



Contents lists available at ScienceDirect

Saudi Journal of Biological Sciences

journal homepage: www.sciencedirect.com

Review

Traditional ancient Egyptian medicine: A review

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ARTICLE INFO

Article history:

Received 25 March 2021

Revised 6 June 2021

Accepted 13 June 2021

Available online 19 June 2021

Keywords:

The ancient Egyptians

Traditional medicine

Egyptian medicine

ABSTRACT

The ancient Egyptians practiced medicine with highly professional methods. They had advanced knowledge of anatomy and surgery. Also, they treated a lot of diseases including dental, gynecological, gastrointestinal, and urinary disorders. They could diagnose diabetes and cancer. The used therapeutics extended from different plants to include several animal products and minerals. Some of these plants are still used in the present day. Fortunately, they documented their life details by carving on stone, clay, or papyrus. Although a lot of these records have been lost or destroyed, the surviving documents represent a huge source of knowledge in different scientific aspects including medicine. This review article is an attempt to understand some information about traditional medicine in ancient Egypt, we will look closely at some basics, sources of information of Egyptian medicine in addition to common treated diseases and therapeutics in this great civilization.

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Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

<https://doi.org/10.1016/j.sjbs.2021.06.044>

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1. Introduction

According to WHO traditional medicine can be defined to be the sum of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether used in health maintenance as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illness (WHO, 2018).

The Egyptian civilization extended for centuries along the sides of the Nile River in the place which is now the country Egypt as one of the greatest and oldest civilizations in the history of humankind, it was renowned for its remarkable achievements in several fields including arts, science, and medicine (Kemp, 2007). Ancient Egypt (3300BCE to 525BCE) is where the first dawn of modern medical care has been found, including bone setting, dentistry, simple surgery, and the use of different sets of medicinal pharmacopeias (Nunn, 2002). The first mention of a physician in history is back to 3533BCE, at that time it was documented that Sekhet'enanch, chief physician healed the Pharaoh Sahura of the fifth dynasty from a disease in his nostrils (Withington, 1894). Documentation of the use of malachite in ancient Egypt as an eye paint and treatment around 4000BCE has been found (Žuškin et al., 2008). Imhotep (2780BCE) was the most famous of early Egyptian physicians, Imhotep was the chief vizier to the pharaoh Zoser, who was the first king of the Third Dynasty of the Old Kingdom. Additionally, he was known as the engineer of the step pyramid at Sakkara (Cormack, 1965). Some pictures carved on the door-posts of a tomb in Memphis may be considered as the earliest known pictures of surgical operations (2500B. C.) (Garrison, 1921).

Herodotus (The father of History), about 450BCE, wrote about Egyptians: 'The practice of medicine is so divided among them, that each physician is a healer of one disease and no more. All the country is full of physicians, some of the eye, some of the teeth, some of what pertains to the belly, and some of the hidden diseases' (Todd, 1921b).

2. Some basic concepts about traditional ancient Egyptian medicine

Ancient Egyptians did not have a clear dichotomy between both medicine and magic, they considered health and illness resulted from a person's relationship with the universe including people, animals, good and bad spirits (Zucconi, 2007).

The basic concept of health and disease according to the Ebers Papyrus is that the body has twenty-two *mtw* (vessels) which connect the body carrying various substances such as blood, air, semen, mucus, and tears. These *mtw* (vessels) are linked up at some junctures, controlled by the heart, and opened to the outside from several points like an anus. Egyptian healers should determine the condition of *mtw*-vessels by examination of the patient's pulse. The balance (*maat*) of this movement is vital for human health just like the balance of the Nile flooding and irrigating is vital for Egypt. If the *mtw*-vessels were blocked by foreign or noxious matters (*wekhedu*), the disease takes place. These matters may enter the patient's body through wounds or natural openings (Veiga, 2009; Zucconi, 2007).

Medical practice was rigidly prescribed by the Hermetic Books of Thoth, and if a patient died as a result of a deviation from this

strict line of treatment, it was regarded as a capital crime, if the patient didn't improve after four days of treatment, physicians were allowed to modify the treatment (Garrison, 1921). There was a hierarchy of medical profession starting with the 'swnw' (ordinary doctor); 'imyrswnw' (overseer of doctors); 'wrswnw' (chief of doctors); 'smsw swnw' (eldest of doctors); and 'shd swnw' (inspector of doctors) (Reeves, 1992; Sullivan, 1995), there is also evidence proved the existence of women physicians (Willerson and Teaff, 1996a).

Ancient Egyptians got a surprising knowledge about anatomy, a lot of diseases of the osseous, alimentary, respiratory, circulatory, genital, muscular, nervous, ocular, auditory, and olfactory systems were described in details, They identified the function of the heart, and its relation to the two types of blood vessels, in addition, cerebrospinal fluid was known to them too (El-Assal, 1972). They wrongly thought that the heart was the center for all body fluids including urine and tears (Ja, 1962).

The surgery in ancient Egyptian was so advanced, surgeons used various instruments similar to what we using today such as the scalpel, forceps, and scissors, splints were made of reeds tied together by strips of linen or pieces of wood padded with plant fibers (Reeves, 1992; Saber, 2010). They sutured wounds, stopped bleeding using cautery (Reeves, 1992; Saber, 2010). Boils, abscesses, and septic wounds were opened surgically and drained by pieces of linen, and poultices were used as well (Sipos et al., 2004; Todd, 1921a). A dislocated shoulder was treated in a similar way to the Kocher method, also a dislocated mandible was reduced by the method used today (Sullivan, 1996). The plaster used for fractures consisted of linen soaked in a sticky material which hardened, They made circumcision a lot and there are some reports documented a surgical treatment of a hernia (Ja, 1962; Saber, 2010).

They knew psychology; Diodorus reported that it was written over the library of the Ramesseum "Healing Place of the Soul". The patient suggested to write his troubles in a letter to dead relatives (catharsis), also there were some specialists in dream interpretation (El-Assal, 1972). In most cases, doctors prescribe a remedy of different drugs, not a single drug. The routes of drug administration were basically five; oral, rectal, vaginal, topical, and fumigation. Treatments were given in different forms like; pills, cakes, ointments, eye drops, gargles, suppositories, fumigations, and baths (Bryan, 1930).

3. Ancient Egyptian medical papyri

Pharaohs documented day after day events using hieroglyphic language by carving on walls of temples, stones, clay, or papyri (Baines, 1983). The translation of the Rosetta stone in 1822, gave an excellent chance to translate several ancient Egyptian papyri including medical papyri (Parkinson et al., 1999). The language which was used for writing on papyri is mostly the hieratic, which was written from the right side to left, using red ink for the headings and black ink for the bulk. Papyrus made from *Cyperus papyrus* by split interweaving, pounding in water, and drying to form brownish sheets then being written with brush and ink, and finally glued at edges, making a roll (Baines, 1983).

The ancient Egyptian medical papyri documented several details about the way by which they practiced medicine. The

Table 1
Chief Medical Papyri of ancient Egypt.

| Name | Date of copy | Date found | Place found | Location | Content | Ref. |
|-------------------------------|--------------|-------------------|---------------------------------|------------------|---|---|
| Kahun papyrus | 1825BCE | 1889 | Kahun, near the Fayoum oasis | London, UK | Gynecological diseases | (Griffith and Petrie, 1898; Leake, 1952) |
| Edwin Smith papyrus | 1600BCE | 1862 | Thebes | New York, USA | Medicinal encyclopedia and pharmacopeia | (Stiefel et al., 2006) |
| Ebers papyrus | 1550BCE | 1873 | Thebes | Leipzig, Germany | Ophthalmology, GIT, head, the skin, and urinary tract | (Bryan, 1930) |
| Hearst papyrus | 1550BCE | Published in 1912 | Deir el-Ballas, south Dendera | Berkeley | Practitioner's recipe book | (Reisner, 1905a) |
| Erman papyrus | 1550BCE | 1886 | Thebes | Berlin, Germany | Childbirth and infants care | (Leake, 1952) |
| London papyrus | 1300BCE | 1860 | Thebes | London, UK | 61 recipes, 25 of which are medical and 36 are magical | (Nunn, 2002) |
| Berlin papyrus | 1350BCE | Published in 1909 | Saqqara | Berlin, Germany | Childbirth and infants, heart description and vessels anatomy | (Leake, 1952; Willerson and Teaff, 1996b) |
| Chester Beatty papyrus | 1200BCE | 1928 | Deir el-Medina (Western Thebes) | London, UK | Formulary for anal diseases | (Reeves, 1992) |

papyri describe in-depth the diseases, how to diagnose, and different remedies that were used to treat. These remedies included herbal remedies, sometimes surgery, and even magical spells. (Leake, 1952). Starting from the Middle Kingdom, about 1800 to 300BCE, the remains of more than 40 papyri describing the medical procedures that used to treat various illnesses have explored (Pommerening, 2012).

Most of our knowledge of ancient Egyptian traditional medicine was originated from the ancient Egyptian medical papyri includes Ebers papyrus, Edwin Smith papyrus, Kahun Papyrus, Ramessesum medical papyrus, Hearst papyrus, London Medical Papyrus, Brugsch Papyrus, Carlsberg papyrus, Chester Beatty Medical Papyrus, Brooklyn Papyrus, Erman Papyrus, and Leiden Papyrus, the most important eight papyri are listed in table 1.

4. Kahun gynecological papyrus

The text contains 34 sections that deal with gynecology, contraception, and conception techniques (Haimov-Kochman et al., 2005). All of the treatments in the Kahun Papyrus are non-surgical, varied, and interesting including fumigation, massage, and medicines introduced into the body in the form of pessaries or as a liquid to be drunk or rubbed on the skin. Eyes and the womb are, for some reason, closely linked in ancient Egyptian health and medicine (Stevens, 1975). The papyrus discusses each case as the following; a brief description of the symptoms, then the physician is advised how to tell the patient her diagnosis and, finally, treatment is suggested (Smith, 2011). In order to prevent pregnancy (conception), the papyrus recommends excrement (not identified for sure) of crocodile dispersed in honey or sour milk with a pinch of natron (sodium carbonate decahydrate) and injected into the vagina (Griffith and Petrie, 1898; Reeves, 1992).

5. The Edwin Smith papyrus

This papyrus was named after the man who purchased it in 1862 from a dealer. It is a very old medical text dating back to 1600BCE, it's about surgical trauma discussing 62 diseases and surgery cases, just fourteen cases with known treatments, maybe because other cases are chronic diseases difficult to treat or even unknown (Veiga, 2009). It has seventeen pages documenting head, neck, and arms injuries in addition to detailing a diagnosis, prognosis, and cause of the trauma (van Middendorp et al., 2010). The treatments included the closure of wounds using sutures, prevent and treat infection with honey and stop bleeding using raw meat. The papyrus recommends immobilizing the head and neck

in the case of its injuries in addition to some detailed anatomical observations (Brandt-Rauf and Brandt-Rauf, 1987; Breasted, 1930). Six cases of spinal injuries were documented in the papyrus, diagnosed with a specific description of symptoms in addition to the clear description for the treatment of three cases of them (van Middendorp et al., 2010).

6. The Ebers papyrus

The famous Ebers Papyrus has been written in 1550BCE using 328 different ingredients (most of them are derived from plant species) to make 876 prescriptions (Bryan, 1930). It's the longest medical papyrus (68 feet in length and 12 in. in width) and the most complete surviving one, being an encyclopedia of medicine discussing details of a huge number of prescriptions and treatments for a wide variety of diseases that were in vogue among Egyptians of the eighteenth dynasty (c. 1630–1350BCE) including helminthiasis, ophthalmology, dermatology, gynecology, obstetrics, dentistry, and surgery. There is a short section on psychiatry, describing a “despondency” which may be similar to depression in our concept, besides, more than 700 magical formulas were described (Subbarayappa, 2001).

7. The Hearst medical papyrus

The Hearst Papyrus, found in a house made of mud-brick in a provincial town, it's thought to be a reference for a local physician, and, less carefully organized than Ebers, seems to have been made for this very purpose. The Hearst papyrus contains several remedies including; six remedies related to purging, eight remedies relating to teeth and bones, seven remedies relating to pains, eleven remedies relating to digestion, ten remedies relating to the urinary organs, seven remedies related to head diseases, thirty remedies relating to the vessels, eight remedies relating to the blood, thirteen remedies relating to the hair, the skin, thirty-six remedies relating to fingers and toes, eighteen remedies relating to broken bones, seven or more remedies concerning bites in addition to two incantations and twelve remedies against unidentified diseases (Bryan, 1930; Leake, 1952).

8. The Berlin papyrus

It was discovered in a jar by Heinrich Brugsch during excavations at Saqqara in the early twentieth century. It consists of 279 lines of prescriptions and is housed in the Berlin Museum. The Berlin Papyrus discusses a pregnancy test; the woman has to moisten

barley and emmer with her urine every day ... if grow, she will give birth. If the barley grows, she will get a boy child. If the emmer grows, she will get a girl child. If neither grows, she will not get a birth (Reeves, 1992).

9. Diseases

There is a lot of prescriptions for the management of different urinary disorders such as; hematuria, urine retention, urine frequency, infection, and dropsy have been mentioned in medical papyri (Salem and Eknayan, 1999). The ancient Egyptian physicians were aware of a variety of cardiac diseases, including arrhythmia, aneurysm, congestive heart failure, and venous insufficiency (Saba et al., 2006; Willerson and Teaff, 1996a).

Ancient Egyptians treated different dental problems including dental caries, mouth ulcers, teeth extraction, pyorrhea, abscesses, calculus formation, gums inflammation, jawbone, and jaw dislocation, all such data found in the Edwin Smith and Ebers Papyri (Leek, 1967). Furthermore, they performed dental surgeries, where surgically produced holes used to an abscess drain under the 1st molar were found in the mandible of a 4th dynasty mummy around (2625–2510BCE) (Harbort et al., 2008). Amazingly, it was discovered that a mummy had two teeth, a lower third and a lower second molar joined together by a golden wire piece woven around the gingival margins, Professor Euler who examined that discovery confirmed that this dental work has been performed in the mouth before death (Puech et al., 1983).

The first known medical reference to diabetes mellitus was the Ebers Papyrus containing the following description: “*to eliminate urine which is too plentiful.*” the condition described was polyuria (increased Urine volume) which refers mainly to diabetes (Ahmed, 2002; Loriaux, 2006)."

The first written description of cancer was reported in the Edwin Smith Papyrus, it was for a breast cancer case and described as “*bulging tumor of the breast was a grave disease and there was no treatment for it*” (Breasted, 1930; Hajdu, 2011). In the Ebers Papyrus, several tumors have been described such as; enlarged thyroids, polyps, and tumors of the pharynx, skin, stomach, rectum, and uterus (Hajdu, 2004; Weiss, 2000; Withington, 1894). Some reports indicated the usage of different types of treatments for cancer such as cautery, knife, or salts of lead and sulfur or arsenic paste (Hajdu, 2011; Riordan, 1949).

10. Therapeutics in traditional ancient Egyptian medicine

Humans relied on nature as the main source of treatments since the dawn of history. In order to fulfill this need, he used different sources such as plants (Han et al., 2019; Metwaly et al., 2019; Wang et al., 2019), marines (El-Demerdash et al., 2021; Sperstad et al., 2011), and microbes (Metwaly, 2019; Metwaly et al., 2014a; Metwaly et al., 2017). Similarly, the ancient Egyptian pharmacopeia comprised a wide diversity of treatments, these treatments include minerals, metals, animals, and plant sources. The range of plants used by ancient Egyptians was very wide, they have used the whole plant, or its fruit, leaves, juice, or root (Ja, 1962). The mentioned plants belonged to different species such as; acacia, anise, barley, cassia, castor bean, coriander, cucumber, cumin, date, fennel, fig, mulberry, garlic, gourd, juniper, leek, lettuce, lotus, peas, poppy seeds, saffron, sunflower, styrax, terebinth, wheat, willow buds, white thistle, and wormwood. Plants contain wide range of bioactive secondary compounds that belong to vast diverse of chemical classes such as saponins (Mostafa et al., 2016; Sharaf et al., 2021; Yassin et al., 2017), diterpenes (Zhanzhaxina et al., 2021), sesquiterpenes (Jalmakhanbetova et al., 2021a; Jalmakhanbetova et al., 2021b), pyrones (Metwaly et al., 2014b),

isochromenes (Metwaly et al., 2014c), flavonoids (Ghoneim et al., 2019; Liu et al., 2020; Mostafa et al., 2014), isoflavonoids (Alesawy et al., 2021), and alkaloids (Metwaly et al., 2015). Some of the extensively used plants in ancient Egypt in addition to their major bioactive compounds and uses have been summarized in table 2.

11. Minerals and metals

Minerals and metals in the Egyptian pharmacopeia included antimony, alum, carbon from charred wood, copper, feldspar, iron oxide, limestone, red ochre, sodium carbonate, sodium bicarbonate, salt, stibnite, sulphur, and possibly arsenical compounds (Leake, 1952). These remedies are usually recommended for local mild astringent or antiseptic action in cases of boils, felons, and burns. Antimony sulphide Given by mouth for bilharziasis Sulphur For scabies, calamine for its soothing effect, yellow ochre hydrated oxide of iron, used in the anemia of ankylostoma, red ochre natural oxide of iron, to combat hemorrhage, green copper ore against eye inflammation (El-Assal, 1972). Some minerals possessed strong color and used for cosmetic use such as antimony and lead sulfides were used to produce the black paints used for beautifying men's and women's eyes, also the green color in eye make-up mainly produced by malachite. Also, chrysocolla and copper silicate, which is a lovely blue-green, was used (Smith, 2011).

Natron was used a lot as a cleansing product in addition to using for household cleansing, Kahun papyrus mentioned that natron can be used also for contraception, namely: “*honey, sprinkle over her womb, this to be done on a natron bed*” (Smith, 2011). Nubian ochre was used in an antidiabetic remedy and to fix a loose tooth (Carpenter et al., 2006; Leek, 1967).

12. Animal sources

Many different types of drugs from animal sources are recommended in the medical papyri, Fat and grease from different animals are mentioned in various prescriptions, sometimes for internal use and other times topically as a treatment or as a base in the formation of ointments. Goose-fat was a part of a remedy used orally to remove pain and is also used externally for relaxation (Veiga, 2009).

Different forms of animal-derived drugs have been described; animal products such as; urine, eggs, feces, or milk in addition to animal structural components such as blood, bone, meat, bone marrow, bile, liver, spleen, and skin were used also. The liver (which is rich in vitamin A) was described to prevent grey hair and to treat night blindness (El-Assal, 1972). There was a wide range of animals from which animal constituents were obtained, including cow, goose, donkey, man, cat, pig, mouse, goat, sheep, bat, hippopotamus, antelope, dog, insect, ostrich, pigeon, pelican, raven, frog, lizard, snake, tortoise and crocodile, animal sources are included invertebrates (beetles and worms) and fish (Ja, 1962).

Different products have been used as vehicles; some of them have strong curative properties such as bee's wax which was extensively recommended for use as a vehicle or binding material in various ointments or preparations for applications to the skin or wounds. Honey is a vital constituent in about five hundred prescriptions and remedies; it was used for its efficacy, also as a vehicle. Honey was the most commonly used agent in the Hearst document (Reeves, 1992) and was used as anti-cough, anti-diarrheal, wound healing, antiseptic, fix a loose tooth, and for toothache (Aboelsoud, 2010a; Leek, 1967; Sipos et al., 2004). Several other foodstuffs are included as vehicles to such as; beer, wine, milk, and water (Leake, 1952).

Table 2
some plants used in traditional ancient Egyptian medicine.

| Drug name | Major bioactive compounds | Ref. | Traditional use in ancient Egypt | Ref. |
|--|--|---------------------------------|---|---|
| <i>Abies Cilicia</i> (Pinaceae) | Resin and oils | (Dayisoylu and Alma, 2009) | Antiseptic and an embalming material promotes hair growth | (Amin, 2003; Reeves, 1992) |
| <i>Acacia nilotica</i> (Fabaceae) | Tannins, flavonoids, alkaloids, fatty acids, and polysaccharides (gums) | (Rather and Mohammad, 2015) | Vermifuge, anti-diarrhea, internal bleeding, also used externally to soothe and treat skin diseases as a mucilaginous paste or poultice. | (Aboelsoud, 2010a; Ja, 1962; Leake, 1952; Reisner, 1905b) |
| <i>Acacia senegal</i> (Gum arabic) (Fabaceae) | Gums and polysaccharides | (Evans, 2009) | In a remedy for diabetes. | (Carpenter et al., 2006) |
| <i>Acanthus</i> sp. (Acanthaceae) | Resins, steroids, tannins, and glycosides | (Ganesh and Vennila, 2011) | In a laxative remedy. | (Bryan, 1930) |
| <i>Allium ampeloprasum</i> (Amaryllidaceae) | Sulphur containing bio-active constituents | (Mathew, 1996) | Local application to insect bites and skin irritations. | (Leake, 1952) |
| <i>Allium cepa</i> (Onion) (Amaryllidaceae) | Volatile oil with organosulfur compound, flavonoids, and phenolic acids | (Ivan, 2004) | Antidiarrheal, diuretic, induces perspiration, prevents colds, soothes sciatica, relieves pains, and for some cardiovascular problems. | (Aboelsoud, 2010b; Arab, 2004; Bryan, 1930) |
| <i>Allium sativa</i> (Garlic) (Amaryllidaceae) | Organosulfur and phenolic compounds | (Martins et al., 2016) | Local application to insect bites and skin irritations, external mild astringent and antiseptic, gives vitality, soothes flatulence and aids digestion, mild laxative, shrinks hemorrhoids, rids the body of "bad spirits". | (Aboelsoud, 2010a; Leake, 1952) |
| <i>Allium kurrat</i> (Leek) (Amaryllidaceae) | Sulphur containing compounds and phenolics | (Abd and Ali, 2013) | Eye treatment, night blindness, for genitals warts | (Amin, 2003) |
| <i>Aloe vera</i> (Asphodelaceae) | Mono- and polysaccharides, tannins, sterols, organic acids, enzymes, saponins, and anthraquinones. | (Barnes et al., 2007) | Expels catarrh from the nose, relieves headaches, soothes chestpains, for burns, ulcers, skin disease, and allergies. | (Aboelsoud, 2010b; Reeves, 1992) |
| <i>Althea species</i> (Marshmallow) (Malvaceae) | Starch, mucilage, pectin, and flavonoids. | (Tavassoli and Afshar, 2018) | As an enema to cool the anus. | (Reeves, 1992) |
| <i>Anisum officinale</i> (<i>Pimpinella anisum</i>) (Anise) (Apiaceae) | Volatile oils, starch, and proteins. | (Bährle-Rapp, 2007) | A carminative and mouthwash. | (El-Assal, 1972; Leake, 1952; Reisner, 1905b) |
| <i>Anethum graveolens</i> (Dill) (Apiaceae) | Volatile oils. | (Jana and Shekhawat, 2010) | Soothes flatulence, relieves dyspepsia, laxative, and diuretic. | (Aboelsoud, 2010a) |
| <i>Ammi majus</i> (Apiaceae) | Furanocoumarins, essential oils, and acetylated flavonoids. | (Elgamal et al., 1993) | To treat vitiligo | (Gurib-Fakim, 2006) |
| <i>Ammi visnaga</i> (Apiaceae) | Furanochromone, coumarins and essential oils | (Hashim et al., 2014) | Used against an asthmatic cough. | (El-Assal, 1972) |
| <i>Balanites aegyptiaca</i> (Zygophyllaceae) | Saponins, alkaloids, flavonoids, and pregnane glycosides. | (Yassin et al., 2017) | Antidiabetic. | (Carpenter et al., 2006) |
| <i>Boswellia</i> sp. (Frankincense) (Burseraceae) | Triterpenes, resins and essential oils. | (Li et al., 2010) | Mild antiseptic for throat and larynx, respiratory tract infections, stops bleeding, cuts phlegm, asthma stops and vomiting for a septic tooth and in wound healing. | (Aboelsoud, 2010a; Sipos et al., 2004) (Leek, 1967) (Cohen, 1992b) |
| <i>Cannabis sativa</i> (Cannabaceae) | Cannabinoids, volatile terpenes, and sesquiterpenes. | (Turner et al., 1980) | Sedative is used especially against infection of the bladder, uterus, eye pain, and as inhalation and as an enema (cool the anus). | (El-Assal, 1972; Reeves, 1992) |
| <i>Carum carvi</i> (Caraway) (Apiaceae) | Volatile oils. | (Razzaghi-Abyaneh et al., 2009) | In a laxative remedy, soothes flatulence, digestive and breath freshener. | (Aboelsoud, 2010a; Bryan, 1930) |
| <i>Ceratonía siliqua</i> (Carob pods) (Leguminosae) | Carbohydrates, proteins, tannins, and pectins. | (Calixto and Cañellas, 1982) | Anti cough. | (Arab, 2004) |
| <i>Cinnamomum camphora</i> (Camphor) (Lauraceae) | Volatile oils. | (Khare, 2008) | Reduces fever and soothes gums. | (Aboelsoud, 2010b) |
| <i>Cinnamomum zeylanicum</i> (Cinnamon) (Lauraceae) | Volatile oils and tannins. | (Khare, 2008) | GIT disorders and for ulcerated gum. | (Leake, 1952; Reeves, 1992) |
| <i>Citrullus colocynthis</i> (Colocynthis) (Cucurbitaceae) | Colocynthosides, alkaloids, resins, cucurbitacins, and polyphenols. | (Hussain et al., 2014) | In fevers, lung treatment, soothes rheumatism locally, reduces swelling, as a bitter purgative, for a septic tooth, removing cloudiness from the eye, in ascites and liver diseases, and as a pessary for abortion. | (Aboelsoud, 2010a; Arab, 2004; Cohen, 1992a, b; El-Assal, 1972; Leek, 1967; Ritner, 2000) |
| <i>Commiphora molmol</i> (Myrrh) (Burseraceae) | Oleo-gum-resin. | (Khare, 2008) | Removes bad odor, stops diarrhea, relieves headaches, soothes gum, for toothache and backache, and removes cloudiness from the eye. | (Aboelsoud, 2010a; Ritner, 2000) |

(continued on next page)

Table 2 (continued)

| Drug name | Major bioactive compounds | Ref. | Traditional use in ancient Egypt | Ref. |
|--|--|---|--|--|
| <i>Coriandrum sativum</i> (Coriander) (Apiaceae) | Volatile oils, flavonoids, and phenolics. | (Laribi et al., 2015) | Local application to irritating or injured parts as cooling and astringent, in a laxative remedy, treatment of pain in the head. | (Bryan, 1930; Leake, 1952) |
| <i>Cuminum cyminum</i> (Cumin) (Apiaceae) | Volatile oils, phenolics and glycosides. | (Li and Jiang, 2004) | Carminative, anti-cough, for a septic tooth, as an enema (cool the anus), and for alimentary troubles. | (El-Assal, 1972; Leake, 1952; Leek, 1967; Reeves, 1992) |
| <i>Cucumis melo</i> (Cucurbitaceae) | Vitamins, phenolics and cucurbitacins. | (Amaro et al., 2015) | As an enema (cool the anus). | (Reeves, 1992) |
| <i>Curcuma longa</i> (Turmeric) (Zingiberaceae) | Curcuminoids, volatile oils, and starches. | (Govindarajan and Stahl, 1980) | Closes open wounds. | (Aboelsoud, 2010a) |
| <i>Cyperus papyrus</i> (Cyperaceae) | Volatile oils | (Hassanein et al., 2014) | In a laxative remedy. | (Bryan, 1930) |
| <i>Drimia maritima</i> (Asparagaceae) | Bufadienolides (cardiac glycosides) and phenolics. | (Knittel et al., 2014) | Cardiotonic. | (Willerson and Teaff, 1996a) |
| <i>Elettaria cardamomum</i> (Cardamom) (Zingiberaceae) | Volatile oils and fatty acids. | (Khare, 2008) | Digestive and soothes flatulence. | (Aboelsoud, 2010a) |
| <i>Ficus carica</i> (Fig) (Moraceae) | Minerals, polyphenols, proteins, and sugars. | (Veberic and Mikulic-Petkovsek, 2016) | Mild laxative and removing noxious matter. | (Leake, 1952; Reisner, 1905b) |
| <i>Ficus sycomorus</i> (Sycamore Fig) (Moraceae) | Terpenoids, flavonoids, and phenolic. | (Hossain, 2018) | Laxative, kill worms, toothache, and for skin ailments. | (Manniche and Museum, 1989) |
| <i>Borinella</i> sp. | Triterpenoids, diterpenoids, and volatile oils | (Cao et al., 2019) | Anti-asthmatic. | (Cohen, 1992a; Leek, 1967) |
| <i>Glycyrrhiza glabra</i> (Licorice) (Fabaceae) | Saponins and flavonoids | (Tanemoto et al., 2015) | A mild laxative, expels phlegm, soothes liver, pancreas, and chest and respiratory problems. | (Aboelsoud, 2010a) |
| <i>Gum acacia</i> (Fabaceae) | Polysaccharides | (Musa et al., 2018) | Local vaginal contraceptive and mild antiseptic. | (Arab, 2004; Sipos et al., 2004) |
| <i>Hordeum vulgare</i> (Barley) (Poaceae) | Flavonoids | (Seikel et al., 1962) | External application in mucilaginous poultices. | (Reisner, 1905b) |
| <i>Hyoscyamus niger</i> (Solanaceae) | Alkaloids | (Alizadeh et al., 2014) | To relieve colic from <i>Ascaris</i> , against fever, and for intestinal troubles. | (Bruce, 1991; El-Assal, 1972) |
| <i>Inula graveolens</i> ; <i>Inula conyza</i> (Compositae) | Volatile oils | (Kiliç, 2014) | Antibacterial, drive fleas from the house | (Reeves, 1992) |
| <i>Juniperus</i> sp. (Cupressaceae) | Flavonoids, volatile oil, and coumarins. | (Bais et al., 2014) | Urine disorders, diuretic, digestive, soothes chest pains, soothes stomach cramps, and in treatment of pain in the head. | (Aboelsoud, 2010a; Bryan, 1930; Carpenter et al., 2006; El-Assal, 1972; Leake, 1952) |
| <i>Lawsonia alba</i> (Lythraceae) | Flavonoids | (Mikhaeil et al., 2004) | Antifungal, astringent, stops diarrhea, treats hair loss, and closes open wounds. | (Aboelsoud, 2010a; Reeves, 1992) |
| <i>Malus sylvestris</i> (Rosaceae) | Vitamins, minerals, polyphenols | (Patocka et al., 2020) | Laxative, skin allergies, soothes headache, gums, and teeth, for asthma, liver stimulant, and weak digestion. | (Aboelsoud, 2010a) |
| <i>Mandragora officinarum</i> (Mandrake) (Solanaceae) | Alkaloids | (Mou et al.) | Pain reliever, aphrodisiac properties, promote conception, and for healthy teeth. | (Kong et al., 2003; Leek, 1967; Reeves, 1992) |
| <i>Matricaria chamomilla</i> (Chamomile) (Compositae) | Volatile oils, coumarins, and flavonoids | (Singh et al., 2011) | Wound healing and antibacterial. | (Sipos et al., 2004) |
| <i>Mentha piperita</i> (Peppermint) (Lamiaceae) | Volatile oils | (Brahmi et al., 2017) | Soothes flatulence, aids digestion, stops vomiting, breath freshener and in a laxative remedy. | (Aboelsoud, 2010a; Bryan, 1930) |
| <i>Moringa aptera</i> (Moringaceae) | Alkaloids, phenolics, and saponins | (Senthilkumar et al., 2018) | As an enema to cool the anus and to detoxify the body. | (Reeves, 1992) |
| <i>Myrica cerifera</i> (Myricaceae) | Volatile oils | (Bello et al., 1996) | Stops diarrhea, soothes ulcers, shrinks hemorrhoids and repels flies. | (Aboelsoud, 2010a) |
| <i>Myrtus communis</i> (myrtle) (Myrtaceae) | Volatile oils | (Usai et al., 2018) | As a poultice with porridge remove mucus' from the chest (may be a case of lobar pneumonia or pleurisy). | (Reeves, 1992) |
| <i>Ocimum basilicum</i> (Basil) (Lamiaceae) | Volatile oils | (Joshi, 2014) | Excellent for heart. | (Aboelsoud, 2010a) |
| <i>Papaver somniferum</i> (Papaveraceae) | Narcotic alkaloids | (Soleymankhani et al., 2015) | For a crying child, relieves insomnia, soothes respiratory problems and for headache. | (Aboelsoud, 2010a; Bryan, 1930; Reeves, 1992) |
| <i>Peucedanum officinale</i> (Apiaceae) | Volatile oils | (Jaimand et al., 2006) | Antibacterial and fragrant gum resin. | (Reeves, 1992) |
| <i>Phoenix dactylifera</i> (Palm dates) (Arecaceae) | Polyphenols, sterols, and tannins | (Al-Alawi et al., 2017; Al-Mssallem et al., 2020) | Diuretic, in mucilaginous poultices for local soothing, for lung treatment and in a laxative remedy. | (Bryan, 1930; Cohen, 1992a; Leake, 1952; Reisner, 1905b) |
| <i>Piper cubeba</i> (Piperaceae) | Volatile oils | (Andriana et al., 2019) | Urinary tract infections, larynx and throat infections, gum ulcers and infections and to soothe headache. | (Aboelsoud, 2010a) |
| <i>Poa</i> sp. (Poaceae) | Carbohydrates and flavonoids | (Pilon et al., 1999) | Antidiabetic. | (Carpenter et al., 2006) |
| <i>Potentilla</i> sp. (Rosaceae) | Triterpenes, flavonoids, and tannins | (Tomczyk and Latté, 2009) | For healthy teeth and against tapeworm. | (El-Assal, 1972; Leek, 1967) |

Table 2 (continued)

| Drug name | Major bioactive compounds | Ref. | Traditional use in ancient Egypt | Ref. |
|--|---|-----------------------------|--|--|
| <i>Punica granatum</i> (Pomegranate) (Lythraceae) | Flavonoids, ellagitannins, vitamins, and minerals | (Rahmani et al., 2017) | Dislodge roundworm. | (Reeves, 1992) |
| <i>Pisum sativum</i> (Leguminosae) | Polyphenols, alkaloids, and saponins | (Zilani et al., 2017) | External application in mucilaginous poultices. | (Reisner, 1905b) |
| <i>Pistacia terebinthus</i> (Anacardiaceae) | Volatile oils, resins, flavonoids, and tannins | (Pulaj et al., 2016) | Against tapeworm. | (El-Assal, 1972) |
| <i>Raphanus sativus</i> (Radish) (Brassicaceae) | Glucosinolates, and isothiocyanates | (Banihani, 2017) | Supplied with garlic (<i>Allium sativa</i>) and onion (<i>Allium cepa</i>) to the workmen who built the greatest pyramid in Egypt, 2780BCE | (Burkill, 1953) |
| <i>Ricinus communis</i> (Castor) (Euphorbiaceae) | Alkaloids, terpenoids, flavonoids, coumarins, and tocopherols | (Ribeiro et al., 2016) | Laxative, for intestinal infections, mucilaginous poultices, leaves for promoting urination or expelling fluid accumulation. | (Arab, 2004; Bryan, 1930; El-Assal, 1972; Leake, 1952) |
| <i>Salix alba</i> (White willow) (Salicaceae) | Flavonoids, and tannins | (Edwards et al., 2015) | Inflamed wound healing. | (Sipos et al., 2004) |
| <i>Santallum albus</i> (Santalaceae) | Volatile oils | (Zhang et al., 2012) | Aids digestion, stops diarrhea, soothes headaches, and gout. | (Aboelsoud, 2010a) |
| <i>Thymus vulgaris</i> (Thyme) (Lamiaceae) | Volatile oils | (Al-Asmari et al., 2017) | Pain reliever, expel phlegm and against tapeworm. | (Aboelsoud, 2010a; El-Assal, 1972) |
| <i>Trigonella foenum-graecum</i> (Leguminosae) | Proteins, mucilage, alkaloids, and saponins | (Goyal et al., 2016) | Respiratory disorders, cleanses the stomach and calms the liver. | (Aboelsoud, 2010a) |
| <i>Triticum aestivum</i> (Poaceae) | Glycolipids | (Luyen et al., 2015) | In a remedy for diabetes, for external application in soothing mucilaginous poultices. | (Carpenter et al., 2006; Reisner, 1905b) |
| <i>Urginea maritima</i> (squill) (Asparagaceae). | Bufadienolides | (Mammadov et al., 2010) | Combat hydropsy (one of the striking symptoms of cardiac failure). | (Sayed, 1980) |
| <i>Vitis vinifera</i> (Vitaceae) | Catechins, and procyanidins | (Ma and Zhang, 2017) | Seeds for Wound healing and fruits in a laxative remedy. | (Bryan, 1930; Sipos et al., 2004) |
| <i>Vigna sinensis</i> (Fabaceae) | Flavonoids, and anthocyanins | (Chang and Wong, 2004) | As an enema (cool the anus). | (Reeves, 1992) |
| Yeast (Saccharomycetaceae) | Nitrogenous compounds, and amino acids | (Ohdake, 1927) | Locally to relieve boils and ulcers and swallowing it to soothe digestive disorders. | (Reeves, 1992) |
| <i>Zizyphus spina</i> (Rhamnaceae) | Saponins | (Ikram and Tomlinson, 1976) | Nutritive, against snake bites and as an enema to cool the anus. | (Kadioglu et al., 2016; Reeves, 1992) |

Prescriptions for cosmetic use have been mentioned also in several Egyptian papyri, for instance, these sentences were written in the Ebers papyrus “To make the skin of the face smooth, soak meal in spring water. Let her wash her face daily, and then apply the meal” (Withington, 1894). Although I couldn’t find a satisfying meaning for the word meal in this paragraph, the authors of the book “Albany Medical Annals” have mentioned that the meal is more effective and safer than most used toilet powders and face washers (Babcock et al., 1921). Also, some prescriptions have been mentioned for households such as cleaning the house and keep harmful animals and rodents away “To keep away mice, smear everything possible with cat’s fat.” “To prevent the hefu-snake from coming out of his hole, put a dried ant-fish, or soda, or an onion upon it—he will not crawl out.” (Withington, 1894).

13. Past, present and future

Interestingly, a lot of ingredients that used in ancient Egyptian remedies are still used for the same purpose today. Their biological activities were confirmed using modern methods and techniques. For example, *Ammi majus* fruit which is endogenous to Egypt was used to treat vitiligo, recently, a compound (8-methoxypsoralen) has been isolated from *Ammi majus* (Rather and Mohammad, 2015) to treat psoriasis and vitiligo (Pakkish et al., 1980). *Zizyphus spina* has been mentioned as an ingredient of 33 ancient Egyptian prescriptions under the name nebes, mostly to treat different types of inflammations. Recently, gallicocatechin

and epigallocatechin were identified as two major compounds in the plant, and they were significantly correlated to the expression of 79 inflammation-related genes in the National Cancer Institute (NCI, USA) cell lines (Kadioglu et al., 2016). Likewise, the methods of analysis of the materials (organic and inorganic) that incorporated in ancient Egyptian pharmaceuticals and cosmetics preparations including (lead chloride, cerussite, beeswax, mastic resin, pine resin, frankincense resin, castor oil, animal fat, and starches) have been reported (Ribechini et al., 2011). Additionally, the powerful effect of honey as an antimicrobial agent besides its great effect in wound healing with six different mechanisms of action has been reported recently (Krishnakumar et al., 2020). Accordingly, a huge amount of research must be conducted in the future to review the reported remedies, authenticate their content, and confirm their biological activities.

14. Conclusion

Ancient Egyptians surprisingly had a great knowledge of different medical fields such as anatomy, surgery, and general medicine; they could diagnose and treat several diseases successfully. Hundreds of cases have been mentioned in several medical papyri. The treatment in that time included a huge diversity of sources as plants, animals, and minerals. Most of our knowledge of this great medicine was derived from the medical pharaonic papyri which could be an incredible source to understand and learn several things from such a great civilization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

We are grateful to AlMaarefa University for their financial support.

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