics, praising the animal products and emphasizing the close relationship between food and health (Lauritzen, 2015).

2. Material and methods

We used the edition of Nikolaos Myrepsos' *Dynameron* (Valiakos, 2019) as our book of reference. The book contains 2667 recipes and it is divided into 24 sections, named "Elements from Alpha to Omega", according to the letters of the Greek alphabet.

In the present article, attention has been given in finding all medicines of animal origin included in the twenty-four chapters of *Dynameron*. The material of the edition was studied recipe by recipe and word by word. All animals mentioned in the 2667 recipes are recorded. The names are identified in dictionaries (Dimitrakos, 1966; Kriaras, 1968–2014; Liddell et al., 1996; Apostolides, 1997), in publications of Universities (Salamanca, (Universidad Salamanca, 2009); dioscorides.usal.es; Michigan, (Myers et al., 2021) animaldiversity.org) and databases of taxonomy ((Catalogue of Life et al., 2020) www.catalogueoflife.org; (Encyclopedia of Life et al., 2014) www.eol.org and (UBIO et al., 2021): www.ubio.org).

The nosological conditions described in the text were determined according to modern medical terminology. The remedies of animal origin described by Myrepsos very often refer to different ailments and different organs of the human body. In the current paper they are grouped and presented in different subchapters according to the system concerned.

In addition to the identification of the animals and the animal products mentioned by Nikolaos Myrepsos, we have also tried to quote and categorize the pathological conditions for which these medicines are proposed as a treatment.

Myrepsos describes several pathological conditions with terms originating from antiquity, which can be found in texts of earlier authors (Ackerknecht, 1982). During antiquity and the byzantine era, many diseases are described which are related with the respiratory, the digestive and the urogenital system. Although not fully understood, there are also descriptions for neurological and mental diseases, for

anemia, for leprosy and even for neoplastic diseases (Eftychiadis, 1997; Karpozilos and Pavlidis, 2004).

The terms in ancient medical books were not always clear and were not used by all authors in the same way. However, earlier descriptions facilitated the work of scientists during the 18th and the 19th century, who studied and classified the diseases, suggesting new therapeutic approaches (Aufderheide and Rodriguez-Martin, 1998: 127-8).

Additionally, it should be noticed that the ancient name of a specific illness or ailment does not necessarily correspond to the one used by modern medicine, despite apparent similarities. Today, pathophysiology gives a different and deeper insight for the causes of a nosological phenomenon, as can be easily understood in the case of infectious diseases. This explains, for example, the fact that during antiquity and the Middle Ages, every epidemic disease with a high mortality rate was called "plague" and any incurable skin disease was called "leprosy". In addition, the word "cholera" in the medical texts of antiquity and even in the late Middle Ages meant any serious illness with vomiting and diarrhea, which was attributed to bad dietetic habits. Today the same word is used for a specific disease caused by the bacterium *Vibrio cholerae*. On the other hand, "φθίσις", which meant any devastating disease with cachexia, is known today to be the consequence of a chronic infection with *Mycobacterium tuberculosis*. A similar general notion of a devastating illness had the word "πανώλης", but today this term is used only for the disease caused by the pathogen *Yersinia pestis*. In fact, genetic material of these bacteria has been detected in many ancient skeletal relics (Valtueña et al., 2017; Duchêne et al., 2020). The medical writers of antiquity and Byzantium were not aware of the existence of these pathogens. However, in many instances, they left behind a full account of the symptoms of infectious diseases and an accurate description of the clinical picture of the patients.

3. Results

In the treatise *Dynameron* of Nikolaos Myrepsos, there are 344 recipes with animal remedies (corresponding to 12.9% of the total number of recipes), which are cited 769 times (6.1% of all citations). Also, there are 268 recipes containing animal by-products (10% of all recipes), with 626 citations (4.9% of all citations). In addition, honey and milk are quoted in a very large number of recipes (2136), corresponding to 80,9% of all recipes, because they are used mainly as excipients.

In total, we have identified the use of 93 animals (Table 1), 16 animal parts (Table 2) and 34 animal by-products (Table 3).

Remedies of animal origin are used in recipes intended for the treatment of a variety of pathological conditions, which could be roughly grouped as follows.

3.1. Upper respiratory system and lungs

The diseases of this category, for the treatment of which medicines of animal origin are suggested, are chest infections with cough, dyspnea and orthopnea, pneumonia, empyema, pleurisy, asthma, phthisis, complaints of common cold, catarrh, tonsillitis, pharyngitis and laryngitis. The products that have been used, include river crabs, excrements from goat or donkey, fat from goose, badger, hen, pig, stork, cat or fox, as well as aythya intestines mixed with milk, butter and honey. Sponges and wool from sheep or goat are mentioned as antiseptic and preventive agents against the transmission of disease through haemoptysis (Valiakos, 2019).

Moreover, for the treatment of pleurisy and phthisis, the donkey milk and rooster testicle, as well as the use of poultices with butter, are recommended.

Of particular interest are the reports of animal products used as haemostatic preparations against nasal bleeding or as analgesics for sinus inflammations; poultices made with wool, wax, honey and powdered female pig breast are recommended, as well as various ointments, containing honey, milk, feces of dog, droppings from chicken and

Table 1
Animals quoted in Nikolaos Myrepsos' *Dynameron*.

Name in the book	Common name	Scientific name/family	Animal parts	Mentioned in the text (Page/Line)
1. αἶθυια (<i>ethyia</i>)	Aythya	<i>Aythya</i> spp., Anatidae	dung, feces, excrement	82, 2; 83, 13; 83, 16; 84, 6
2. αἴλουρος (<i>elouros</i>) κάττος (<i>kattos</i>)	Cat	<i>Felis catus</i> , Felidae	dung, feces, excrement, lard	946, 13; 274, 18
3. αἶξ (<i>ex</i>)	Goat	<i>Capra aegagrus hircus</i> , Bovidae	horn, cornus, breast, milk, dung, feces, excrement	166, 16; 312, 18; 325, 21; 446, 13; 619, 12; 680, 17; 688, 17; 855, 9; 990, 13; 1093, 13; 1120, 10
4. ἀλεκτρυών (<i>alektryon</i>) ἀλέκτωρ (<i>alektor</i>)	Rooster	<i>Gallus gallus</i> , Phasianidae	dung, feces, excrement	26, 20; 71, 12; 151, 7; 151, 8; 154, 3; 212, 18; 266, 2; 403, 19; 556, 9; 564, 2; 631, 23; 683, 3
5. ἀλκυόνη (<i>alkyoni</i>)	Kingfisher	<i>Alcedo atthis</i> , Alcedinidae		579, 21; 941, 4
6. ἄλογον (<i>alagon</i>) ἵππος (<i>hippos</i>)	Horse	<i>Equus ferus caballus</i> , Equidae		187, 13; 944, 7; 975, 4; 1018, 24
7. ἀλώπηξ (<i>alopix</i>)	Red fox	<i>Vulpes vulpes</i> , Canidae	fat, flesh	50, 8; 102, 13; 247, 3; 247, 5; 247, 6; 264, 24; 462, 15; 941, 10; 941, 5; 941, 7; 974, 18; 1116, 15; 1117, 12
8. ἄρκος (<i>arkos</i>) ἄρκτος (<i>arktos</i>)	Brown bear	<i>Ursus arctos</i> , Ursidae	testicle, lard, bile	183, 18; 244, 10; 247, 11; 257, 15; 258, 20; 266, 2; 264, 24; 269, 24; 274, 18; 412, 9; 562, 14; 619, 10; 941, 11; 1124, 13
9. ἄρκα θαλασσία (<i>arka thalassia</i>)	Noah's Ark shell	<i>Arca noae</i> , Arcidae	flesh	962, 2
10. ἀσβός (<i>asvos</i>)	European badger	<i>Meles meles</i> , Mustelidae	fat, lard,	247, 10; 462, 15
11. ἀσκαλαβώτης (<i>askalavotis</i>)	Wall gecko	<i>Hemidactylus turcicus</i> , Gekkonidae		54, 5; 990, 18 990, 19
12. ἀσπίς (<i>aspis</i>)	Asp viper	<i>Vipera aspis</i> , Viperidae		425, 14; 483, 7; 483, 11; 1001, 2
13. ἀστερίας (<i>asterias</i>)	Mediterranean starfish	<i>Echinaster sepositus</i> , Echinasteridae		619, 11
14. ἀσφάλαγξ (<i>asphalax</i>)	Greater mole-rat	<i>Spalax microphthalmus</i> , Spalacidae		487, 5
15. βάτραχος (<i>vatrachos</i>)	Greek frog	<i>Rana graeca</i> , Ranidae		262, 17; 263, 8; 495, 16; 839, 14; 839, 15; 847, 16; 847, 20; 848, 11; 869, 13; 1075, 6; 1075, 8
16. βδέλλα (<i>vdella</i>)	European medicinal leech	<i>Hirudo medicinalis</i> , Hirudinidae		141, 21; 303, 13; 307, 1
17. βούς (<i>vous</i>)	Ox, cow	<i>Bos taurus</i> , Bovida	fat, bone arrow, bone, milk, meat, dung, feces, excrement	79, 10; 80, 2; 117, 6; 168, 5; 248, 4; 250, 14; 260, 1; 262, 20; 267, 20; 268, 11; 273, 4; 454, 2; 512, 5; 556, 16; 560, 15; 924, 7; 951, 9; 974, 12; 1074, 6; 1097, 11; 1099, 11; 1101, 13; 1102, 13; 1107, 15
18. γάλη (<i>gali</i>)	Weasel	<i>Mustela nivalis</i> spp., Mustelidae		975, 6
19. γερανός (<i>geranos</i>)	Common crane	<i>Grus grus</i> , Gruidae		212, 22
20. δορκάς (<i>dorkas</i>)	Roe deer	<i>Cervus capreolus</i> , Cervidae	meat	168, 7; 313, 6
21. ἐγγραυλῖς (<i>engravilis</i>)	Anchovy paste	<i>Engraulis encrasicolus</i> , Engraulidae	scale	168, 8
22. ἐγγελεύς (<i>enchelys</i>)	European eel	<i>Anguilla anguilla</i> , Anguillidae		967, 12
23. ἐλάφιον, (<i>elaphion</i>) ἐλαφος (<i>elaphos</i>)	Red deer	<i>Cervus elaphus</i> , Cervidae	vulva, horn, cornus, bone arrow, meat	26, 4; 36, 13; 37, 3; 40, 1; 41, 19; 42, 19; 43, 12; 44, 22; 44, 3; 54, 18; 61, 16; 64, 18; 65, 13; 65, 23; 71, 7; 73, 10; 90, 11; 113, 14; 148, 16; 150, 13; 153, 21; 168, 6; 171, 14; 178, 21; 189, 1; 190, 8; 199, 17; 201, 20; 201, 6; 205, 2; 206, 15; 209, 1; 209, 12; 210, 21; 210, 8; 211, 25; 212, 22; 215, 16; 216, 7; 243, 19; 243, 26; 244, 10; 244, 15; 244, 20; 244, 22; 245, 24; 245, 5; 247, 12; 247, 24; 250, 16; 253, 18; 253, 24; 253, 8; 254, 7; 257, 14; 269, 25; 269, 8; 273, 4; 325, 21; 337, 6; 338, 12; 338, 7; 399, 11; 414, 4; 213, 22; 214, 17; 437, 7; 459, 18; 461, 5; 462, 8; 479, 17; 495, 7; 510, 2; 523, 9; 523, 12; 524, 5; 524, 7; 525, 10; 549, 15; 562, 13; 578, 18; 578, 22;

(continued on next page)

Table 1 (continued)

Name in the book	Common name	Scientific name/family	Animal parts	Mentioned in the text (Page/Line)
				585, 15; 585, 22; 588, 18; 591, 20; 592, 13; 619, 12; 622, 16; 665, 12; 669, 3; 670, 22; 671, 3; 675, 7; 678, 20; 687, 20; 740, 14; 740, 5; 819, 8; 820, 2; 823, 11; 824, 4; 827, 3; 853, 11; 853, 2; 904, 13; 904, 3; 922, 11;; 923, 12; 923, 16; 923, 6; 924, 20; 925, 3; 925, 8; 932, 17; 926, 3; 932, 20; 947, 3; 964, 8; 990, 16; 992, 6; 1007, 12; 1007, 13; 1018, 20; 1018, 7; 1030, 14; 1030, 33; 1041, 17; 1064, 18; 1088, 7; 1097, 12; 1099, 11 43, 12; 61, 15; 26, 6; 44, 22; 65, 13; 65, 24; 148, 16; 150, 14; 189, 2; 190, 18; 192, 26; 199, 25; 206, 4; 214, 17; 651, 8; 1018, 8 263, 6
24. ἐλέφανς (<i>elephas</i>)	Elephant	<i>Elephas</i> spp. Elephantidae	bone	
25. ἔριον θαλάσσης (<i>erion thalassis</i>)	Tube anemone (?)	<i>Cerianthus membranaceus</i> (?) Cerianthidae		
26. ἐχενηίς (<i>echeniis</i>)	Remora, Suckerfish	<i>Remora remora</i> , Echeneidae		168, 5
27. ἔχιδνα (<i>echidna</i>)	Horned viper	<i>Vipera ammodytes</i> , Viperidae		630, 11; 800, 4; 992, 24; 1012, 12; 1012, 14
28. ἐχίνος θαλάσσιος (<i>echinos thalassios</i>)	Sea urchin	<i>Paracentrotus lividus</i> , Parechinidae	shell,	941, 19; 945, 4; 946, 19; 971, 6; 988, 7; 988, 21
29. ἐχίνος χερσαίος (<i>echinos cherseos</i>)	Hedgehog	<i>Erinaceus europaeus</i> , Erinaceinae	skin, head, bile	71, 14; 154, 4; 416, 14; 416, 8; 916, 17; 942, 13; 945, 6; 969, 10; 1121, 2
30. θύμνα (<i>thymna</i>)	Tuna fish	<i>Thunnus thynnus</i> , Scombridae	scale	168, 8
31. ἰέραξ (<i>hierax</i>)	Falcon	<i>Falco</i> spp., Falconidae		657, 6; 662, 17; 683, 3
32. κάμηλος (<i>kamilos</i>)	Camel	<i>Camelus dromedarius</i> , Camelidae	dung	948, 2
33. κάπρος (<i>kapros</i>) ῦς (<i>hys</i>)	Wild boar	<i>Sus scrofa</i> , Suidae	fat, lard,	247, 15; 492, 21; 933, 18
34. καρκίνος (<i>karkinos</i>) καβούρι (<i>kavouri</i>)	Crab	<i>Liocarcinus vernalis</i> , Portunidae		47, 15; 271, 12; 271, 13; 335, 5; 351, 24; 352, 20; 372, 18; 392, 15; 405, 10; 405, 11; 405, 13; 405, 9; 630, 23; 634, 7; 1071, 7; 1071, 9; 1104, 6
35. κάστωρ (<i>kastor</i>)	Castor	<i>Castor fiber</i> , Castorridae	testicle	913, 3
36. κοράλλι (<i>koralli</i>)	Coral	class Anthozoa, phylum Cnidaria		4, 12; 4, 13; 22, 11; 25, 17; 31, 5; 31, 19; 42, 11; 61, 14; 64, 19; 66, 2; 70, 16; 71, 8; 82, 27; 87, 12; 89, 14; 90, 11; 89, 23; 148, 16; 152, 20; 153, 22; 201, 5; 212, 18; 216, 3; 216, 6; 254, 15; 337, 5; 459, 17; 497, 4; 769, 20; 991, 25; 991, 26; 991, 27; 992, 25; 995, 1; 995, 10; 1018, 4; 1025, 4; 1034, 91003, 11 1004, 13; 1004, 14; 1004, 17; 1004, 19; 1004, 8; 1004, 9; 1013, 3; 1030, 17; 1037, 4 ~ἐρυθρόν 178, 22; 301, 9; 33, 10; 36, 25; 36, 9; 42, 16; 43, 17; 44, 16; 73, 10; 158, 4; 188, 22; 190, 21; 199, 26; 206, 10; 208, 25; 210, 7; 211, 22; 214, 18; 218, 12; 345, 22; 92, 7; 1013, 4; 1039, 1; 574, 6; 331, 20; 339, 4; 379, 2; 384, 2; 418, 3; 460, 6; 494, 16; 494, 20; 714, 12; 770, 1 913, 2
37. κόραξ/κορακίνος (<i>korax/korakinos</i>)	Tub-fish	Similar to perch; fish so called from its black color		
38. κόραξ (<i>korax</i>)	Common raven	<i>Corvus corax</i> , Corvidae		424, 28; 480, 7
39. κοχλίος (<i>kochlios</i>)	Snail	<i>Helix</i> spp., Helicidae	shell, flesh,	392, 14; 405, 5; 417, 2; 417, 5; 864, 8 924, 7; 1001, 18; 1088, 19; 1001, 18; 405, 6; 924, 8 966, 10; 393, 29; 1007, 13; 1126, 1
40. κριός (<i>krios</i>)	Ram	<i>Ovis aries</i> , Bovidae		47, 4; 271, 18; 342, 10; 345, 26; 347, 14; 348, 14; 348, 20; 369, 13; 369, 24; 370, 21; 370, 9; 375, 29; 376, 12; 376, 6; 612, 12; 618, 11; 890, 22; 968, 12; 1108, 16; 374, 6 657, 12; 664, 18; 1038, 12
41. κύκνος (<i>kyknos</i>)	Swan	<i>Cygnus Cygnus</i> , Anatidae		
42. κύων (<i>kyon</i>)	Dog	<i>Canis lupus familiaris</i> , Canidae	bone, dung, feces, excrement	33, 19; 119, 1; 398, 16; 400, 10; 451, 1; 482, 13; 492, 9; 510, 6; 551, 3; 585, 10; 612, 22; 612, 9; 613, 2; 642, 4; 845, 15; 854, 6; 859, 3; 864, 18; 867, 2; 869, 6; 881, 25; 890, 7; 909, 1; 953, 16; 1031, 6; 1044, 15; 1064, 1; 1123, 8; 1136, 25; 1136, 5
43. λαγώς (<i>lagoos</i>)	Hare	<i>Lepus timidus</i> , Leporidae		

(continued on next page)

Table 1 (continued)

Name in the book	Common name	Scientific name/family	Animal parts	Mentioned in the text (Page/Line)
			bile, dung, feces, excrement, meat	168, 5; 50, 2; 71, 14; 93, 15; 117, 7; 178, 4; 179, 11; 292, 7; 311, 19; 923, 6; 924, 8; 931, 10; 931, 6; 932, 6; 932, 8; 939, 16; 972, 9; 1065, 13
44. λέων (<i>leon</i>) λέαινα (<i>leena</i>)	Lioness	<i>Panthera leo</i> , Felidae	lard	245, 24; 247, 10; 253, 26; 421, 18; 425, 15; 425, 16; 437, 5; 443, 13; 453, 4; 483, 15; 483, 21; 618, 26; 924, 4
45. λύκος (<i>lykos</i>)	Wolf	<i>Canis lupus</i> , Canidae	testicle, dung, feces, excrement	128, 10; 398, 16; 619, 10; 683, 4
46. μέλισσα (<i>melissa</i>)	Bee	<i>Apis mellifera</i> , Apidae		The honeybee as an animal is not mentioned anywhere in <i>Dynameron</i> . However, its products, such as wax, honey, propolis, etc. are widely used, more than 2000 times.
47. μόσχος (<i>moschos</i>)	Little calf	<i>Bos taurus</i> , Bovidae	horn, cornus, bone arrow, bone	3, 21; 8, 1; 9, 25; 11, 14; 21, 24; 36, 11; 36, 27; 36, 4; 42, 17; 42, 26; 43, 13; 43, 21; 44, 19; 44, 22; 51, 14; 52, 11; 52, 7; 55, 17; 61, 16; 64, 20; 65, 14; 72, 12; 72, 18; 73, 11; 80, 11; 80, 7; 81, 14; 81, 8; 84, 12; 85, 10; 85, 11; 85, 20; 96, 21; 97, 1; 97, 4; 112, 20; 113, 15; 113, 6; 125, 7; 150, 15; 189, 12; 189, 2; 201, 14; 201, 20; 206, 16; 207, 15; 208, 1; 209, 1; 209, 5; 210, 12; 211, 23; 212, 20; 212, 29; 212, 5; 213, 17; 213, 24; 213, 8; 214, 16; 214, 28; 215, 20; 215, 31; 217, 28; 225, 11; 252, 7; 253, 25; 189, 21; 190, 13; 399, 11; 444, 6; 460, 8; 483, 10; 488, 9; 502, 12; 509, 3; 597, 11; 619, 19; 621, 23; 622, 4; 622, 5; 623, 19; 687, 19; 689, 12; 694, 11; 708, 15; 712, 20; 715, 1; 716, 2; 761, 2; 914, 10; 926, 20; 927, 16; 927, 6; 961, 13; 987, 5; 993, 11; 1018, 10; 1018, 14; 1018, 19; 1058, 6
48. μούκιον (<i>myakion</i>)	Small sea mussel	<i>Mytilus</i> spp., Mytilidae		1138, 10
49. μυγαλή (<i>mygali</i>)	Shrew	<i>Sorex araneus</i> , Soricidae		491, 12
50. μυΐα (<i>myia</i>) μύα (<i>mya</i>)	Housefly	<i>Musca domestica</i> , Muscidae	feather	941, 1; 941, 5; 947, 12
51. μύς (<i>mys</i>)	House mouse	<i>Mus musculus</i> , Muridae		436, 7; 438, 2; 446, 27; 541, 26; 905, 8; 905, 9; 941, 5; 945, 9; 948, 6; 1030, 5
52. μυωτίς (<i>myotis</i>)	Bat	<i>Myotis</i> spp., Vespertilionidae		338, 9
53. νήσσα (<i>nissa</i>)	Duck	<i>Anas</i> spp., Anatidae	fat, lard,	71, 14; 82, 23; 149, 13; 194, 21; 194, 22; 911, 5; 911, 6; 952, 17; 138, 14; 154, 5; 208, 24; 247, 10; 264, 9; 266, 2; 267, 21; 268, 10; 274, 18; 461, 6
54. όνος (<i>onos</i>)	Donkey	<i>Equus africanus asinus</i> , Equidae	bone marrow bone, milk, dung, feces, excrement	166, 16; 179, 14; 247, 14; 274, 19; 687, 19; 946, 16; 975, 2
55. όρνειον (<i>orneon</i>)	Eurasian griffon	<i>Gyps fulvus fulvus</i> , Accipitridae		414, 5
56. όρνίθιον (<i>ornithion</i>) όρνις (<i>ornis</i>)	Chicken, hen	<i>Gallus gallus domesticus</i> , Phasianidae	fat, lard, broth, meat	925, 3; 1130, 35; 36, 26; 924, 21; 254, 10; 266, 2; 271, 25; 479, 12; 549, 16; 551, 8; 562, 13; 820, 1; 884, 4; 924, 3; 930, 15; 1116, 14; 232, 2; 247, 11; 257, 15; 260, 8; 262, 8; 267, 21; 268, 10; 268, 5; 272, 9; 274, 18; 274, 28; 410, 19; 461, 6; 462, 15; 463, 11; 464, 16; 558, 16; 564, 22; 573, 23; 926, 3; 927, 13; 927, 8; 931, 18; 932, 2; 1107, 15; 1126, 9
57. όστρεον (<i>ostreon</i>)	European flat oyster	<i>Ostrea edulis</i> , Ostreidae		71, 15; 154, 5; 589, 8; 841, 4; 858, 1; 858, 2; 873, 25; 955, 19; 1030, 16; 1030, 31; 1098, 12
58. όφις (<i>ophis</i>)	Snake	Suborder: Serpentes		26, 20; 119, 1; 151, 7; 303, 13; 307, 1; 881, 25; 909, 1; 956, 16; 1103, 1
59. παλαμής (<i>palamis</i>)	Atlantic bonito	<i>Sarda sarda</i> , Scombridae	scale	168, 8

(continued on next page)

Table 1 (continued)

Name in the book	Common name	Scientific name/family	Animal parts	Mentioned in the text (Page/Line)
60. πάρδαλις (<i>pardalis</i>)	Leopard	<i>Panthera pardus</i> , Felidae		421, 19; 453, 10
61. πελαργός (<i>pelargos</i>)	White stork	<i>Ciconia ciconia</i> , Ciconiidae	dung, feces, excrement	421, 20; 454, 5; 454, 7
62. πέρδιξ (<i>perdix</i>)	Grey partridge	<i>Perdix perdix</i> , Phasianidae		683, 3; 908, 20; 1120, 20
63. περιστέρα (<i>peristera</i>) περιστέρα λευκή (<i>peristera lefki</i>)	Rock dove Collared dove	<i>Columba livia</i> , Columbidae <i>Streptopelia decaocto</i> , Columbidae	feather, blood, dung, feces, excrement	71, 12; 154, 3; 416, 8; 416, 14; 433, 8; 458, 15; 482, 12; 489, 7; 492, 8; 492, 16; 495, 8; 581, 16; 672, 7; 674, 8; 695, 12; 1002, 2; 1077, 16; 1088, 11; 1093, 15; 1102, 4; 1078, 23
64. πολύπους (<i>polyπους</i>)	Octopus	<i>Octopus vulgaris</i> , Octopodidae		842, 20; 842, 21; 868, 9; 868,13; 868, 16
65. πορφύρα (<i>porphyra</i>)	Sea snail	<i>Bolinus brandaris</i> , Muricidae		26, 4; 36, 13; 40, 2; 43, 13; 44, 5; 66, 3; 190, 18; 199, 23; 201, 8; 372, 5; 420, 17; 446, 1; 479, 3; 989, 16; 1018, 9
66. πρόβατον (<i>provaton</i>)	Sheep	<i>Ovis aries</i> , Bovidae	dung, feces, excrement	267, 20; 423, 15; 460, 20; 460, 23; 461, 10; 461,12; 461,15; 510,11; 569, 8; 611, 8; 948, 5; 1118, 5; 683, 4
67. σκάρος (<i>skaros</i>)	Parrotfish	<i>Sparisoma cretense</i> , Scaridae		
68. σιπία (<i>sipia</i>)	Common cuttlefish	<i>Sepia officinalis</i> , Sepiidae	shell,	579, 18; 589, 13; 590, 7; 860, 5; 863, 4; 873, 24
69. σιλουρος (<i>silouros</i>)	Sheatfish	<i>Silurus glanis</i> , Siluridae	broth	913, 2
70. σκούμβρος (<i>skoumvrros</i>)	Mackerel	<i>Scomber scombrus</i> , Scombridae	scale	168, 8
71. σκορπίος (<i>skorpios</i>)	Scorpion	order Scorpiones		441, 11; 441, 17; 625, 11; 634,21
72. σκίγγος (<i>skingos</i>)	Skink	<i>Scincus scincus</i> , Scincidae	tail	986, 4; 990, 16
73. σκώληξ (<i>skolix</i>)	Earthworm	<i>Lumbricus terrestris</i> , Lumbricidae		534, 5; 1113, 23; 1125, 1; 1125,2; 680, 15; 1113, 9; 1119, 4
74. σπόγγος (<i>spongos</i>) σπογγιον (<i>spongion</i>)	Sponge, Little sponge	<i>Spongia officinalis</i> , Spongiidae		238, 11; 252, 12; 192, 9; 261, 22; 262, 2; 272, 24; 345, 21; 457, 5; 485, 4; 490, 6; 490, 7; 509, 24; 511, 11; 512, 10; 512, 3; 575,22; 590, 20; 607, 17; 612, 6; 954, 2; 954, 3; 955, 15; 972, 14; 1030, 15; 1031, 1; 1031, 23; 1062, 4; 1063, 13; 1063, 16; 1063, 17; 1063, 18; 1064, 1; 1064, 1; 1070, 1; 1093, 14
75. σπουργίτης (<i>sourgitis</i>) στρούθιον (<i>strouthion</i>) <σ>τρογλίτης (<s>troglitis)	Eurasian tree sparrow	<i>Passer montanus</i> , Passeridae	brain, bone marrow	53, 2; 54, 1; 414, 5; 458, 12; 911, 11; 987, 6; 985, 10; 990, 18
76. στρουθοκάμηλος (<i>strouthokamilos</i>)	Common ostrich	<i>Struthio camelus</i> , Struthionidae	lard	247, 10; 486, 20
77. ταύρος (<i>tavros</i>)	Ox, bull	<i>Bos taurus</i> , Bovidae	bone arrow, lard	141, 12; 183, 18; 243, 24; 244, 20; 245, 5; 247, 11; 250, 15; 252, 16; 260, 1; 269, 25; 270, 16; 305, 17; 308, 15; 308, 18; 404, 8; 407, 7; 410, 10; 433, 6; 446, 18; 450, 22; 450, 4; 451, 15; 455, 18; 456, 23; 458, 16; 460, 19; 461, 3; 473, 7; 474, 25; 474, 26; 476, 2; 480, 10; 482, 19; 484, 2; 487, 26; 489, 6; 492, 22; 501, 12; 501, 7; 523, 9; 525, 10; 525, 2; 529, 21; 618, 3; 701, 16; 702, 6; 740, 5; 751, 5; 823, 10; 824, 5; 874, 11; 874, 19; 923, 12; 932, 21; 948, 7; 950, 4; 957, 3; 973, 19; 1010, 10; 1122, 11
78. τέτιξ (<i>tettix</i>)	Cicada	<i>Tibicen plebejus</i> , Cicadidae	leg, feather, head	20, 1; 46, 7; 47, 18; 50, 13; 192, 11; 192, 5; 968, 5; 557, 16
79. τούρπανα (<i>tourpena</i>)	Torpedo	<i>Torpedo torpedo</i> , Torpedinidae		487, 1; 487, 5
80. τράγος (<i>tragos</i>)	Domestic goat	<i>Capra aegagrus hircus</i> , Bovidae	testicle, lard, milk, dung, feces, excrement	4, 19; 46, 1; 46, 12; 46, 15; 46, 25; 46, 5; 47, 1; 47, 2; 49, 11; 192, 10; 192, 11; 270, 17; 315, 12; 556, 12; 557, 2; 574, 3; 619, 10; 683, 4; 948, 7; 959, 8; 959, 12; 1029, 24; 1112, 1
81. τρυγών (<i>trygon</i>) τρυγώνιν (<i>trygonin</i>)	European turtle dove	<i>Streptopelia turtur</i> , Columbidae		414, 5; 452, 18
82. τρυγών θαλασσία (<i>trygon thalassia</i>)	Thornback ray	<i>Raja clavata</i> , Rajidae		441, 10; 452, 20

(continued on next page)

Table 1 (continued)

Name in the book	Common name	Scientific name/family	Animal parts	Mentioned in the text (Page/Line)
83. ὕαινα (<i>hyaena</i>)	Hyena	<i>Hyaena</i> spp., Hyaenidae	bile	455, 4; 683, 4; 902, 12; 911, 5; 911, 6; 945, 12
84. φασιανός (<i>phasianos</i>)	Pheasant	<i>Phasianus gallus</i> , Phasianidae		475, 4
85. φθειρ (<i>phthir</i>)	Louse	order Phthiraptera		1083, 2; 1083, 3; 1083, 4; 1085, 2; 1085, 7; 1085, 8; 1086, 7; 1124, 5
86. χελιδών (<i>helidon</i>)	Swallow	<i>Hirundo</i> spp., Hirundinidae	feather, dung, feces, excrement	313, 24; 399, 1; 400, 13; 958, 1; 968, 1; 1093, 16
87. χελιδών θαλάσσια (<i>chelidon thalassia</i>)	Flying gurnard	<i>Dactylopterus volitans</i> , Dactylopteridae		873, 23
88. χελώνη χερσαία (<i>chelone hersea</i>)	Mediterranean tortoise	<i>Testudo graeca</i> , Testudinidae	broth	191, 2; 352, 21; 913, 1
89. χελώνη θαλάσσια (<i>chelone thalassia</i>)	Green sea turtle	<i>Chelonia mydas</i> , Testudinidae	blood	823, 18
90. χλωρίων (<i>hlorion</i>)	Eurasian golden oriole	<i>Oriolus oriolus</i> , Oriolidae		683, 4
91. χήν (<i>hin</i>)	Greylag goose	<i>Anser anser</i> , Anatidae	fat, lard,	175, 29; 245, 5; 247, 10; 254, 10; 257, 15; 260, 8; 261, 12; 261, 13; 262, 8; 266, 2; 267, 21; 268, 10; 268, 5; 272, 9; 274, 18; 274, 28; 451, 11; 454, 2; 461, 6; 462, 15; 462, 7; 463, 11; 464, 16; 467, 18; 474, 2; 475, 4; 479, 12; 479, 16; 488, 15; 488, 4; 488, 9; 507, 16; 508, 20; 509, 3; 509, 4; 534, 16; 558, 16; 560, 12; 562, 13; 564, 21; 740, 5; 819, 23; 823, 10; 824, 4; 922, 11; 923, 6; 925, 3; 925, 7; 926, 12; 926, 21; 926, 3; 927, 13; 927, 16; 927, 4; 927, 8; 928, 7; 930, 15; 932, 2; 932, 20; 952, 17; 961, 13; 1088, 7; 1097,11; 1099,11; 1099, 7; 1116, 14; 1117, 12; 1117, 2; 1126, 9
92. χοίρος (<i>hiros</i>)	Domestic pig	<i>Sus scrofa domesticus</i> , Suidae	knuckle, fat, lard, meat	117, 7; 168, 5; 243, 25; 244, 10; 245, 5; 248, 4; 250, 14; 262, 18; 267, 4; 269, 24; 274, 18; 405, 19; 439, 3; 439, 6; 439, 9; 473, 10; 473, 15; 473, 18; 473, 22; 474, 11; 474, 3; 477, 22; 478, 18; 478, 2; 482, 26; 489, 6; 547, 21; 563, 19; 735, 11; 740, 18; 740, 5; 741, 19; 811, 8; 812, 4; 884, 4; 923, 16; 973, 19; 974, 8; 1101, 17; 1103, 16; 1112, 8
93. ψύλλα (<i>psylla</i>) ψύλλος (<i>psyllos</i>)	Flea	<i>Pulex irritans</i> , Siphonaptera		489, 17; 582, 15; 1111, 12

pigeon, ashes from swallow, hen egg (white and shell). In addition, bird feathers are recommended as a tool for applying topical preparations.

3.2. Cardiovascular system

Beneficial for the heart and the circulatory system are considered the following: meat and bone marrow from hen, cattle, pig and hare, musk, pheasant testicle, pork knuckle, ivory shavings and deer bones, marine molluscs (*Bolinus* spp.), red coral, ambergris or pearl, mixed with honey or wine (Valiakos, 2019). In addition, wine has a well-established use as a stimulant for the cardiovascular system or for the physical exhaustion (Ruckenbusch, 1982).

It is noteworthy, that Nikolaos Myrepsos along with the cardiovascular diseases mentions also sweating (*ἐφίδρωσις*), fainting (*λιποθυμία*) and heart pain (*καύσις καρδιάς*). In other parts of the text, Myrepsos considers fainting as a symptom of high fever and weakness of the body (Valiakos, 2019).

Heart attack has often been confused with heartburn by some medical authors (Bestetti et al., 2014; Gesualdo, 2016). This is because in both cases we have burning or pain in the chest. Thus, we read the term heart attack (*συγκοπὴ καρδιάς*) in parallel with heartburn (*καύσις*

καρδιάς) in Alexander of Tralles (Puschmann, 1879: II. 279.19-281.5) and Aetius of Amida (Olivieri, 1950: II. 117.17-21), who confuse heart disease with heartburn (stomach ache).

Among medicines of the cardiovascular diseases, in *Dynameron* there are references for soothing patches, incenses for fumigation (*θυμιάματα*), and large round pills (*trochisci*), that consist of calf, ambergris, coral, the shell of the mollusc *Bolinus* and ivory shavings.

Eggs and milk are suggested for the improvement of the blood circulation in the arteries and the balanced blood composition, while beneficial is also considered the intake of bone marrow from animals and birds, especially cattle, deer and hen, as well as fat from goat, cattle, lion, leopard, bear, hen, goose and pheasant.

3.3. Nervous system

In *Dynameron*, mostly cited disorders of this category are apoplexy, coma, lethargy, melancholy, depression, vertigo, muscular weakness, tremor, opisthotonus and mania. Headaches and migraines are treated with proper nutrition and secondarily with compresses. Chicken, and francolin meat, pork knuckle, milk and honey are suggested against chronic headaches and migraines. Compresses made with wool and wax

Table 2Animal parts quoted in Nikolaos Myrepsos' *Dynameron*.

No.	Names in <i>Dynameron</i>	Common name	
1.	αἰδοῖον	<i>aedoion</i>	Vulva
2.	ἀστράγαλος (χοίρειος)	<i>astragalos (xoireios)</i>	Pork knuckle
3.	δέρμα	<i>derma</i>	Leather
4.	κέλυφος	<i>kelyphos</i>	Shell
5.	κέρας, κεράτιον, κέρατον	<i>keras, keration, keraton</i>	Horn, cornus
6.	λέπι	<i>lepi</i>	Scale
7.	μαστός	<i>mastos</i>	Breast
8.	μυαλόν	<i>myalon</i>	Brain
9.	μυελός	<i>myelos</i>	Medulla
10.	ὄρχις	<i>orxis</i>	Testicle
11.	ὀστάριον, ὀστέον, ὀστούν	<i>ostarion, osteon, ostoun</i>	Bone
12.	ὀστράκιν, ὀστρακον	<i>ostrakin, ostrakon</i>	Seashell
13.	πετρόν	<i>pteron</i>	Feather
14.	πετερύγιον	<i>pterygion</i>	Fin
15.	σάρξ	<i>sarx</i>	Flesh
16.	σπλάγχνον	<i>splachnon</i>	Internal organ, offal

Table 3Animal by-products quoted in Nikolaos Myrepsos' *Dynameron*.

Nr.	Names in <i>Dynameron</i>	Common name	
1.	ἄφόδευμα	<i>aphodeuma</i>	Dung, feces, excrement
2.	βούτυρο	<i>boutyro</i>	Butter
3.	γάλα	<i>gala</i>	Milk, Lac
4.	γάρος	<i>garos</i>	Garum
5.	ἔριον	<i>erion</i>	Wool
6.	ζωμός	<i>zomos</i>	Broth
7.	κηρίον	<i>kerion</i>	Spermaceti wax
8.	κηρός	<i>keros</i>	Beeswax, Cera flava et alba
9.	κοπρία, κόπρος	<i>kopria, kopros</i>	Dung, feces, excrement
10.	κρέας	<i>kreas</i>	Carne, meat
11.	λέπος	<i>lepos</i>	Rind, husk, scale
12.	λίπος	<i>lipos</i>	Pinguis, crassus fat
13.	μέλι	<i>meli</i>	Honey, mel
14.	μελικηρίς	<i>melikeris</i>	Honeycomb
15.	μελικρατον	<i>melikraton</i>	Drink of honey and milk
16.	μετάξιμ	<i>metaxin</i>	Silk, seta
17.	οινόγαρον	<i>oinogaron</i>	Garum with wine
18.	οινόμελι	<i>oinomeli</i>	Drink from wine and honey
19.	οισυπηρός	<i>Oesyperos</i>	Containing lanoline
20.	ὄνθος	<i>onthos</i>	Dung
21.	ὄξουγγιον	<i>oxoungion</i>	Grease, axungia
22.	ὄξυμελι	<i>oxymeli</i>	Oxymel
23.	ὄξυμελικρατον	<i>oxymelikraton</i>	Drink from honey and water
24.	ὄξυγαρον	<i>oxygaron</i>	Garum with venigar
25.	ὄρος (γάλακτος)	<i>oros (galaktos)</i>	Whey
26.	οὔρα	<i>oura</i>	Urine
27.	πορφύρα	<i>porfyra</i>	Tyrian purple from <i>Bolinus brandaris</i> , fam Muricidae
28.	πρόπολις	<i>propolis</i>	Propolis
29.	σάρξ	<i>sarx</i>	Carne, meat
30.	τυρός	<i>tyros</i>	Cheese
31.	ὕδρογάλα	<i>hydrogala</i>	Drink of water and milk
32.	ὕδρογαρον	<i>hydrogaron</i>	Garum with water
33.	ὕδρομελι, ὕδρομελον	<i>hydromeli, hydromelon</i>	Mead
34.	χοιροσπέλεθος	<i>choirospelethos</i>	Dung of pig

are also recommended. Intake of hen meat is described also in earlier medical treatises, such as the ones by Galen (Kühn, 1827: XIII. 948.16-949-7) and Aetius of Amida (Olivieri, 1950: II. 284.2-7; Zervos, 1912: 330.25-27; 380.15-18).

For melancholy, honey and milk are recommended, while the patient should abstain from deer meat and certain fishes (mackerel, tuna, bonito

and anchovy).

Milk, honey and its derivatives, such as *apomeli* (the residue or honey of lower quality mixed with water), *oxymeli* (honey mixed with vinegar), *hydromeli* (mead: honey mixed with water), *oinomeli* (mulse: honey mixed with wine), as well as blood from goat, bear, wolf, duck or testicles from swallow and the body of the starfish are proposed as important ingredients in pharmaceutical preparations for those patients suffering from epilepsy and depression. Contrary, abstinence from deer and roe deer meat, as well from fish such as mackerel, tuna, bonito and anchovy is recommended. The reason for the fish abstinence is given by Galen, who points out that although mollusks and shellfish have soft and smooth flesh, they are harmful to the diet and they need special attention (Kalbfleisch, 1898: 21).

Broth from weasel with honey is frequently reported for the treatment of epilepsy. In cases of apoplexy, deer meat is recommended, as well as products from aquatic animals (intestines and flesh).

For almost all the aforementioned disorders, *Dynameron* proposes woolen compresses with extracts of meat and brain from hare, fat from duck and wax.

In recipes for the treatment of disorders of the nervous system, there are in parallel some references for drunkenness. One recipe proposes the consumption of cow and goat meat for the deterrence of drunkenness and its unpleasant symptoms. One other recipe refers specifically to the mixture of eel blood with wine, suggesting its intake for three days. Despite the medicines proposed in *Dynameron* for drunkenness, Myrepsos states clearly that vomiting remains the most effective treatment for excess drinking.

3.4. Arthritis and gout

Disorders pertaining to the spine and the bones of the upper and lower extremities usually refer to various types of arthritis. Those disorders were quite common and at least 14 Byzantine Emperors were suffering either from arthritis or gout (Lascaratos, 1995). This is the reason why all the medical treatises are referring either shortly or more extensively to those disorders (Gritzalis et al., 2011).

In *Dynameron*, the terms of arthritis and gout (*podagra*) usually refer to the upper and lower extremities, respectively. Moreover, sciatica and rheumatism refer to the spine. For their treatment, pharmaceutical preparations are recommended (e.g. beeswax salve), as well as nutritional guidelines (fat from goose, pig, goat and bull, as well as deer bone marrow). For the treatment of gout, it is recommended to prepare a compress of beeswax together with flesh of the fish *turpaena*.

The use of *turpaena* as a constituent of wax salves and compresses has also been reported by Paul of Aegina (Heiberg, 1924: II. 366.1-8) and Alexander of Tralles (Puschmann, 1879: II. 575.18-30).

Compresses or poultices containing goat dung, bird fat, sea urchin or brine from embalmed fish are also advised. Alternatively, a compress may be prepared with blood of mole rat and oil, while a variation contains also sea urchin. Another recipe recommends eating fat from lion, bear, bull, badger, ostrich, duck, goose, chicken, or deer bone marrow mixed with butter.

It is worth noticing that for the treatment of "rheumatism" (referring to back pain), a special diet is recommended, which excludes the meat of cow or sheep, because it "may raise the levels of *black bile* and *phlegm* in the body". This comment, together with several others in *Dynameron*, shows that the Hippocratic theory of humors is still present in medical treatises written during the 13th century.

3.5. Digestive system and abdomen

Nikolaos Myrepsos is also using animal products for the treatment of the disorders and diseases of the digestive system. For instance, he recommends the use of leeches for indigestion, diarrhea, ileus, parasitic worms (helminths), flatulence, colic, tenesmus and hemorrhoids. Some of the digestive symptoms recorded are attributed nowadays to various

pathological and psychological factors (Shah et al., 2014; Cao and Ding, 2019), such as anorexic and bulimic disorders. Moreover, disorders of the esophagus are reported including pain, for which the intake of burned swallow newborns mixed with honey, is recommended. In the same group, some infectious diseases are classified, which have signs and symptoms of the digestive system, including dysentery, lientery (the passage of undigested food in the feces), flatulence and cholera. The dung or milk of goat, intestines from pigeon or rooster, sea urchin, duck uterus and burned cicada, as well as deer heart and the mollusc *Bolinus* are suggested as remedies. Regarding this category, the treatment aims to the temporary alleviation of the patient's symptoms, but also to the prevention of transmitting the disease. Nikolaos Myrepsos mentions also disorders related with liver (cirrhosis, jaundice and dropsy) and the spleen, for which animal products, such as honey and eggs are used.

One ingredient which is suggested as a natural drug related to diet, is meat from pig or wild deer since they are considered very nutritious and pain relieving (Alves and Rosa, 2005). Regarding the aquatic animals, beneficial for the balanced function of the digestive system are considered many shellfish and crustaceans, including barnacle, crawfish and *garum* (juice of fermented fish) (Voultsiadou, 2010). Throughout the text of *Dynameron*, becomes clear that milk and butter are considered very important for the digestive system.

The use of pharmaceutical preparations, which contain animal products, varies according to the disease. Thus, for the treatment of colitis and constipation, pork knuckle, fish broth and milk boiled with gravel from the seabed are advised. The latter is also recommended as an antidote for poisoning. Regarding the parasitic worms (helminths), the preparation include smashed shells of shrimps and horns from deer. Moreover, bull bile and hedgehog with honey or honey mixed with wine from unripe grapes are proposed as emetic agents, as well as for patients suffering from cachexia. Concerning other pathological conditions of the abdomen, such as cirrhosis, splenomegaly and dropsy, broth from river frogs and compresses with fat, dung and bone marrow from terrestrial animals and birds are recommended. In addition, warm poultices made of wool and *garum* are recommended for the treatment of hernia.

Similar uses have been reported in earlier medical treatises. For example, aythya abdomen is recommended for improving digestion by Galen (Kühn, 1826: XII. 336.10-15), Oribasius (Raeder, 1928: I. 41.26-29), Aetius of Amida (Olivieri, 1935: I. 212.1-2), Kyranides (Kaimakis, 1976: 196.1-11), and also by Paul of Aegina (Heiberg, 1924: II. 226.19-24).

3.6. Urinary system

Disorders of the urinary system concern mainly dysuria (pain during urination), and strangury (difficulty in urination due to kidney and urinary bladder stones). Nikolaos Myrepsos reports over 155 recipes for kidney diseases, 110 recipes for dysuria and strangury, and 58 recipes for bladder stones. The 320 recipes on kidney diseases are scattered throughout the text and include patches, trochisci and recipes for diuresis, lithiasis, strangury and dysuria. Many different herbs are recommended for the treatment of kidney diseases (Valiakos, 2020b). Among the animal products that have been used, some of them are blood from goat, a snake quoted as *tyhodaemon* and river crabs, broth from snails, deer meat, wings and legs from cicada, with the addition of oil and wine. Broth from shellfish is considered highly beneficial for the treatment of kidney stones. In addition, goat milk, egg yolk and goose fat are recommended for kidney inflammations, while colostrum or blood of a male goat are suggested against dysuria (Ptinopoulou et al., 2020).

It is noteworthy that in *Dynameron*, as well as in other medical treatises (Pardalidis et al., 2008), there are superstitions regarding the treatment of diseases of the urinary system. Amulets, charms, holy oil and holy water are reported (Bennett, 2000), while uroscopy was part of the diagnostic procedure (Diamantopoulos, 1997).

3.7. Gynecological disorders

Gynecological problems included in *Dynameron*, concern fertility and contraception, management of normal labor, as well as uterine disorders.

For fertility, it is suggested that conception may be facilitated by the consumption of snails, milk from cow and donkey, meat and blood from hare, as well as snails, shells and goose fat. It is noteworthy that the brain of sparrow, the rennet of hare and the bile of pig are remedies with a very high frequency of use for fertility. Myrepsos recommends their intravaginal application for 2 h, either as smears or as pessaries on top of wool. An intercourse immediately after that increases the possibility of a woman to become pregnant.

For contraception, *garum* with wine and external genitals of female hare are recommended.

The reported gynecological disorders in *Dynameron*, are pain, inflammation, haemorrhage, ulcers and nomas of the vagina, genital warts and pelvic abscesses. The treatise contains also information on spontaneous abortion, solid tumors of the uterus, uterine prolapse, lateral inclination of the uterus, obstruction of the uterine cervix, nymphomania and stretch marks. These ailments are treated with a variety of remedies, including animal products, such as honey and wax, and poultices or compresses with sheep wool or sea sponge and a variety of ingredients such as oxymel, eggs, fat, bone marrow, shellfish, sea urchin, snails, birds, goat and cow. Moreover, there are extensive references to uterine cancer, for the treatment of which Myrepsos proposes deer bone marrow, goose fat or hare rennet (Valiakos, 2019).

According to Bell (2010), pre-eclampsia and eclampsia cannot be identified in medical treatises during the late Byzantine period. This holds true, also in the case of *Dynameron*.

3.8. Dermatological diseases

For the treatment of skin lesions, *Dynameron* contains several recipes for topical application or for oral intake. There is a plethora of reported dermatological disorders. Some are considered genuine dermatologic disorders, such as sycosis, erysipelas, herpes, papilloma, vitiligo, dull-white leprosy, alopecia, ophiasis (a form of alopecia areata), pustule, furuncle, abscess, anthrax, chilblain, psoriasis and stretch marks. Treatment includes bile from falcon, partridge, rooster, hyena, wolf, male goat, griffon or parrotfish mixed with honey. Especially, smearing of the head scalp with a mixture of sea urchin with olive oil or wine is reported multiple times in *Dynameron*. The use of sea urchin is also proposed by Galen (Kühn, 1826: XII. 417.2), while there are also references in *Kyranides* (Kaimakis, 1976: 256.1-7). However, Aelius Promotus (Crismani, 2002: 48.3), Aetius of Amida (Olivieri, 1935: I. 215.20-216.20), and Alexander of Tralles (Puschmann, 1878: I. 443.26-7) are suggesting the use of the hedgehog. Other dermatological disorders mentioned in *Dynameron* are symptoms of systemic diseases, which are manifested also in the skin, such as diaphoresis, inguinal abscesses, elephantiasis, scab like and purulent skin alterations, leprosy, scrofula (mycobacterial cervical lymphadenitis). Skin damages due to injury and stings consist one more group of dermatologic disorders (Alves and Policarpo, 2018). Animal products, such as broth from cat, the ash of asp viper, fat from cattle, burnt newborn swallows or sea urchins and shells mixed with honey or butter, are proposed for the treatment of all the above-mentioned skin disorders. In addition, the intake of a pill or a small bread containing viper is suggested.

The pharmaceutical preparations recommended for dermatological disorders occupy a large part of the total recipes, including guidelines for the preparation of ointments, poultices with dung or milk from goat, cow, fat from goat and bull, as well as wax, oil and wine, which are used in case of elephantiasis and erysipelas, for the treatment of burns and snake bites, as well as ointments and compresses for injuries and other pathological conditions of the skin. Important ingredients are regarded the egg white and bone marrow from cattle and deer. Therapeutic

ointments and poultices for injuries and inflammations of the skin contain wax, butter, fat from bear, pig and goose, deer meat and bone marrow, droppings from hen and dove, feathers from birds and fish flesh. Compresses with honey and intake of water and milk solutions are suggested for skin rash, while butter and bear fat are recommended for alopecia, and inguinal abscesses.

Nikolaos Myrepsos believes that rays possess healing properties for the treatment of abscess, dull-white leprosy, sycosis and injuries from sharp objects and thorns. In addition, broth from these aquatic animals is recommended as an antidote to the venom of snakes. The intake of shellfish gruel for the treatment of abscesses and bites is reported in the other medical texts, such as in *Kyranides* (Kaimakis, 1976: 264.1-4), as well by other medical writers such as Aetius of Amida (Zervos, 1905: 284.12-14), Dioscorides (Wellmann, 1907: I. 121.11-14; 126.7-14) and Oribasius (Raeder, 1933: II. 292.25-293.34).

Moreover, rennet from hare and liver from pig together with honey, fat or wax are also suggested as poison antidotes; compresses with fat and bone marrow from deer, donkey fat, bile from ox or goat for the treatment of skin carcinoma (Voultsiadou, 2010) and melanoma and *nomas*, an infection of the mouth or external genitals; while for the treatment of inflammations of the feet caused by shoes, poultices from pig, goat or sheep lungs are recommended. Dung from goat, fat from cow, goose or hen and deer bone marrow, are used as ingredients for ointments and poultices for psoriasis, scabies and rheumatism. For leprosy, eggs and honey are suggested. Poultices made with wax, honey, fat and horn shavings are recommended for almost all disorders of the skin and nails of the upper and lower extremities.

3.9. Disorders of the eyes

In ophthalmology, pharmaceutical preparations are difficult to develop, because of the complex anatomy and physiology of the eye (Awwad et al., 2017).

In *Dynameron*, the following disorders of the eyes are treated with animal products: amblyopia, glaucoma, xanthelasma, loss of corneal transparency, pterygium, nyctalopia, staphyloma, trachoma, eyelash loss, xerophthalmia, cataract, ectropion, entropion, pimples, inflammation of the corners of the eyelids, inflammation of the eyelids, ulcers, scars.

The pharmaceutical preparations being used are collyria, spreads, patches, powders, granules and poultices. Although mostly herbal medicines are quoted as collyria, also several animal products are applied, such as milk, honey, egg, liver, fat, broth and flesh from terrestrial animals or fish by adding honey or omphacomele (Table 1). More specifically, one recipe describes the soaking of the herbal ingredients with goat milk, while other recipes report the use of deer horn, cuttlefish bone or blood from white pigeon. Another collyrium preparation describes the use of the bile from: crow, partridge, white rooster, golden oriole, vulture, male goat, hyaena, female wolf and parrotfish. The use of bile for the treatment of eye disorders can also be found in the *Dynameron* of Aelius Promotus (Crismani, 2002: 196.16-20), in *Hippiatrika* (Oder and Hoppe, 1927: II. 257.5-23) as well as in *Kyranides* (Kaimakis, 1976: 175.27-33).

It is also noted in Nikolaos Myrepsos, that the blood and liver from bat, or human milk with goat bile, or pigeon blood, or blood from a child's finger, or milk from a woman having a male child treat eye diseases.

The animal products which are being used for the preparation of ointments, patches, beeswax salve, suppositories and poultices for the eyes are: wool, fat, milk, honey and propolis. The recipes describe the preparation of three patches made of wool and hyssop extract, which are meant to treat patients with chronic inflammation of the corners of the eyes and with loss of the eyelashes. Aetius of Amida describes an identical recipe for an eye patch (Olivieri, 1935: I. 195.26-196.25), for the origin of which he acknowledges Dioscorides.

In a spread, it is recommended to mix together with some plants and

mineral materials, the eyes of the land frog as well as a sea animal called "sea wool" (*ἔριον τῆς θαλάσσης*), probably meaning the tube anemone, an anthozoon common in the Mediterranean sea.

Rarely, in other spreads or compresses for the eyes is reported the use of dung from mammals, such as mouse or goat. Even less common is the use of the flesh of the Noah's Ark shell (*θαλασσία ἄρκα*), or the use of the flesh of sea snail.

It is noteworthy, that in many recipes that aim at the complexion, it is recommended that the physician should pay extra attention in order to avoid any contact with the eyes, because of the toxicity of the ingredients. In these cases, it is suggested to keep the eyes tightly shut, in order to prevent any harm (Valiakos, 2019).

3.10. Disorders of the ears

The Byzantine era and the modern age share many similarities regarding the disorders of the ears. The most important disorders that required medical attention was hearing loss, purulent otitis, rupture of the eardrum and ear malignancies (Ramoutsaki et al., 2002).

For the treatment of these disorders in *Dynameron*, the use of patches, suppositories, poultices, and beeswax salve is suggested. For earache, the usual animal materials are wool and fat from pig, goose, chicken, bear or fox. Rinsing of the ear canal is usually performed with lukewarm water, olive oil, carp oil, or fat from pig, goose, chicken and fox. Some recipes recommend the use of sheep bile, donkey milk or cooked worms. Sheep wool and sometimes lanoline is mentioned to be placed in the ear canal after instillation of oils of various plant extracts, hot vinegar or melted butter. Aelius Promotus (Crismani, 2002: 166.3-27), Galen (Kühn, 1826: XII. 659.13-660.18) Oribasius (Raeder, 1929: I. 218.1-6) and Alexander of Tralles (Puschmann, 1879: II. 85.19-28) use the same ingredients in their ear recipes, while Symeon Seth recommends a mixture with crane bile (Langkavel, 1893: 30.15-31.6).

According to *Dynameron*, the ear pain disappears after three days when the bile of fish, partridge or hedgehog is instilled into the ear canal. Emphasis is given to recipes containing goose or fox fat, with the belief that the patient can be cured within three to five days. As a matter of fact, it is suggested that the physician should be paid in advance. In severe cases, such as neoplasias or injuries, it is recommended that treatment of the ear pain should exceed the ten days.

Apart from earache, several other disorders are also mentioned: hyperacusis, dysphonia, deafness, persistent inflammations, ulcers, bleeding, pimples and pustules with stench. For these disorders, is recommended the use of goat urine, as well as goat or bear bile with the addition of vinegar.

3.11. Ailments of the oral cavity

Dynameron contains references to disorders of the palate, ozostomia and toothache. In cases of toothache, are recommended butter, pigeon droppings with propolis, or honey with lard. For the pain of teething, butter and fat from fox or bear, or fox lung, or cat feces are proposed. The intake of fat from goat or goose, as well as brain from cow and deer are recommended for the treatment of lip dryness. Inflammations of the oral cavity are treated with honey, eggs and garum. Similar references can be found in Aelius Promotus (Crismani, 2002: 170.29-30), Galen (Kühn, 1826: XII. 873.14-17, 1827: XII. 309.8), Oribasius (Raeder, 1926: 458.16-19), Paul of Aegina (Heiberg, 1921: I. 198.7-201.5) and Aetius of Amida (Olivieri, 1935: I. 209.16-27, 1950: II. 429.19-430.10).

Laryngitis with *aphonia* and pharyngitis with sore throat, are treated with sublingual tablets made from horn or bone marrow of deer and pigeon droppings. Another recipe proposes as ingredients the shell from the mollusc *Bolinus*, bone from elephant, silk and coral. For the treatment of oral cancer, the use of powder made from burnt snail shells and cuttlefish bone with the addition of wine is suggested. Myrepsos mentions that wine should be firstly applied in the area, which should be then wrapped with a cloth. The cloth should be wrapped around the

finger and the mixture should be applied on the carcinoma. Similar reports on the use of animal products for the treatment of diseases of the oral cavity can be found in earlier texts, the oldest being that of the Egyptian papyrus of Ebers (Boulos, 1986), while extensive descriptions were made by the Greek physicians Hippocrates, Erasistratus, Archigenes and Galen (Inchingolo et al., 2020).

4. Discussion

Animal products seem to play an important role in the medical practices described in the treatise of Nikolaos Myrepsos, where they are often used as ingredients in recipes referring to a wide variety of ailments.

In *Dynameron*, there are 93 references on the use of remedies of animal origin. In several cases, specific organs of an animal are recommended, including 16 anatomical parts of various animals. In addition, 34 animal by-products are recorded, such as milk and honey.

Many recipes depicted by Nikolaos Myrepsos are found in previous medical texts, extending back to the classical antiquity, the Hellenistic period and the early Byzantine era.

The frequent use of animal products also in earlier Byzantine medical texts, although not always designated with accuracy, reflects a continuation of the Hippocratic principles on dietetics and their role in good health (De Vos, 2010; Rzeznicka, 2016; Merianos, 2014).

According to the therapeutic guidelines of *Dynameron*, meat, fat, blood and sometimes mammalian manure seem to play an important role in the drug-making process, especially in patches, plasters, ointments and poultices. On the other hand, the consumption of meat, lard, or broth of birds seems to be very important and unquestionable, showing a long-lasting confidence in their therapeutic value.

In accordance, many recipes contain flesh of specific birds, based on empiric knowledge pertaining to alleged or real properties.

Fishes and other aquatic animals are frequently reported ingredients of the recipes or dietary patterns.

Some animal by-products, such as honey, butter, milk, eggs and fat, are included in recipes and they are intended for virtually all types of diseases. Especially milk and butter have an ancient history and accompanied humans from times immemorial (Caramia et al., 2012). The application of dairy products for extra nutritional uses, such as cosmetics, ceremonial and healing rituals are also well known. Regarding honey, it was also very popular, especially in ancient Egypt and Greece. In Hippocratic medicine, a simple diet based on honey is given as hydromel (water and honey) for thirst, a mixture of honey, water and various medicinal substances for acute fevers, and oxymel (vinegar and honey) for pain and persistent coughs (Eteraf-Oskoue and Najafi, 2013; Johnston and Gaas, 2006).

In some instances, animal organs are apparently incorporated into a recipe in accordance with the principle of the “influence of the similar”. Typical examples are the use of deer vulva or the tail of a skink in remedies intended to improve the sexual intercourse of a couple and to facilitate conception.

Here we must mention that in medical treatises, sometimes, the properties attributed to ingredients cannot always be given a strictly scientific interpretation. In some cases, it is also clear that we are dealing with beliefs and superstitions related to symbolic or magical practices. In *Dynameron*, especially we have found only five, prescription cases, pertaining to preventions. They are exorcisms advocated for stopping nose (Valiakos, 2019: 180.8-19), uterine bleeding (Valiakos, 2019: 180.21-181.11), for the treatment of hemorrhoids (Valiakos, 2019: 512.22-513.12), and two to extract a herringbone stuck to the throat (Valiakos, 2019: 911.3-9; 911.10-13).

Myrepsos also recommended animal feces as excipients for the preparation of poultices. Such disgusting ingredients are mentioned in the pharmaceutical arsenal already in antiquity, but in the Byzantine era their use seems to be more and more frequent (Harris, 2020).

In Nikolaos Myrepsos' *Dynameron*, references to small domestic

animals, such as cat (αἴλουρος, κᾰτος) or weasel (γαλιῆ) are few. However, it is the first book to simultaneously address these concepts, which have often confused researchers (Table 1). It is worth noticing that *cat* is written by Myrepsos either as αἴλουρος (a word used in antiquity) or as κᾰτος (a word used in the Byzantine era). This shows that the author has used sources from different eras, for writing the treatise *Dynameron*.

5. Conclusions

The present study demonstrated the use of animals and animal products in the therapeutic recipes of *Dynameron* follows a long-lasting tradition since antiquity. Of the 2667 quoted recipes, 344 recipes contain medicines of animal origin, which can be detected in totally 769 citations. In addition, 626 citations for animal by-products are found in 268 recipes. Honey and milk are mentioned in 2136 recipes, mostly as excipients. On many occasions, dietary instructions are present, reflecting the attitude for a healthy everyday life, similar to the modern beliefs about food as an essential factor for good health. The extensive references to animal products and their applications in the treatment of several diseases provide useful information for the everyday medical practice in late Byzantium.

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