

Journal of Nature and Science of Medicine

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Welcome to the Inaugural Issue of the *JNSM*: Let's Dream Big

We are proud and honored to launch the inaugural issue of the *Journal of Nature and Science of Medicine (JNSM)*. The *JNSM* is a new peer-reviewed biomedical publication, which is sponsored by the College of Medicine at King Saud University and authored and supported by leading national and international physicians and scientists. This is a profoundly interdisciplinary, international, peer-reviewed journal that focuses on clinical practice, translational medicine, medical education, public health, health policy, and general topics of interest to the biomedical research community. The *JNSM* aims to complement other general medical journals and to link with them to exchange experiences.

The *JNSM* will be initially published as two issues per year, and with contributions from national and international physicians and scientists, we aim to increase the frequency to four issues per year starting 2019. There are no submission fees, no page or other publication charges, and no subscription fees. Articles will be published on the Journal's website (<http://www.jnsmonline.org>) upon acceptance and be freely available.

The *JNSM* targets researchers in clinical practice, translational medicine, medical education, and public health. Moreover, we aim to promote this journal as an international journal by inviting international experts to join the editorial board. Additional audiences include graduate medical students, interns, house officers, fellows, specialists, and also generalists.

In the forthcoming issues, our journal seeks to publish original, high-quality, peer-reviewed papers including original clinical and basic biomedical research; reviews; quality improvement reports; and editorials, book reviews, and correspondence on clinical matters that will provide comprehensive coverage on all aspects and subspecialties of medicine.

The *JNSM* will be orchestrated under the collaborative work of the Editor-in-Chief, Deputy Editor-in-Chief, associate editors, and a multidisciplinary national and international editorial board along with an editorial advisory board. Leading national, regional, and international experts will contribute to the journal, which means the content of the journal will cover virtually every core as well as contemporary topic in medicine, from the established theories to the most modern research and development in medical sciences.

On this occasion, I would like to thank many people who have worked diligently behind the scenes to bring this inaugural

issue to light. We would like to express our gratitude to the leadership of King Saud University and the related University councils for their advice, reviews, and acceptance of our proposal. I am deeply inspired by and appreciative to Professor Khalid Fouda (the Dean of the College of Medicine) and Dr. Majid Al Madi (Vice Dean and Deputy Editor-in-Chief), for providing valuable support throughout the preparation and presentation of the proposal and the process for publication of the inaugural issue. I would also like to thank the associate editors, Professor Ahmad Hersi, Professor Assim Alfadda, Professor Ali Somili, and Dr. Abdulrahman Alsultan, who will be the backbone of this journal and for taking up this challenging role.

This launch of the *JNSM* would not have been possible without the experienced and devoted editorial board members who willingly signed up for time-consuming workloads and enthusiastically agreed to provide their critical input to the review process.

Thank you all for your trust and support. Indeed, it is a real honor to serve as the founding Editors-in-Chief.

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The Jewel in the Crown

We are happy to present the first inaugural issue of the Journal of Nature and Science of Medicine (JNSM) which is the official journal for the College of Medicine at King Saud University. We have great aspirations and hopes for the journal and we are confident that it would be a vessel that would carry knowledge and innovation to our readership and be of added value to the medical field at large.

The college of medicine has a long history and legacy regionally and globally. First established in 1967; the college has graduated over the span of 50 years more than 5000 physicians and over 700 postgraduate trainees in different disciplines of medicine. The college has become a global leader in medical education and ranked in the top 100 medical schools globally as well as continentally in different ranking systems throughout the years. Furthermore, the graduates of the school have proven to be instrumental to health-care delivery in the country providing leaders at different levels of the health-care sector as well as education as the first postgraduate programs were established in the college prior to the establishment of the Saudi Commission of Health Specialties (SCFHS), and the leadership for the SCFHS has been from the faculty of the college over the years.

The scientific publications from the college of medicine have seen a significant increase in quantity as well as quality over the years and when measured by impact would be in the forefront of institutions in the region. This is due to the deep understanding of the researchers of the needs of the community and conducting research that is diverse from basic sciences to translational medicine to research that is epidemiological in nature. More recently, an innovation unit within the college has started to flourish guided by a mature leadership with clear goals and ambitions and that has embraced newer enthusiastic generations of physicians.

In addition, the college faculty have been founders of multiple scientific societies that played a major role in shaping the health-care system in the country; a number of these societies have journals that are focused in their disciplines [Table 1]. This most recent addition to the journals of the college is meant to be inclusive of multiple disciplines and would focus on translational research as well as interdisciplinary scientific work.

We strive for the JNSM to be a platform for researchers to intertwine and view challenges to the health-care systems in different prisms whether it is medical education-, health

Table 1: The medical societies or associations that have evolved from the College of Medicine at King Saud University

| Medical Society or Association | Journal name |
|---|--|
| Saudi Gastroenterology Association | The Saudi Journal of Gastroenterology |
| Saudi Heart Association | Journal of the Saudi Heart Association |
| Saudi Ophthalmological Society | Saudi Journal of Ophthalmology |
| Saudi Anesthesia Society | Saudi Journal of Anesthesia |
| Saudi Otolaryngology Society | The Saudi Journal of Oto-Rhino-Laryngology Head and Neck Surgery |
| Saudi Society of Dermatology and Dermatologic Surgery | Journal of Dermatology and Dermatologic Surgery |
| Saudi Thoracic Society | Annals of Thoracic Medicine |

policy-, public health-, or disease-related research. We believe that the breadth of the JNSM would be inspiring for researchers to tackle their areas of interest from different angles and possibly foster some interdisciplinary research and collaboration on a regional and hopefully international level. Leveraging on the experience of the current leadership of the journal as well as the faculty of the college, we are confident that the journal will be successful in achieving its goals and promoting research that is meaningful and of value to the community and the advancement of science. We also believe in the value of disseminating knowledge and having access to a broad spectrum of readers; thus, we embraced an open access system.

We also have trust in our readership to help us cater to their needs and we would be eager to have feedback that would help us gear our focus and improve the quality of the manuscripts submitted to the journal and would encourage them to submit their valued work or to voice their opinions or share their experiences in the form of letters to the editor or short communications.

This journal has been imagined by a few, initiated by the believers, and would be carried forward by those who are passionate.

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The Medicinal Mushroom *Agaricus bisporus*: Review of Phytopharmacology and Potential Role in the Treatment of Various Diseases

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Abstract

Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources, based on their use in traditional medicine. Since ancient time's plants as well as fungus sources of medicinal compounds have continued to play a dominant role in maintenance of human health. Over 50% of all modern clinical drugs are of natural product origin and play an important role in drug development programs in the pharmaceutical industry. Mushrooms are an important natural source of food and medicine. Traditional aboriginals knew the importance of edible and wild mushrooms, and these are now being screened for their bioactivity in various ailments. We are aiming for this review is to compact a compressive scientific description of pharmacognosy, chemistry, and pharmacology of button mushroom (*Agaricus bisporus*), depending on published data and other available resources.

Keywords: *Agaricus bisporus*, medicinal compounds, pharmaceutical industry, traditional medicine

INTRODUCTION

The world population is increasing day-by-day. Currently, it is considered nearly 7 billion. Some theories suggest that by the year 2050, the global population will reach to 9 billion, and during 2100, it could be 20 billion.^[1] Lack of food and deterioration in human health will be burning issue due to the population growth and urbanization, with a concomitant reduction in arable land. To address global food demand (especially protein) can be converted into lingo-cellulosic agricultural and forest residues into protein-rich mushrooms is one of the most economically viable and sustainable biotechnology processes.^[2] Utilization of edible fungi to fulfil human nutritional rights has been a common denominator in the history of humankind.^[3,4] Penicillin, perhaps the most famous of all antibiotic drugs, is derived from a common fungus called *Penicillium*. Many other fungi also produce antibiotic substances, which are now widely used to control diseases in human and animal populations. The discovery of antibiotics revolutionized healthcare worldwide. Some fungi which parasitize caterpillars have also been conventionally used as medicines.^[5]

Agaricus bisporus (*A. bisporus*) Imbach is the most wild and cultivated edible mushroom and represents more than 40% of the world bearing of mushrooms.^[6,7] It is cultivated in over 70 countries and on every ascetic, except Antarctica. The global production in the 1990s was more than \$800 million/year^[8] and increased to \$12,250 in 2002 (UN 2010). *A. bisporus* has a luscious taste with more nutritional value has very good aroma or flavoring taste is used as food and in food industries.^[9] It is considered to have high biological activity, low toxicity and has significance folklore and ethanopharmacological significance. Apart from food and food beverages it has a role in perfumery, cosmetic industries and pharmaceutical industries.^[10,11] Wild *A. bisporus* were referred for customer due to their flavor and texture.^[12] It has been reported lots of primary and secondary metabolites responsible for the therapeutic activity for the prevention and treatment of many diseases such as cancer, hyperlipidemia, microbial diseases,

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cardiovascular problems, liver diseases, and immune problems. *A. bisporus* is a litter degrading basidiomycete commonly found in humic-rich environments which are useful as a model organism and cultivated in large scale for the food industry. Due to its ecological niche, it produces a variety of enzymes for detoxification and degradation of humified plant litter.^[13]

HISTORY AND ETHNOPHARMACOLOGY

A. bisporus is an edible basidiomycete mushroom native to grasslands in Europe and North America. Commonly known as white button mushroom (WBM), is widely cultivated in most countries and it constitutes the bulk of all mushrooms consumed in the United States and Australia. Historical evidence indicates that it was first cultivated in France and that cultivar strains originated in Western Europe.^[14-16] Ancient Egyptians believed mushrooms could grant immortality and thus, only the pharaohs were deemed worthy of eating or even touching them. In ancient Rome, mushrooms were often referred to as “food for the gods.” In Russia, China, and Mexico, and other world cultures, folklore held that mushrooms conferred superhuman strength.^[17] Conventionally, the fungus was used in the treatment of cancer, cerebral stroke, and heart diseases. Furthermore, it has anti-aging property.^[18] They represent as one of the world’s greatest untapped resources of nutrition and palatable food of the future. Mushrooms have been found to be more effective against cancer, cholesterol reduction, stress, insomnia, asthma, allergies, and diabetes.^[19] They can be used to bridge the protein malnutrition gap because they have a high amount of protein. Mushrooms are useful to increase the immunity. Hence, it provides a nutrient supplement as a form of tablets. They are also useful for diabetic and patients with cardiovascular disorders (because they contain low starch and low cholesterol). One-third of the iron in the mushrooms is available in free form. Their polysaccharide content is used as an anticancer drug and combat HIV effectively.^[20,21] Biologically active compounds from the mushrooms possess antifungal, antibacterial, antioxidant, and antiviral properties, and have been used as insecticides and nematocides as well. There have been studies that demonstrate that women who eat these button mushrooms daily have reduced chances of getting breast cancer. The mushrooms can be thought to inhibit the production of enzymes that affect the production of estrogen which is a hormone that causes cancer to develop. The special effects of this substance on other kinds of cancer are still being studied.^[22]

BOTONICS

Botanical name: *Agaricus bisporus* (Lange) Imbach [Figure 1]

Kingdom - Fungi

Divison - Basidiomycota

Class - Agaricomycetes

Order - Agaricales



Figure 1: Morphology of *Agaricus bisporus*

Family - Agaricaceae

Genus - Agaricus

Species - *Agaricus bisporus*^[17]

A young fungus either light-yellow or light-brown in color with an abutted cap, known as common mushroom, white mushroom or button mushroom. In strains with darker flesh, the premature mushroom is variously marketed as cremini mushroom, baby bella, Mini bella, roman mushroom, Italian mushroom or brown mushroom.^[23] Original cap is a pale gray-brown, with extensive, horizontal scales on a paler background and fading toward the margins. It is first hemispherical in shape before flattening out with maturity and 5–10 cm (2–4 inches) in diameter. The precise, crowded gills are free and initially pink, then red-brown and finally a dark brown with a whitish edge from the cheilocystidia. The cylindrical stipe is up to 6 cm tall by 1-2 cm wide and bears a thick and narrow ring, which may be streaked on the upper side. The firm flesh is white, although stains a pale pinkish-red on bruising. The spore print is dark brown. The spores are oval to round and measure approximately $4.5\text{--}5.5 \times 5\text{--}7.5 \mu\text{m}$. Mushrooms are considered as a heterotrophic and have no chlorophyll.^[24] Scientific confession of the commercial cultivation of *A. bisporus* was made by French botanist Joseph Pitton de Tournefort in 1707.^[25] French agriculturist Olivier de Serres seen that transplanting mushroom mycelia would lead to the propagation of more mushrooms. Originally, cultivation was capricious as mushroom growers would watch for good flushes of mushrooms in fields before digging up the mycelium and replanting them in beds of composted manure or inoculating “bricks” of compressed litter, loam, and manure. Spawn collected this way usually contained pathogens and commonly crops would be infected or not grow at all.^[26] In 1893, pure culture, spawn was discovered and produced by the Pasteur Institute in Paris, for cultivation on composted horse dung.^[27] The substrate for culturing *A. bisporus* is the most complicated culture medium

used for edible mushroom production. The compost is prepared by a two-stage mechanism. In the first stage, a mixture of raw materials, animal manure (such as stable bedding or poultry manure) and gypsum are assembled, wetted and formed into a stack (windrow). The cultivation of this species have succeeded on different composted organic such as chicken, horse or pigeon manures, straw residues from wheat, oat, tifton,^[28] reed crops,^[29,30] corn cob, molasses, wheat bran,^[31] sugarcane bagasse, tea levaves,^[32] brachiaria,^[33] reed plant (*Phragmites australis*) straw,^[34] water hyacinth (*Eichhornia crassipes*),^[35] and others. Wheat straw with waste tea leaves^[36,37] and waste paper was used in the casing layer.^[38] Water inclusion is controlled, and the stack is dissembled and reformed at intervals. In the second stage, pasteurization is done to brace the compost for a selective growth medium on which *A. bisporus* has been inoculated. This two-phase process for substrate preparation has some demerits, Such as more time and space required for cultivation.^[39-42] Automated harvesting of *A. bisporus* by machine at the laboratory level; and the resulting pilot harvester was completely tested on a commercial mushroom farm. The apparatus associates various handling systems and mechatronic technologies. Mushrooms are located and sized using image analysis and a monochromatic vision system. An expert selection algorithm then decides the order in which they should be picked and selection of picking action (bend, twist or both).^[43,44] One of a pair of suction cup mechanisms attached to the single head of a Cartesian robot is then deployed, which can delicately detach individual mushrooms and place them gently into a specially designed, compliant finger conveyer. After high-speed skiving, a gripper mechanism is finally used to remove mushrooms from the conveyor into packs at the side of the machine.^[45]

CHEMICAL CONSTITUENTS

A. bisporus comes under the category of a food which is beneficial for humane health with excellent levels of dietary fibers and antioxidants including vitamins namely; thiamine, ascorbic acid, vitamin D₂ etc as well as minerals like folates, ergothioneine (ET) and polyphenols which may provide favorable effects on cardiovascular diseases and diabetes suggests that the mushroom might have potential anti-inflammatory, hypoglycemic, and hypocholesterolemic effects.^[46-49] Around half of the fungal cell wall mass is constituted by β -glucans along with ergosterol, tocopherols, linoleic acid, and lectins. Fungus contains 1-6 mg of phenolics/g of dried mushroom and flavonoid concentrations ranged between 0.9 and 3.0 mg/g of dried matter; as myricetin and catechin.^[50] Agaritine and its derivatives which chemically belongs to hydrazines, are the main aromatic compound of mushrooms. Hydrazines are present in mushroom species like *A. bisporus*, etc., Agaritine was found to contribute to the formation of toxic aryl diazonium ions. Gamma-glutaminy-4-hydroxybenzene is the principal phenolic compound present in mushrooms.^[51,52]

Abou-Heilah *et al.* reported potassium and sodium concentration was 300 and 28.2 parts per million, respectively.^[53] The ash analysis revealed the high amount of K, P, Cu, and Fe.^[54] *A. bisporus* contains Ca (0.04 g), Mg (0.16 g), P (0.75 g), Fe (7.8 g), Cu (9.4 mg), Mn (0.833 mg) and Zn (8.6 mg) per kilogram fresh weight.^[55] Various constituents, microelements, and vitamins present which is shown in Tables 1-3.^[56]

Table 1: Constituents present in *Agaricus bisporus*

| Constituents | Value (Unit/100 g) |
|-----------------------------|--------------------|
| Proximates water | 92.45 g |
| Energy | 22 kcal |
| | 93 kJ |
| Protein | 3.09 g |
| Adjusted protein | 2.18 g |
| Total lipid (fat) | 0.34 g |
| Ash | 0.85 g |
| Carbohydrate, by difference | 3.26 g |
| Fiber, total dietary | 1 g |
| Sugars, total | 1.98 g |
| Glucose (dextrose) | 1.48 g |
| Fructose | 0.17 g |

Table 2: Microelements present in *Agaricus bisporus*

| Microelements | Value (Unit/100 g) |
|----------------|--------------------|
| Calcium (Ca) | 3 mg |
| Iron (Fe) | 0.5 mg |
| Magnesium (Mg) | 9 mg |
| Phosphorus (P) | 86 mg |
| Potassium (K) | 318 mg |
| Sodium (Na) | 5 mg |
| Zinc (Zn) | 0.52 mg |
| Copper (Cu) | 0.318 mg |
| Manganese (Mn) | 0.047 mg |
| Selenium (Se) | 9.3 μ g |

Table 3: Vitamins present in *Agaricus bisporus*

| Vitamins | Value (Unit/100 g) |
|--|--------------------|
| Vitamin C, total ascorbic acid | 2.1 mg |
| Thiamin | 0.081 mg |
| Riboflavin | 0.402 mg |
| Niacin | 3.607 mg |
| Pantothenic acid | 1.497 mg |
| Vitamin B ₆ | 0.104 mg |
| Folate | 17 μ g |
| Choline | 17.3 mg |
| Betaine | 9.4 mg |
| Vitamin B ₁₂ | 0.04 μ g |
| Vitamin E | 0.01 mg |
| Tocopherol, beta | 0.01 mg |
| Tocopherol, gamma | 0.01 mg |
| Tocopherol, delta | 0.01 mg |
| Vitamin D (D ₂ + D ₃) | 0.2 μ g |
| Vitamin D ₂ (ergocalciferol) | 0.2 μ g |

PHARMACOLOGICAL ACTIVITY

Antioxidant and immunomodulating activity

Polysaccharides reported in *A. bisporus* had a good amount of “a” and “b” glucans which was confirmed by Fourier-transform infrared spectroscopy (FTIR) and were found to have immune stimulating effect.^[57]

Metabolic effect

A total of 240 seven-day old mix sexes quail chicks were randomly allocated to four experimental groups treated with the *A. bisporus* then old male and female chicks were separated at 21 days. Birds were allowed to free to take water and feed at the time of the 35 days of the growth period. Total cholesterol (TC), triglyceride (TG) and low-density lipoprotein (LDL) were found to be significantly decreased compared to the control. HDL cholesterol was significantly increased with 2% mushroom compared to the control so in conclusion 2% mushroom positively affects cholesterol, TG, high-density lipoprotein (HDL), and LDL of quails diet.^[58]

Anticancer activity

A. bisporus is effective in case of breast cancer because it decreases aromatase enzyme activity and estrogen biosynthesis. The researcher evaluated the activity of mushroom extracts in the estrogen receptor-positive/aromatase-positive and found to have decreased testosterone-induced cell proliferation in MCF-7aro cells but had no effect on MCF-10A, a nontumorigenic cell line.^[59]

Anticholesterolemic and antiglycemic

The objective of this study was to examine the hypothesis that intake of the fruiting bodies of WBM regulates antiglycemic responses. For these studies the rats were fed hypercholesterolemic diet and type 2 diabetes induced by injection of streptozotocin for 3 weeks in rats. The result allowed reduced plasma glucose, TG concentrations, liver enzyme activities, alanine aminotransferase and aspartate aminotransferase.^[60] In hypercholesterolemic rats, oral feeding of ABP for 4 weeks resulted in a significant decrease in plasma TC, LDL, and concluded that *A. bisporus* had both hypoglycemic and hypolipidemic activity in rats.^[60]

Anti-inflammatory activity

The anti-inflammatory activity of methanolic extracts of *A. bisporus* was investigated on activated macrophages and found that some edible mushrooms species have a potential anti-inflammatory capacity *in vitro*.^[61]

Biomarkers of inflammation

In such a study (pilot) evaluation of bioavailability of ET in healthy men ($n = 10$), using a randomized, cross-over, dose-response, postprandial time-course design, conducted at the General Clinical Research Center at Pennsylvania State University in 2009. ET was administered with mushroom powder. Postprandial red blood cell concentrations of ET and plasma glucose, TGs, HDL, LDL and TC were also monitored. Biomarkers of inflammation and oxidative stress

were evaluated using C-reactive protein and oxygen radical absorbance capacity (total). ET from *A. bisporus* mushrooms is bioavailable as assessed using red blood cell uptake postprandial, and consumption is associated with an attenuated postprandial TG response.^[62]

Enhances maturation of bone marrow-derived dendritic cells

In this study, *in vitro* supplementation with *A. bisporus* on the maturation of bone marrow-derived dendritic cell (BMDC) of C57BL mice and found that dose-dependently increased expression of maturation markers CD40, CD80, CD86, and major histocompatibility complex-II.^[63]

As a source of antibiotics and in cosmetics industry

A. bisporus contain a group of benzoquinone which belongs to antibiotics group and tyrosinase enzyme which was isolated from this species is completely resemble human tyrosinase which is very beneficial in field of cosmetics.^[64]

Intestinal fermentation

Kawakami *et al.*, reported the intestinal fermentation of *A. bisporus* in rats. It was proved by physical examination of animals by bacterial and HPLC analysis of cecal content and concluded that the mushrooms powder have a beneficial effect on the intestine.^[65]

Skin disorders

This investigation was based on an effect of purified tyrosinase from *A. bisporus* on B16F10 melanocytes for the melanin production through blocking pigment cell machinery. Using B16F10 melanocytes showed that the stimulation of melanogenesis by purified tyrosinase is due to increased tyrosinase absorption. Cellular tyrosinase activity and melanin content in B16F10 melanocytes were increased by purified tyrosinase in a dose-dependent manner. The results indicated that purified tyrosinase can be treated as a contestant for the treatment of vitiliginous skin conditions.^[66]

Antinociceptive properties

Komura *et al.* proved the anti-inflammatory and antinociceptive effects of fucogalactans, fucomannogalactans, and mannogalactans isolated from *Agaricus brasiliensis* and *A. bisporus* var. hortensis.^[67]

Antimicrobial activity

The study involved isolating *Erwinia* spp. and *Ralstonia solanacearum* from infected plants followed by subjecting the isolates and commercially acquired *Staphylococcus aureus* (ATCC 25923), *Enterococcus faecalis* (ATCC 29212), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), *Streptococcus pneumoniae* (ATCC 49617), *Proteus vulgaris* (ATCC 49990), *Candida albicans*, *Aspergillus niger* (ATCC 1015), *Fusarium oxysporum* (ATCC 16608), *Ustilago maydis* (ATCC 14826), *Microsporium gypseum* (ATCC 15621), and *Malassezia furfur* (ATCC 14423) and were successfully antagonized by mushroom.^[68]

Agaricus bisporus as nanoparticles

Owaid *et al.*, developed the methanolic nanoparticles of *A. bisporus* have various advantages to treat cancer, viral, bacterial, fungal diseases, etc., This type of the nanoparticle synthesis by edible and medicinal mushrooms are economic and suitable to apply in nanomedicine due to the huge number of fruiting bodies which are produced in the world.^[69-71] The commercial mushroom production process is usually performed in buildings or tunnels under highly controlled environmental conditions. In nature, the basidiomycete *A. bisporus* has a significant impact on the carbon cycle in terrestrial ecosystems as a saprotrophic decayer of leaf litter.^[72]

FUTURE PROSPECTS

Emerging evidence from exciting new studies suggests that mushrooms may also help to: boost energy, eliminate fatigue and balance the effects of stress, promote healthy skin and hair, cleanse the liver and flush out toxins, improve brain cell function and promote memory and concentration on the basis of various constituents present in the *A. bisporus*.

CONCLUSION

We can conclude about the diverse benefits of mushrooms towards humans by the words of the father of medicine that is, Hippocrates “Let food be your medicine and medicine be your food.” This saying applies suits mushrooms, as they have tremendous medicinal food, drug, and mineral values. Hence, they are a valuable asset for the welfare of humans. *A. bisporus* may be used to cure various diseases in future and play a key role or like a backbone in the research field. They are small plants but treasures major qualities which act as a key principle for various researches applicable to pharmacology, pharmacognosy, microbiology and biotechnology.

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There are no conflicts of interest.

REFERENCES

- Livi-Bacci MA. Concise History of World Population. 5th ed. Malden (MA): Wiley-Blackwell; 2012. p. 50.
- Hawksworth DL. The fungal dimension of biodiversity: Magnitude, significance, and conservation. *Mycol Res* 1991;95:641-55.
- Chang ST. The world mushroom industry: Trends and technological development. *Int J Med Mushrooms* 2006;8:297-314.
- Singha R, Bishnoi DK, Singh A. Cost benefit analysis and marketing of mushroom in Haryana. *Agric Econ Res Rev* 2010;23:165-71.
- Thakur MP, Singh HK. Advances in the cultivation technology of tropical mushrooms in India. *JNKVV Res J* 2014;48:120-35.
- Callac P, Imbernon M, Guinberteau J. Discovery of a wild Mediterranean population of *Agaricus bisporus*, and its usefulness for breeding work. *Mushroom Sci* 2000;15:245-52.
- Carluccio A. Complete Mushroom Book: The Quiet Hunt. London: Quadrille Publishing Ltd; 2003. p. 21-2.
- Andersson HC, Gry J. Phenyl Hydrazines in the Cultivated Mushroom *Agaricus bisporus* Occurrence, Biological Properties, Risk Assessment and Recommendations. Nordic Council of Ministers, Copenhagen. Tema Nord 558, Ekspressen Tryk & Kopicenter; 2004. p. 1-123.
- Misharina TA, Mukhutdinova SM, Zharikova GG, Terenina MB, Krikunova NI, Medvedeva IB, *et al.* Formation of flavor of dry champignons (*Agaricus bisporus*). *Prikl Biokhim Mikrobiol* 2010;46:119-24.
- Caglarirmak N. Determination of nutrients and volatile constituents of *Agaricus bisporus* (brown) at different stages. *J Sci Food Agric* 2009;89:634-8.
- Dastager SG. Aroma compounds. In: Nigam PS, Pandey A, editors. *Biotechnology for Agro-Industrial Residues Utilization*. Kerala, India: Springer; 2009. p. 105-27.
- Sadiq S, Bhatti NH, Hanif MA. Studies on chemical composition and nutritive evaluation of wild edible mushrooms. *JICS* 2008;27:151-4.
- Gonaus C, Kittl R, Sygmund C, Haltrich D, Peterbauer C. Transcription analysis of pyranose dehydrogenase from the basidiomycete *Agaricus bisporus* and characterization of the recombinantly expressed enzyme. *Protein Expr Purif* 2016;119:36-44.
- Atkins FC. Guide to Mushroom Growing. London: Faber and Faber; 1974. p. 122.
- Kerrigan RW. Global genetic resources for *Agaricus* breeding and cultivation. *Can J Bot* 1995;73:973-9.
- Jeong SC, Koyyalamudi SR, Jeong YT, Song CH, Pang G. Macrophage immunomodulating and antitumor activities of polysaccharides isolated from *Agaricus bisporus* white button mushrooms. *J Med Food* 2012;15:58-65.
- Varo P, Lahelman O, Nuurtamo M, Saari E, Koivistoinen P. Mineral element composition of finish food. VII postal, vegetables, fruits, berries, nuts and mushrooms. *Acta Agric* 1980;22:107-13.
- Available from: <http://www.healthblog247.com/some-benefits-of-agaricus-bisporus-extract/>. [Last assessed on 2017 Dec 25].
- Available from: <http://www.undergroundhealthreporter.com/mushroom-health-benefits-cancer/>. [Last assessed on 2017 Dec 25].
- Prasad S, Rathore H, Sharma S. Medicinal mushrooms as a source of novel functional food. *IJFS* 2015;4:221-5.
- Bahl N. Medicinal Value of Edible Fungi. In: *Proceeding of the International Conference on Science and Cultivation Technology of Edible Fungi*. Indian Mushroom Science II; 1983. p. 203-9.
- King TA. Mushrooms, the ultimate health food but little research in U. S to prove it. *Mushroom News* 1993;41:29-46.
- Imbach EJ. Pilzflora des kantons luzern und der angrenzen innerschweiz. *Mitt Naturforsch Ges Luzern* 1946;15:5-85.
- Available from: <http://www.gbif.org/species/5243447/synonyms>. [Last assessed on 2017 Dec 25].
- Chang ST, Miles PG. *Mushrooms Cultivation, Nutritional Value, Medicinal Effect and Environmental Impact*. 2nd ed. USA: CRC Press LLC; 2004. p. 59.
- Spencer DM. The mushroom – Its history and importance. In: Flegg PB, Spencer DM, Wood DA, editors. *The Biology and Technology of the Cultivated Mushroom*. New York: John Wiley and Sons; 1985. p. 1-8.
- Genders R. *Mushroom Growing for Everyone*. London: Faber; 1969. p. 19.
- Genders R. *Mushroom Growing for Everyone*. London: Faber; 1969. p. 18.
- de Andrade MC, de Jesus JP, Vieira FR, Viana SR, Spoto MH, de Almeida Minihoni MT, *et al.* Dynamics of the chemical composition and productivity of composts for the cultivation of *Agaricus bisporus* strains. *Braz J Microbiol* 2013;44:1139-46.
- Alkaisi MR, Hasan AA, Aljuboori AW. Evaluation of production efficiency for some cultivated mushroom strains *Agaricus bisporus* which was renovated mother culture in multiple methods. *Iraqi J Sci*

- 2016;57:383-90.
31. Rehman MK, Ali MA, Hussain A, Khan WA, Khan AM. Effect of different casing materials on the production of button mushroom (*Agaricus bisporus* L.). *J Environ Agric Sci* 2016;7:55-61.
 32. Baysal E, Yigitbasi ON, Colak M, Toker H, Simsek H, Yilmaz F. Cultivation of *Agaricus bisporus* on some compost formulas and locally available casing materials. Part I: Wheat straw based compost formulas and locally available casing materials. *Afr J Biotechnol* 2007;6:2225-30.
 33. Simsek H, Baysal E, Colak M, Toker H, Yilmaz F. Yield response of mushroom (*Agaricus bisporus*) on wheat straw and waste tea leaves based composts using supplements of some locally available peats and their mixture with some secondary casing materials. *Afr J Biotechnol* 2008;7:88-94.
 34. Muslat MM, Al-Assaffii IA, Alheeti MN. Use efficiency of reed residues *Phragmites australis* with amendment by streptomycetes to prepared compost for *Agaricus bisporus* production and influence of spraying *Glycyrrhiza* Sp. extracts. *Res J Aleppo Univ Agric Sci Ser* 2011;93:149-68.
 35. Reddy MT, Reddy KA, Reddy KA, Reddi EU, Reddi B. A study on the production of *Agaricus bisporus* mushrooms using *Eichhornia crassipes* (mart. Solms) – A troublesome exotic aquatic weed of Kolleru Lake. *IJSN* 2013;4:100-3.
 36. Gülser C, Pekşen A. Using tea waste as a new casing material in mushroom (*Agaricus bisporus* (L.) sing.) cultivation. *Bioresour Technol* 2003;88:153-6.
 37. Peker H, Baysal E, Yigitbasi ON, Simsek H, Colak M, Toker H. Cultivation of *Agaricus bisporus* on wheat straw and waste tea leaves based compost formulas using wheat chaff as activator material. *Afr J Biotech* 2007;6:400-9.
 38. Sassine YN, Abdel-Mawgoud AM, Ghora Y, Bohme M. Effect of different mixtures with waste paper as casing soil on the growth and production of mushroom (*Agaricus bisporus*). *Aust J Basic Appl Sci* 2007;1:96-104.
 39. Sassine YN, Ghora Y, Kharrat M, Bohme M, Abdel-Mawgoud AM. Waste paper as an alternative for casing soil in mushroom (*Agaricus bisporus*) production. *J Appl Sci Res* 2005;1:277-84.
 40. Sinden JW, Heuser E. The nature of the short composting process and its relation to short composting. *Mushroom Sci* 1953;2:123-31.
 41. Wuest PJ. Compost and the composting technique. *Mushroom News* 1977;2:11-6.
 42. Fermor TR, Grant WD. Degradation of fungal and actinomycetemycelia by *Agaricus bisporus*. *J Gen Microbiol* 1985;129:15-22.
 43. Overtjins A. The conventional phase II in trays or shelves. *Mushroom J* 1998;584:15-25.
 44. Reed JN, Miles SJ, Butler J. Influence of mushroom strains and population density on the performance of a robotic harvester. *J Agric Eng Res* 1997;68:215-22.
 45. Tillett RD, Batchelor BG. An algorithm for locating mushrooms in a growing bed. *Comput Electron Agric* 1991;6:191-200.
 46. Reed JN, Crook S, He W. Harvesting mushrooms by robot. *Mushroom Sci* 1995;15:385-91.
 47. Reed JN, Miles SJ, Butler J. Automatic mushroom harvester development. *J Agric Eng Res* 2001;28:15-23.
 48. Fukushima M, Nakano M, Morii Y, Ohashi T, Fujiwara Y, Sonoyama K, et al. Hepatic LDL receptor mRNA in rats is increased by dietary mushroom (*Agaricus bisporus*) fiber and sugar beet fiber. *J Nutr* 2000;130:2151-6.
 49. Koyyalamudi SR, Jeong SC, Cho KY, Pang G. Vitamin B12 is the active corrinoid produced in cultivated white button mushrooms (*Agaricus bisporus*). *J Agric Food Chem* 2009;57:6327-33.
 50. Koyyalamudi SR, Jeong SC, Song CH, Cho KY, Pang G. Vitamin D2 formation and bioavailability from *Agaricus bisporus* button mushrooms treated with ultraviolet irradiation. *J Agric Food Chem* 2009;57:3351-5.
 51. Mattila P, Kõnkö K, Euro M, Pihlaja JM, Astola J, Vahteristo L, et al. Contents of vitamins, mineral elements, and some phenolic compounds in cultivated mushrooms. *J Agric Food Chem* 2001;49:2343-8.
 52. Valverde ME, Hernández-Pérez T, Paredes-López O. Edible mushrooms: Improving human health and promoting quality life. *Int J Microbiol* 2015;2015:376387.
 53. Beaulieu M, D'Aprano MB, Lacroix M. Dose rate effect of gamma irradiation on phenolic compounds, polyphenol oxidase, and browning of mushrooms (*Agaricus bisporus*). *J Agric Food Chem* 1999;47:2537-43.
 54. Espin JC, Jolivet S, Overeem A. Agaritine from *Agaricus bisporus* is capable of preventing melanin formation. *Phytochemistry* 1999;50:555-63.
 55. Abou-Heilah AN, Kasionalsim MY, Khaliel AS. Chemical composition of the fruiting bodies of *Agaricus bisporus*. *Int J Exp Bot* 1987;47:64-8.
 56. Anderson EE, Fellers CR. The food value of mushrooms (*Agaricus campestris*). *J Am Soc Hortic Sci* 1942;41:301.
 57. Nanba H. Maitake mushroom the king mushroom. *Mushroom News* 1993;41:22-5.
 58. Zheng R, Jie S, Hanchuan D, Moucheng W. Characterization and immunomodulating activities of polysaccharide from *Lentinus edodes*. *Int Immunopharmacol* 2005;5:811-20.
 59. Chen S, Oh SR, Phung S, Hur G, Ye JJ, Kwok SL, et al. Anti-aromatase activity of phytochemicals in white button mushrooms (*Agaricus bisporus*). *Cancer Res* 2006;66:12026-34.
 60. Jeong SC, Jeong YT, Yang BK, Islam R, Koyyalamudi SR, Pang G, et al. White button mushroom (*Agaricus bisporus*) lowers blood glucose and cholesterol levels in diabetic and hypercholesterolemic rats. *Nutr Res* 2010;30:49-56.
 61. Moro C, Palacios I, Lozano M. Anti-inflammatory activity of methanolic extracts from edible mushrooms in LPS activated RAW 264.7 macrophages. *Food Chem* 2012;130:350-5.
 62. Weigand-Heller AJ, Kris-Etherton PM, Beelman RB. The bioavailability of ergothioneine from mushrooms (*Agaricus bisporus*) and the acute effects on antioxidant capacity and biomarkers of inflammation. *Prev Med* 2012;54 Suppl:S75-8.
 63. Ren Z, Guo Z, Meydani SN, Wu D. White button mushroom enhances maturation of bone marrow-derived dendritic cells and their antigen presenting function in mice. *J Nutr* 2008;138:544-50.
 64. Bożena M, Katarzyna K, Jacek R, Agata G, Opoka W. Composition and biological properties of *Agaricus bisporus* fruiting bodies – A review. *Pol J Food Nutr Sci* 2017;67:173-81.
 65. Kawakami S, Araki T, Ohba K, Sasaki K, Kamada T, Shimada K, et al. Comparison of the effect of two types of whole mushroom (*Agaricus bisporus*) powders on intestinal fermentation in rats. *Biosci Biotechnol Biochem* 2016;80:2001-6.
 66. Zaidi KU, Ali SA, Ali AS. Effect of purified mushroom tyrosinase on melanin content and melanogenic protein expression. *Biotechnol Res Int* 2016;2016:9706214.
 67. Komura DL, Carbonero ER, Gracher AH, Baggio CH, Freitas CS, Marcon R, et al. Structure of *Agaricus* Spp. Fucogalactans and their anti-inflammatory and antinociceptive properties. *Bioresour Technol* 2010;101:6192-9.
 68. Waithaka PN, Gathuru EM, Githaiga BM. Antimicrobial activity of mushroom (*Agaricus Bisporus*) and fungal (*Trametes Gibbosa*) extracts from mushrooms and fungi of Egerton main campus, Njoro Kenya. *J Biomedical Sci* 2017;6:3.
 69. Owaid MN, Ibraheem IJ. Mycosynthesis of nanoparticles using edible and medicinal mushrooms. *Eur J Nanomed* 2017;9:5-23.
 70. Eskandari NM, Jafarizadeh MH, Rahbar SJ. Hydrothermal green synthesis of gold nanoparticles using mushroom (*Agaricus bisporus*) extract: Physicochemical characteristics and antifungal activity studies. *Green Process Synth* 2017;7:38-47.
 71. Majumder P. Nanoparticle-assisted herbal synergism an effective therapeutic approach for the targeted treatment of breast cancer: A novel prospective. *Glob J Nanomed* 2017;2:555-95.
 72. Kabel MA, Jurak E, Mäkelä MR, de Vries RP. Occurrence and function of enzymes for lignocellulose degradation in commercial *Agaricus bisporus* cultivation. *Appl Microbiol Biotechnol* 2017;101:4363-9.

The Human Milk: Prejudice versus Science

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Abstract

Exclusive breastfeeding for the nutrition of healthy term infants is currently considered as the gold standard. Indeed, the widely held prejudice against human milk is something of the past. However, the universal acceptance of this fact on mothers' part is still to be achieved. Meanwhile, the widespread of baby-friendly hospital initiative movement makes it increasingly harder to question the safety or efficacy of this practice, even in the face of some concerning reports of unwanted outcomes. Apparently, there is a need for better compliance with safe sleep instructions while actively promoting breastfeeding practices. In some specific situations, breastfeeding becomes impractical, extremely difficult, or even contraindicated. Using a suitable formula in these circumstances becomes a must. Given all of this, a greater emphasis should be placed on efforts to improve the quality of currently available formulas and/or creating new ones that better meet the nutritional needs of all infants.

Keywords: Breastfeeding, formulas, human milk, nutrition

INTRODUCTION

The story of human milk and its rise to the esteemed status it currently enjoys has been checkered by centuries of impediment and disdain, even by those expected to promote it. Indeed, the soon after birth nutritional separation of infants from their mothers was commonplace. This practice stemmed, most likely, from the belief that human milk is impure and unhealthy; Aristotle equaled human milk with retained menstrual blood,^[1] Galen claimed that "the source of milk is from blood undergoing a slight change in the breasts."^[2] Apparently, Ancient Greeks believed in the presence of a physical connection that transfers the raw material for milk production from the uterus to the breasts. These views continued to prevail in Europe for a long time, throughout middle ages and well beyond.

THE "BAD" MILK

The wrong impressions about the safety and purity of human milk were the basis for advising nursing mothers to get rid of it by any means, "mother should let herself suck by a whelp"^[3] and "If, however, she suckles her infant from the beginning, some honey and rose honey should be applied before breastfeeding so that the milk injures it less." The seventeenth-century midwives book^[4] recommended postponing breastfeeding until the lochia cease "because

those unclean purgations cannot make good milk." Whereas eighteenth-century Nurse's Guide^[5] warned against several disorders that could affect the infant from nursing on this milk. "He will be subject to the Epilepsy, or Falling-Sickness." In the nineteenth century, Morton^[6] elaborated on such diseases that "frequently arise in children from lactation," they included "rickets, convulsions, epilepsy, and finally, meningitis, which gives increase to the well-known and fatal disease termed hydrocephalus." As for the "harms" of breastfeeding process on maternal health, Morton concluded: "Disorders frequently produced in women by that process;... lose their good looks, become gradually weaker, and as their strength declines, their milk is simultaneously lessened in quantity, and altered in its other properties,... pain in the head,... perspirations by the night,... and pulmonary consumption." Furthermore, many authorities recommended that women should not breastfeed when they return to their normal sexual activity after birth; because this will turn their milk "very harmful,... a real venom for the infants."^[3]

This practice of discarding "the unclean milk" and postponing breastfeeding made it impossible, except for few mothers, to

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maintain lactation. Thus, delayed breastfeeding became, in reality, no breastfeeding at all. Luckily, the advent of modern ages brought some changes, and voices of dissent started to increase. Cadogan^[7] wrote: “mother’s first milk is purgative, and cleanses the child from its long-hoarded excrement.” Boerhaave^[8] also reported the benefits of colostrum: “The first milk after delivery is not thick, but watery, subtle, and very much different to that which accumulates in the breast during the milk fever. It purges the infant gently and cleans the digestive tract.”

A VIEW FROM THE EAST

Local civilizations on the other side of the Mediterranean basin had different views of this issue; the value of human milk was reflected in their folklore and mythology, which designated cherished goddesses (such as Inanna in Mesopotamia and Hathor in Egypt) as protectors of breastfeeding. According to the Ebers papyrus,^[9] dating back to sixteenth century BC, infants in ancient Egypt were breastfed for 3 years. It asserts that “nothing is more lawful than one’s mother’s milk.” Of interest, Biblical sources indicate that the average duration for suckling was about 3 years and the hire of wet nurses was a well-organized practice a thousand of years before Christ.^[10]

Avicenna (Ibn Sina),^[11] in his prominent book Canon of Medicine wrote: “whenever possible, mother’s milk should be given and by suckling. The duration of lactation normally is 2 years... weaning must not be abrupt.... If there be anything to prevent the mother from giving milk, a wet nurse should be selected.” This advice resonates well with the Qur’anic teaching that decrees: “mothers shall give suck to their children for two whole years” (Qur’an, 2:233) and if a mother is unable or unwilling to do so then the infant’s father has to hire a wet nurse for this job.

EARLY FORMULAS

Industrialization of the west triggered many cultural and societal changes. Importantly, increased involvement of women in the workforce created a legitimate need for a human milk substitute that infant can use as mother returns to her work. Attempts to create such a substitute in the early 1800s were quite disappointing. Around the mid of the nineteenth century, a home-made liquid formula, made of wheat and malt flour cooked with cow’s milk, was introduced. In the first decade of the twentieth century, raw milk formulas showed up and gained popularity. They were prepared of cow’s milk, water, cream, and honey or sugar in specific proportions hoped to approximate the human milk. The first powdered formula came to existence in 1915, whereas evaporated milk formulas made their debut by the late 1930s, their affordability and ease of use made them an attractive option so that their sales surpassed all other formulas in the USA.^[12]

Many improvements followed and new ingredients were added to these preparations throughout the mid-1900s paving the road for the formula to become the infants’ food of choice

in the industrialized world. Unfortunately, the widespread of formula came with a high price, it brought about the less desired effects of shifting from traditional ways of infant care, mostly centered around breastfeeding, to a newer one with formula at its core; these untoward effects encompassed social, financial, and medical ones, most notably was the increased rates of many childhood illnesses including allergies and infections, especially diarrheal diseases and conditions related to the unsanitary preparation methods. Nonetheless, shrinking local markets in the 1960s and 1970s, mainly due to reduced birth rates, led formula companies to boost their marketing efforts in the less-developed world. Aggressive marketing along with legitimate need helped formula to find its way to these new markets, where a sizable segment of the world population resides.

EVOLUTION OF FORMULAS

Creating a formula that delivers most of the benefits of human milk and fixes its deficiencies is an elusive target. Importantly, a milk substitute, be it a nonideal formula, is still in need when breastfeeding is deemed contraindicated. These conditions include some maternal infections (e.g., HIV and Tuberculosis), psychiatric illnesses, malignancies, and the use of cytotoxic drugs. Infant’s conditions that preclude successful breastfeeding may include birth defects, inborn errors of metabolism, and the risk of malnutrition among others. Specific financial, societal, and cultural factors may make formula, at times, a more suitable option as well. All of this urged concerned agencies to set standards for acceptable formulas.

The Global Strategy for Infant and Young Child Feeding,^[13] published jointly by the WHO and UNICEF, stated that formula should “meet applicable standards recommended by the *Codex Alimentarius* Commission” and cautioned that “lack of breast-feeding, and especially lack of exclusive breastfeeding during the first 6 months of life, are important risk factors for infant and childhood morbidity and mortality.” Currently, formulas designed for healthy term infants meet these requirements and are considered a reasonable substitute for human milk. Formulas designed for the preterm infants promise to be not only an acceptable substitute for human milk but also to compensate for its nutritional deficiencies such as low concentrations of protein and calcium.

HUMAN MILK RETURNS

As formula failed to deliver, a comeback of human milk was certain. This comeback received significant support from many international health authorities such as the WHO which launched jointly with UNICEF the “baby-friendly hospital initiative” (BFHI) in 1991. Later on, this initiative was endorsed by CDC and other governmental agencies. Other groups, however, seemed more coercive and rather ideological in their support. For instance, the La Leche League (a not-for-profit organization) referred to women who chose

not to breastfeed as “bad yuppie mothers”^[14] (more information about BFHI on <https://www.babyfriendlyusa.org/get-started/the-guidelines-evaluation-criteria>).

Certainly, exclusive breastfeeding and “rooming-in” have revealed benefits, but they are not totally risk-free. New evidence suggests that strict adherence to the 10 steps of the BFHI may have contributed to the promotion of potentially dangerous practices, and led to untoward outcomes.^[15] Indeed, insisting on full compliance with these steps of the initiative may overwhelm a physically unfit mother and expose the infant to unsafe conditions (co-bedding, soft mattress, and prone positioning).^[16] Furthermore, a recent report has described several cases of sudden unexpected postnatal collapse in healthy newborns during early skin-to-skin care. This report is a sobering call for balancing the efforts to promote breastfeeding with the need to implement safe sleep practices.^[17]

HUMAN MILK SHORTCOMINGS

The recent report by the US Preventive Services Task Force indicated the failure of system-level interventions (such as BFHI) to improve exclusivity or duration of breastfeeding, however, individual-level interventions (such as counseling and education) were more likely to be effective, especially if they were delivered at more than one period (e.g., in both antenatal and postnatal periods).^[18] Feeding the preterm infant exclusively with human milk presents another dilemma; despite its better tolerance profile and the role it plays in protection against serious infections and necrotizing enterocolitis, its low concentrations of many nutritional components, such as protein calcium and Vitamin D, make it unwise for use (especially in the case of the extreme preterm infants) without the right amount and type of supplements. The fear that such supplementation would impact breastfeeding duration negatively is unsubstantiated. Indeed, credible evidence indicated that no adverse effect on the duration of breastfeeding was observed when supplementation was given for a medical indication.^[19]

CONCLUSIONS

Although the universal acceptance of the role that exclusive breastfeeding could play in improving infants' outcomes, the challenge is how to promote it safely. Apparently, there is a need for full compliance with established safe sleep practices while striving to promote breastfeeding. Furthermore, a higher emphasis should be placed on improving current formulas and/or creating new ones so that the nutritional needs of all infants, healthy and nonhealthy alike, can be met.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Cresswell R. Aristotle History of Animals; In Ten Books. Translated for Bohn's Classical Library. London: George Bell & Sons; 1883. p. 72, 192.
2. Green RM. A Translation of Galen's Hygiene (de Sanitate Tuenda). Springfield, Ill.: Charles C. Thomas; 1951. p. 24-9.
3. Obladen M. Bad milk, part 2: New-age doctrines that impeded breastfeeding. *Acta Paediatr* 2012;101:1189-91.
4. Sharp J. The Midwives Book: Or the Whole Art of Midwifery Discovered. London: Simon Miller; 1671. p. 351-71.
5. Eminent Physician. The Nurse's Guide: Or, the Right Method of Bringing Up Young Children. London: Brotherton and Gilliver; 1729. p. 28-39.
6. Morton E. Remarks on the Subject of Lactation: Containing Observations on the Healthy and Diseased Conditions of the Breast-Milk; The Disorders Frequently Produced in Mothers by Suckling; And Numerous Illustrative Cases. London: Longman, Rees, Orme, Brown, and Green; 1831. p. 3, 14, 24.
7. Cadogan W. An essay upon nursing and the management of children, from their birth to three years of age. In: A Letter to One of the Governors of the Foundling Hospital. London: J Roberts; 1750. p. 15, 18, 27.
8. Boerhaave H. Traité des maladies des enfans. traduit du Latin des Aphorismes de Boerhaave, commentés par M. le Baron de Van-Swieten, par: Paul MAVignon: Saillant & Nyon; 1759. p. 38.
9. Koçtürk T. Foetal development and breastfeeding in early texts of the Islamic tradition. *Acta Paediatr* 2003;92:617-20.
10. Wickes IG. A history of infant feeding. I. Primitive peoples; ancient works; renaissance writers. *Arch Dis Child* 1953;28:151-8.
11. Dunn PM. Avicenna (AD 980-1037) and Arabic perinatal medicine. *Arch Dis Child Fetal Neonatal Ed* 1997;77:F75-6.
12. Fomon SJ. Infant Feeding in the 20th Century: Formula and Beikost. San Diego, CA: Department of Pediatrics, College of Medicine, University of Iowa; 2001.
13. World Health Organization. Global Strategy for Infant and Young Child Feeding. Geneva: World Health Organization; 2003.
14. Blum LM. At the Breast: Ideologies of Breastfeeding and Motherhood in the Contemporary United States. Boston: Beacon Press; 1999. p. 63.
15. Bass JL, Gartley T, Kleinman R. Unintended consequences of current breastfeeding initiatives. *JAMA Pediatr* 2016;170:923-4.
16. Helsley L, McDonald JV, Stewart VT. Addressing in-hospital “falls” of newborn infants. *Jt Comm J Qual Patient Saf* 2010;36:327-33.
17. Goldsmith JP. Hospitals should Balance Skin-to-Skin Contact with Safe Sleep Practices. *AAP News*; 28 October, 2013. Available from: <http://www.aapublications.org/content/34/11/22>. [Last accessed on 2017 Dec 05].
18. Patnode CD, Henninger ML, Senger CA, Perdue LA, Whitlock EP. Primary care interventions to support breastfeeding: Updated evidence report and systematic review for the US preventive services task force. *JAMA* 2016;316:1694-705.
19. Vallenat C, Savage F, editors. Step 6: Use of Supplements. In: Evidence for the Ten Steps to Successful Breastfeeding. Geneva, Switzerland: Division of Child Health and Development/World Health Organization; 1998. p. 48-56.

Research Productivity of Health-care Institutions of Saudi Government: Ten-year Based Bibliometric Analysis

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Abstract

Background: Saudi Arabia has recognized the significance of scientific research in social, health-care, and economic transformation and has established a large number of advanced research institutes. This study aimed to investigate the research progress of various universities and research institutes of Saudi Arabia during 2006–2016. **Methods:** In this bibliometric analysis, we investigated research publications published by a number of well-recognized health-care institutions and research centers to authenticate the scientific research productivity in Saudi Arabia during 2006–2016. The Saudi public institutions were selected based on their research activity in the field of medical and health science. The research publications were recorded from Institute of Scientific Information-Web of Science, Thomson Reuters (Clarivate Analytics). **Results:** During 2006–2016, King Saud University (KSU) published the highest number of publications (9954) followed by King Faisal Specialist Hospital and Research Center (KFSHRC) (3886). Moreover, King Abdulaziz Medical City published 685 articles, King Fahad Medical City 486, King Khaled Eye Specialist Hospital 425, Riyadh Military Hospital 165, and Prince Sultan Cardiac Centre and Research Centre published 108 articles. KSU's contribution to medical and health sciences was 63.4% followed by KFSHRC at 24.7% and the rest of the institutions contributed 12% of research publications. **Conclusions:** In Saudi Arabia, KSU produced the highest number of research articles during 2006–2015. This high research productivity shows the leadership visionary approach, proper spending of the research funding, and their faculty members' contributions.

Keywords: Bibliometric, research productivity, Saudi government, Saudi health-care institutions

INTRODUCTION

Saudi Arabia has recognized the significance of scientific research in social and economic transformation and has established a large number of universities and advanced research institutes. These institutes have been extended to the far-flung areas of the country.^[1] Research in medicine and allied health sciences is an essential domain to produce physicians with high standards of medical knowledge, skills, and professionalism in medical practice and provide better health-care services.^[2]

In the past decades, the Kingdom of Saudi Arabia established a dynamic environment for scientific research. This period was the golden era of research revolution in Saudi Arabia.^[1] The Saudi government rewarded special attention on scientific research through planning to implement specialized research centers and several centers of excellence.^[3] In 2017, Saudi Ministry of Education launched multiple research-based

programs to motivate the universities and research institutes to produce quality scientific research in the region^[3] and ultimately to provide health-care services to the nation.

Keeping in view the efforts of the Saudi government in promoting research in the country, this study aimed to investigate the research production of various universities and research institutes of Saudi Arabia during 2006–2016.

METHODS

This observational study was conducted in the College of Medicine, Research Centre (CMRC), King Saud University

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(KSU), Riyadh, Saudi Arabia, from June 2017 to December 2018. In this bibliometric analysis, we recorded the research publications published by a number of well-recognized health-care institutions and research centers to authenticate the scientific research productivity in Saudi Arabia during 2006–2016.

The number of universities and research institutes was collected from the Ministry of Health and Ministry of Higher Educations.^[4] We selected the following universities and institutes which are highly recognized in scientific research in Riyadh, Saudi Arabia: KSU, King Faisal Specialist Hospital and Research Center (KFSHRC), King Khaled Eye Specialist Hospital, King Fahad Medical City, King Abdulaziz Medical City, Riyadh Military Hospital, Security Forces Hospital, Prince Sultan Cardiac Center, King Saud Medical City, and King Salman Hospital.^[4]

Data regarding scientific research publications in medical and allied health sciences published during 2006–2016 were obtained from the Institute of Scientific Information (ISI) Web of Science, Thomson Reuters (Clarivate Analytics).^[5] In scientific community, the Web of Science is considered the gold standard source for research discovery and analytics. Globally, it is a highly valid, reliable, coherent, and perfectly organized database, which contains data about research publications, citations, and indexed journals.^[5] Figure 1 depicts a comparison between major indexing databases.

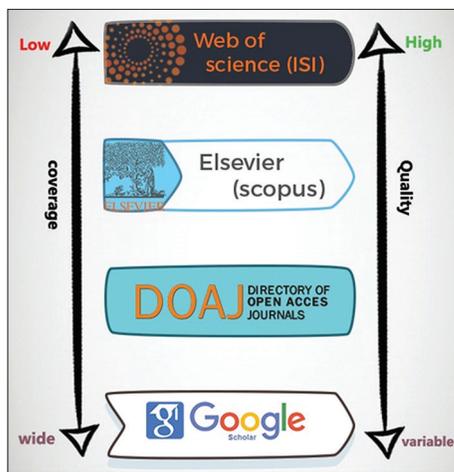


Figure 1: Comparison between major indexing databases

Using the Web of Science database, the name of the country “Saudi Arabia” and the name of the Saudi governmental health-care institutions such as “King Saud University,” “King Faisal Specialist Hospital and Research Center,” and “King Abdulaziz Medical City” were entered. For the recording of bibliometric indicators, research outcome in Saudi Arabia was selected, and subject category, field of “medicine and allied health sciences,” and detailed information regarding the bibliometric indicators including the total number of research papers (documents) in medical and allied health sciences were obtained.

RESULTS

Table 1 summarizes the research productivity of different public sector universities and institutes from Riyadh, Saudi Arabia, during 2006–2016. KSU achieved the highest number of publications of 9954 followed by KFSHRC of 3886. During the same period, King Abdulaziz Medical City published 685 articles, King Fahad Medical City 486, and King Khaled Eye Specialist Hospital had an output of 425 publications. Moreover, Riyadh Military Hospital and Prince Sultan Cardiac Centre produced 165 and 108 publications, respectively [Table 1 and Figure 2].

KSU’s contribution to medical and health publication output among Riyadh medical institutions was 63.4% followed by KFSHRC (24.7%) [Figure 2], and the rest of institutions share the remaining 12%. The highest percentages among the rest of the five facilities were 4.4% and 3.1% for King

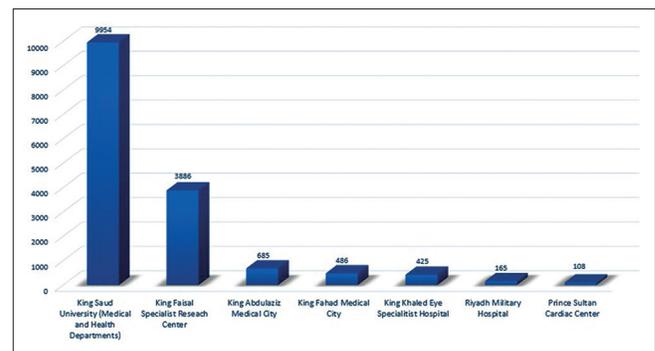


Figure 2: Total number of publications for Riyadh province medical institutions

Table 1: Yearly publications output of Riyadh province medical institutions (source: Web of science)

| Healthcare institution | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 |
|---|------|------|------|------|------|------|------|------|------|------|------|
| King Saud University (Medical and Health Departments) | 1924 | 1676 | 1414 | 1197 | 1191 | 1033 | 621 | 313 | 232 | 178 | 175 |
| King Faisal Specialist and Research Centre | 518 | 530 | 425 | 403 | 345 | 354 | 266 | 244 | 274 | 247 | 280 |
| King Abdulaziz Medical City | 202 | 168 | 102 | 71 | 27 | 30 | 22 | 16 | 23 | 17 | 7 |
| King Fahad Medical City | 180 | 120 | 69 | 36 | 22 | 12 | 12 | 17 | 11 | 3 | 4 |
| King Khaled Eye Specialist Hospital | 121 | 106 | 52 | 35 | 28 | 21 | 12 | 13 | 15 | 10 | 12 |
| Riyadh Military Hospital | 9 | 18 | 16 | 24 | 17 | 14 | 18 | 13 | 18 | 12 | 6 |
| Prince Sultan Cardiac Centre | 26 | 36 | 17 | 4 | 5 | 6 | 6 | 2 | 2 | 4 | 0 |

Abdulaziz Medical City and King Fahad Medical City, respectively [Figure 3].

Quantifying the quality of published articles has the same level of significance as the research output. The h-index of KSU publications was the highest (97) followed by KFSHRC (80). KSU published scientific articles which had been cited 97,951 times during this period followed by the published articles of KFSHRC (41,960 total citations) [Table 2].

DISCUSSION

The government of Saudi Arabia has made tremendous efforts to enhance the country’s educational and research system by introducing new educational programs and the establishment of numerous universities and advanced research institutes,^[1] especially in the health-care sector. In the present study, we found that in Saudi Arabia, KSU produced the highest number of research articles during 2006–2015. This high research productivity shows the leadership visionary approach, proper spending of the research funding, and their faculty members’ contributions.

The Saudi government has announced the 2030 Vision, which established a number of objectives in order to achieve the strategic plan of the country. One of the most important goals pertaining to education was to include at least five Saudi universities in top 200 universities and the most important standard to measure the universities’ progress is the research productivity.^[6] At present, four Saudi Universities are in top 500 universities in the country.^[6]

In the present study, the primary source for data collection was ISI-Web of Science (Clarivate Analytics). Publishing in an ISI-indexed journal is an essential indicator and considered a significant contribution in a subject. Including the medical and health allied departments of KSU in this analysis was necessary to reveal its incorporation in delivering the goals of the 2030 Vision. KSU’s organizational structure includes King Khalid University Hospital, King Abdulaziz University Hospital, and several research centers and research chairs. KSU’s medical and clinical units showed a commitment toward the 2030 vision

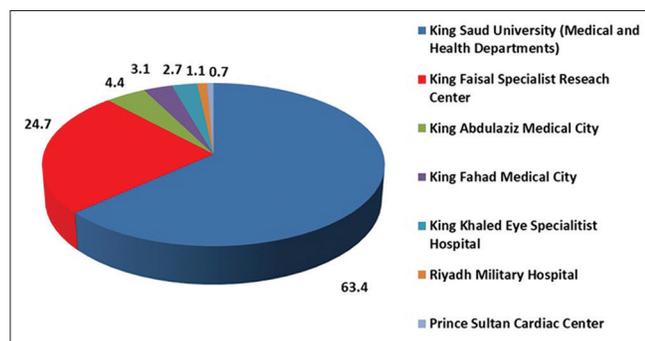


Figure 3: Ten-year research productivity per Riyadh province medical institution

at various levels by attaining the highest number of publications with the highest quality among the other institutions in Riyadh region.

KSU and KFSHRC were ahead on the list, with the most significant share of publications’ productivity. Mostly, this refers to the fund they receive; besides the high quality of their staff, they use international standards in employing their staff.

Bin Abdulrahman^[7,8] demonstrated that Saudi Arabia had made apparent contributions in scientific research. Meo^[1] published a study and concluded that Saudi Arabia has been passing through a revolution of technology transformation period to meet the mandate of transforming the country into a knowledge-based innovative economy. The country has high ambitions of advancing from the factor-based economic development to the innovation-based economic growth. The present study findings are in agreement with the findings of Meo (2015). In another study, Meo *et al.*^[2] reported that Saudi Arabia’s research performance in global medical sciences has markedly increased during 2006–2012. The research publications are continuously on a mounting path. The country improved its regional as well as international research rankings in the world.

Study strengths and limitations

We obtained the research publications from a very reliable source such as ISI, Web of Science, Thomson Reuters (Clarivate Analytics), which is the strength of the study. However, the limitation of the present study is that during the search of research publications, citation count tools may occasionally wrongly cite the research article with slightly different details. This may affect the number of research papers or citation counts [Figures 4 and 5].

Table 2: Citation report of Saudi Healthcare Institutions and Research Centers (source: Web of science)

| | h-index | Average citations per article | Total publications | Sum of times cited |
|---|---------|-------------------------------|--------------------|--------------------|
| King Saud University (Medical and Health Departments) | 97 | 9.84 | 9954 | 97,951 |
| King Faisal Specialist and Research Centre | 80 | 10.8 | 3886 | 41,960 |
| King Abdulaziz Medical City | 40 | 14.89 | 685 | 10,203 |
| King Fahad Medical City | 32 | 15.12 | 486 | 7348 |
| King Khalid Eye Specialist Hospital | 28 | 8.09 | 425 | 3437 |
| Riyadh Military Hospital | 25 | 14.07 | 165 | 2322 |
| Prince Sultan Cardiac Centre | 11 | 6.15 | 108 | 664 |

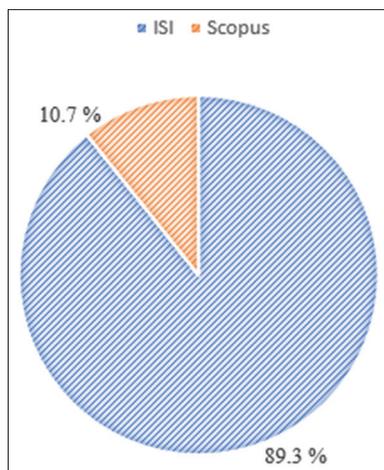


Figure 4: Number of Institute of Scientific Information and Scopus publication from 2007 to 2017 for researchers, doctors, and teaching staff at the College of Medicine, King Saud University (source: Top Academia)

CONCLUSIONS

KSU produced the highest number of research articles during 2006–2016. This high research productivity shows the leadership visionary approach of the university, proper spending of the research funding, and their faculty members' contributions.

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Nil.

Conflicts of interest

There are no conflicts of interest.

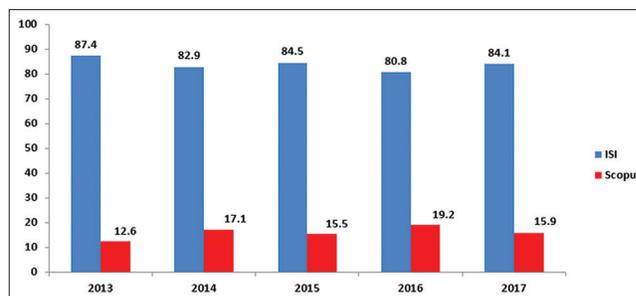


Figure 5: Frequency distribution of publication for different years of Institute of Scientific Information and Scopus for researchers, doctors, and teaching staff at the College of Medicine, King Saud University (2013–2017) (source: Top Academia)

REFERENCES

1. Meo SA. Saudi Arabia: A future regional hub for advanced education, research, science and technology. *J Pak Med Assoc* 2015;65:1112-5.
2. Meo SA, Hassan A, Usmani AM. Research progress and prospects of Saudi Arabia in global medical sciences. *Eur Rev Med Pharmacol Sci* 2013;17:3265-71.
3. The Secretariat of the Research Centers of Excellence. Available from: <https://www.moe.gov.sa/en/TheMinistry/TheSecretariatsAndcommittees/Pages/TheSecretariatOfTheResearchCentersOfExcellence.aspx>. [Last accessed on 2018 Jan 14].
4. Kingdom of Saudi Arabia – Ministry of Health Portal. Available from: <https://www.moe.gov.sa/en/HigherEducation/ExternalEducation/Pages/RecommendedUniversities.aspx>. [Last accessed on 2018 Jan 12].
5. Journal Citation Report, ISI-Web of Knowledge. Available from: <http://www.webofknowledge.com/JCR/JCR?PointOfEntry=Home&SID=4FeKpokbnHkLmE1OGe>. [Last retrieved on 2018 Jan 12].
6. Academic Ranking of World Universities: ARWU World University. Available from: <http://www.shanghairanking.com>. [Last cited on 2018 Jan 22].
7. Khalid BA. The current status of medical education in the gulf cooperation council countries. *Ann Saudi Med* 2008;28:83-8.
8. Bin Abdulrahman KA. The value of medical education research in Saudi Arabia. *Med Teach* 2012;34 Suppl 1:S1-3.

Assessment of Sleep Quality, Daytime Sleepiness, and Depression among Emergency Physicians Working in Shifts

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Abstract

Background: Around-the-clock provision of medical care is needed particularly in acute care areas. Emergency physicians are constantly affected by rotating shifts. Therefore, we conducted this study to assess the sleep quality, daytime sleepiness, and depression among emergency physicians. **Methods:** This study is a cross-sectional case-control study. Participants were divided into two groups; primary participants were 68 emergency physicians working in a shift work system and the controls were 69 family medicine physicians working in a fixed daytime shift. A self-administered questionnaire was filled by all participants that comprised the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQI), and the Beck Depression Inventory. **Results:** Based on the PSQI, around 83.8% of emergency physicians had poor sleep quality, compared to 50.7% in the control group. Daytime sleepiness (ESS >10) was significantly higher in the emergency physicians in comparison to the control group (41.2% vs. 14.5%). A strong correlation was found between poor sleep quality and depression in emergency physicians ($r = 0.437$, $P = 0.001$). **Conclusion:** Emergency physicians working in a shift work system had a significant increase in daytime sleepiness and poor sleep quality. Depressive symptoms were noted among emergency physicians suffering from poor sleep quality.

Keywords: Circadian rhythm, emergency room, insomnia, night work, psychological function

INTRODUCTION

Shift work is a working system in which different groups of workers divide work across the 24 h of the day to provide continuous service coverage. Shift work systems typically divide the 24 h of the day into segments, i.e., “Shifts.” However, it can also include long- and short-term night shifts or nonstandard working hours.^[1,2]

Shift work has an important socioeconomic impact and is crucial to health-care delivery. However, shift work may increase the susceptibility of individuals to misalignment between the sleep/wake cycle of shift workers and their endogenous circadian rhythm.^[3] Shift work has also been linked to an increased risk of several adverse health outcomes such as cardiovascular disease,^[4] breast cancer,^[5] metabolic syndrome,^[6] gastrointestinal disease,^[4] menstrual irregularities,^[7] and psychological distress.^[8]

Sleep quality is affected by shift work, and this effect may extend to the days following irregular working hours, leading to insomnia and sleepiness.^[9] Affected

sleep quality may, in turn, result in sleep deprivation and cumulative sleep debt in shift workers; this effect may lead to impaired performance^[10] and reduced psychomotor vigilance,^[11] therefore increasing the risk of work-related injuries.^[12] Night shift, in particular, may increase the risk of work-related accidents.^[13] In addition, several studies have linked mental health disorders such as depression and anxiety to shift work.^[14]

No study has assessed the interaction between sleep quality, sleepiness, and depression among emergency physicians. Therefore, we conducted this study to assess sleep quality, daytime sleepiness, and depressive symptoms among emergency physicians.

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METHODS

This cross-sectional case-control study was conducted between November 2015 and April 2016. Cases were randomly (simple random) chosen emergency physicians who have worked regularly in shift work for at least 3 months. Controls were randomly (simple random) chosen family medicine physicians who have a fixed daytime shift. The study took place in nine major hospitals in Riyadh, Saudi Arabia, including King Khalid University Hospital, King Faisal Specialist Hospital and Research Center, King Fahad Medical City, National Guard Hospital, Prince Sultan Military Medical City, King Saud Medical Complex, Imam Abdulrahman bin Faisal Hospital, King Salman Hospital, and Prince Mohammed bin Abdulaziz Hospital. The study was approved by the ethics committee at the College of Medicine, King Saud University, and informed consent was obtained from all participants.

Data collection

Data were collected via a self-administered questionnaire. English language was used, as all participants could read and understand English.

The first part of the questionnaire has four segments: demographic data, a question about whether there was a previous diagnosis of depression or a sleep disorder and a question about whether the patient was on any medication at the time of filling the questionnaire. Three additional validated questionnaires were used to assess different aspects related to sleep quality, daytime sleepiness, and depression; the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQI), and the Beck Depression Inventory (BDI).

The ESS is a validated questionnaire used to assess the propensity to fall asleep during different daily situations.^[15] It consists of eight situations in which the participant is asked to fill in the chance of dozing in each situation during the month before filling the questionnaire. The score for each question ranges from 0 to 3 depending on the degree of probability of dozing, a total score ranges from 0 to 24 points. A total score of “10” or more indicates daytime sleepiness.

The PSQI is used to measure the quality and pattern of sleep in adults.^[16] It consists of ten questions with a 7-component scoring system that measures subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction over the past month.^[17] Each item is weighted on a 0–3 interval scale. The PSQI score is then calculated by adding the seven component scores, providing an overall score ranging from 0 to 21, where lower scores denote a healthier sleep quality. A total score of “5” or higher is indicative of poor sleep quality.

The BDI is a questionnaire composed of 21 multiple-choice questions. It is a self-reporting scale used in the detection and treatment monitoring of depressive symptoms. Questions in the BDI can be answered in a range from 0 to 3, with a possible score between 0 and 63. Scores of 0–13 suggest normal to

minimal depression, while 14–19 indicate mild depression, 20–28 moderate depression, and 29–63 severe depression.^[18,19]

Statistical analysis

Data are shown as the mean \pm standard deviation. The comparison of categorical variables between groups was performed with the Chi-square test. The comparison of continuous variables was performed with Student's *t*-test or Mann-Whitney *U*-test if the normality test failed. To explore correlations between the PSQI, ESS, and BDI scores, Pearson's correlation coefficient was used. $P \leq 0.05$ was considered statistically significant. The data were analyzed using Statistical Package for the Social Sciences, IBM version 22 (SPSS Inc., Chicago, IL, USA) software.

RESULTS

This study included a total of 137 participants divided into two groups (cases and controls). The emergency physicians' group (cases) comprised 68 participants. The control group comprised 69 family medicine physicians. The demographics of the two groups are shown in Table 1. There were no statistically significant differences in the demographics of the two groups apart from age, where the mean age of the emergency physicians' group was 35.2 years and the mean age for the control group participants was 40.4 years. There was a higher number of male participants in both groups, 48 male participants in the emergency physicians' group and 40 male participants in the control group, comprising 70.6% and 58%, respectively. The average number of shifts per month for emergency physicians was 4.9 ± 0.9 .

Table 2 shows the comparison of the ESS, PSQI, and BDI scores between the two groups. The mean total score of the

Table 1: Demographic data of cases and controls

| | Total (<i>n</i> =137) | Mean \pm SD/ <i>n</i> (%) | | <i>P</i> |
|-----------------------------|---------------------------|--|-----------------------------|----------|
| | | Emergency physicians (<i>n</i> =68) | Controls (<i>n</i> =69) | |
| Age (years) | 37.7 \pm 9.9 | 35.2 \pm 8.6 | 40.4 \pm 10.5 | 0.003 |
| Average number of shifts | - | 4.9 \pm 0.9 | - | |
| Gender | | | | |
| Male | 88 (64.2) | 48 (70.6) | 40 (58) | 0.123 |
| Marital status | | | | |
| Single | 29 (21.2) | 17 (25) | 12 (17.4) | 0.240 |
| Married | 103 (75.2) | 50 (73.5) | 53 (76.8) | |
| Divorced | 5 (3.6) | 1 (1.5) | 4 (5.8) | |
| Professional ranking | | | | |
| Consultant | 39 (28.7) | 13 (19.1) | 26 (38.2) | 0.065 |
| Assistant professor | 5 (3.7) | 2 (2.9) | 3 (4.4) | |
| Registrar | 37 (27.2) | 20 (29.4) | 17 (25) | |
| Resident | 55 (40.4) | 33 (48.5) | 22 (32.4) | |

SD: Standard deviation

ESS in the emergency physicians' group was 9.1 ± 4.6 , which was significantly higher than that of the control group that has a mean ESS score of 6.1 ± 3.8 ($P \leq 0.001$). Among the emergency physicians' group, 28 participants (41.2%) scored ≥ 10 on the ESS (indicating increased daytime sleepiness) and that was significantly higher than the control group in which only ten individuals (14.5%) scored ≥ 10 on the ESS ($P \leq 0.001$).

Mean total PSQI scores in the emergency physicians' group was 8.3 ± 4 ; it was significantly higher than the control group that has a mean score of 5.3 ± 3.2 ($P < 0.001$). The number of participants scoring ≥ 5 on the PSQI (indicating poor sleep quality) was significantly higher among emergency physicians' group than that of the control group, 57 (83.8%) and 35 participants (50.3%), respectively ($P < 0.001$). Although the scores of emergency physicians and controls were within normal range, emergency physicians had a significantly higher BDI score, which may reflect a higher tendency to develop depression. When using a cutoff value of < 13 to define no depression, 59% ($n = 40$) were normal in the emergency physicians' group compared with 78% ($n = 54$) in the control group ($P < 0.02$).

Table 3 shows Pearson's correlation coefficient results between the ESS, PSQI, and BDI scores in the emergency physicians'

Table 2: Comparison of Epworth Sleepiness Scale, Pittsburgh Sleep Quality Index, and Beck Depression Inventory scores between cases and controls

| Variable | Total (n=137) | Mean±SD/n (%) | | P |
|--|------------------|-----------------------------------|--------------------|--------|
| | | Emergency physicians (n=68) | Controls (n=69) | |
| ESS score (total) | 7.6±4.5 | 9.1±4.6 | 6.1±3.8 | <0.001 |
| ESS score ≥ 10 (daytime sleepiness) (%) | 38 (27.7) | 28 (41.2) | 10 (14.5) | |
| PSQI score | 6.8±3.9 | 8.3±4 | 5.3±3.2 | <0.001 |
| PSQI score ≥ 5 (poor sleep quality) (%) | 92 (67.2) | 57 (83.8) | 35 (50.7) | <0.001 |
| BDI score | 8.8±9.1 | 11.5±10.1 | 6±7.1 | <0.001 |
| BDI < 13 (no depression) (%) | 94 (68.6) | 40 (59) | 54 (78.3) | 0.02 |

SD: Standard deviation, ESS: Epworth Sleepiness Scale, PSQI: Pittsburgh Sleep Quality Index, BDI: Beck Depression Inventory

Table 3: Pearson's correlation coefficient results between the Epworth Sleepiness Scale, Pittsburgh Sleep Quality Index, and Beck Depression Inventory in emergency physicians

| Variable (total n=68) | r | P |
|------------------------------------|-------|--------|
| ESS score versus global PSQI score | 0.178 | 0.146 |
| ESS score versus BDI score | 0.172 | 0.161 |
| BDI score versus PSQI score | 0.437 | <0.001 |

ESS: Epworth Sleepiness Scale, PSQI: Pittsburgh Sleep Quality Index, BDI: Beck Depression Inventory

group, and Figure 1 shows a scatterplot between ESS, PSQI, and BDI scores in emergency physicians. Using the Pearson's correlation coefficient, there was a strong correlation between emergency physicians with poor sleep quality (i.e., scores of ≥ 5 on PSQI) and depressive symptoms as assessed by the BDI scores ($r = 0.437$, $P < 0.001$).

DISCUSSION

This study shows that emergency physicians have more sleep disturbances compared to controls (physicians without shift work). The majority of emergency physicians (83.8%) had poor sleep quality (a score ≥ 5) on the PSQI.

Previous studies have shown that shift workers, in general, have poor sleep quality compared to controls. A prior study by AlMetrek in factory workers in Aseer region, Saudi Arabia, demonstrated a higher percentage of poor sleep quality among shift workers when compared to nonshift workers.^[20] Furthermore, our findings concur with a recent study conducted among health-care professionals, which revealed that shift workers had higher PSQI global scores and higher ESS scores in comparison to nonshift workers.^[21]

Shift work is considered an important factor that affects performance and safety.^[22] There is an increased risk of accidents among shift workers,^[23,24] with subsequent significant socioeconomic costs.^[25] Akerstedt *et al.* showed that self-reported disturbed sleep predicts accidental death at work, even when controlling for stress and physical workload. Similarly, a study by Barger *et al.* demonstrated an increased risk of motor vehicle accidents in interns with extended-duration work shifts.^[26] On the other hand, it has been shown that improving resting conditions for interns

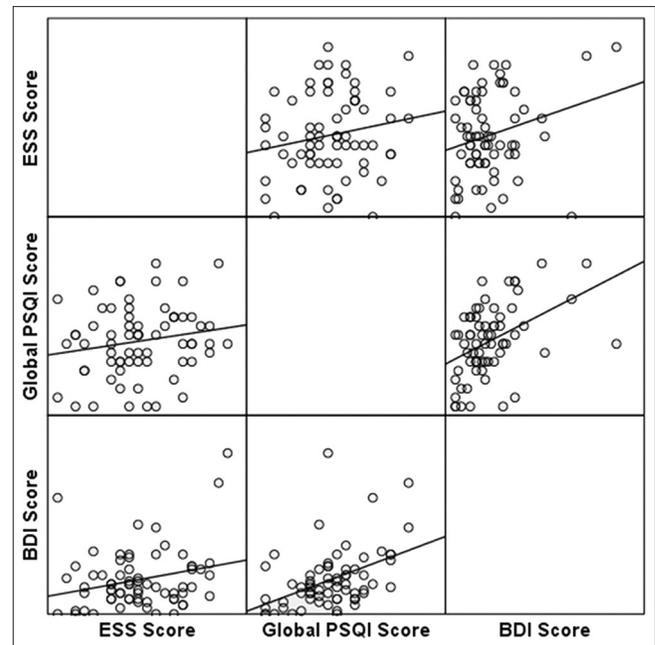


Figure 1: Graphs of the scatterplot between ESS, PSQI, and BDI scores in emergency physicians

with extended work shifts resulted in improved sleep and significantly decreased medical mistakes.^[27] In this study, the high percentage of poor sleep quality among emergency physicians demonstrates the importance of implementing practical countermeasures that may improve sleep and alertness among emergency physicians to avoid mistakes that may accompany poor sleep.

The American College of Emergency Physicians (ACEP) considers shift work as an important area that may affect emergency physicians' well-being.^[14] In addition, the ACEP indicates that patients are served better when emergency physicians practice in a supportive environment.^[14]

Disturbances of sleep and circadian rhythm that occur in shift workers may increase the risk of depression. A recent systematic review demonstrated that nighttime shift work (outside health sector) does increase the risk of depression.^[28] In general, longitudinal studies that assessed depression among shift workers in a wide variety of occupations reported an increased risk of depressive disorders in some subgroups over an extended observation period (more than 4 years).^[28] In a recent integrative review that critically evaluated the impact of shift work on the psychological functioning and resilience of nurses demonstrated lack of longitudinal studies in health-care shift workers.^[29] However, the review concluded that for some nurses, shift work is associated with negative psychological outcomes and these outcomes appear highly dependent on contextual and individual factors.^[29] No studies have adequately assessed depression in emergency physicians. In our study, although both emergency physicians and controls have normal BDI scores, the score of the emergency physicians was significantly higher than that of the controls, which may reflect a tendency to develop depression. In addition, the percentage of emergency physicians with a BDI score <13 was significantly lower than that in the controls. To recognize the impact of shift work on the psychological functioning of emergency physicians, future studies should apply longitudinal designs.

Several coping strategies have been described to prevent fatigue and insomnia among shift workers. These strategies may include scheduled napping, exposure to light at work, and special nutrition guidelines such as taking caffeine, especially at the start of a night shift.^[30,31] Scheduled short napping which minimizes sleep inertia has generally been shown to be helpful.^[32] Bright light is a promising effective method to reduce both fatigue and insomnia. However, there is still a lack of standardized recommendations for light therapy. It is proposed that effective use of light may result in an adaptation to the extended night shift period and enhance the subsequent readaptation to daytime activities.^[33]

The ACEP suggested some solutions to ameliorate the impact of night shifts on physicians.^[14] Whenever possible, shift schedules should be in a manner consistent with circadian principles that rotate in a clockwise manner (day to evening to night). In addition, when possible, long shifts on consecutive nights should be avoided.

Moreover, the ACEP recommends scheduling isolated night shifts or relatively long sequences of night shifts, and it also advocates that shift duration should be no longer than 12 h, there should be regular scheduling of at least 24 h off-duty and a place must be provided to sleep before driving home after night shifts.^[14] Future call schedules should consider the total number of hours worked by each physician and the intervals of time off between shifts. To modify the circadian rhythm and adapt to the new shift, the ACEP stresses that physicians should have regularly scheduled periods of at least 24 h off work. Night shift workers' schedules need to be meticulously designed to provide for planned sleep periods. A critical point that needs clear attention of emergency physicians and the management of emergency departments is providing a place to sleep before driving home after night shifts.

Limitations

This study has a few limitations. First, the proportion of male participants is higher than female participants. Thus, the results cannot be generalizable to both sexes. Second, the number of participants in both groups was relatively small. Nevertheless, the findings may simulate a larger national study to assess the impact of shift work on emergency physicians. Third, shift time and frequency were not accounted for in the questionnaire, which are parameters that may affect the degree of sleep deprivation and its consequences.

CONCLUSION

Shift work is an integral part of health-care systems. This study considered the association between shift work among emergency physicians and sleep quality, daytime sleepiness, and depressive symptoms. Daytime sleepiness was noted in both groups; however, it was significantly higher in emergency physicians. Furthermore, poor sleep quality was apparent among emergency physicians. Emergency physicians suffering from poor sleep quality had significant depressive symptoms, warranting counseling regarding sleep and the possible need for a psychiatrist's and sleep medicine physician's evaluation. Longitudinal studies are needed to consider shift work impact on health-care professionals and strategies to mitigate its negative effects.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Office of Technology Assessment. Biological Rhythms – Implications for the Worker: New Developments in Neuroscience. University Press of the Pacific; 2005.
- Grosswald B. The effects of shift work on family satisfaction. Families in society. J Contemp Soc Serv 2004;85:413-23.

3. Boivin DB, Boudreau P. Impacts of shift work on sleep and circadian rhythms. *Pathol Biol (Paris)* 2014;62:292-301.
4. Karlsson BH, Knutsson AK, Lindahl BO, Alfredsson LS. Metabolic disturbances in male workers with rotating three-shift work. Results of the WOLF study. *Int Arch Occup Environ Health* 2003;76:424-30.
5. Schernhammer ES, Kroenke CH, Laden F, Hankinson SE. Night work and risk of breast cancer. *Epidemiology* 2006;17:108-11.
6. Biggi N, Consonni D, Galluzzo V, Sogliani M, Costa G. Metabolic syndrome in permanent night workers. *Chronobiol Int* 2008;25:443-54.
7. Labyak S, Lava S, Turek F, Zee P. Effects of shiftwork on sleep and menstrual function in nurses. *Health Care Women Int* 2002;23:703-14.
8. Shields M. Shift work and health. *Health Rep* 2002;13:11-33.
9. Åkerstedt T. Shift work and disturbed sleep/wakefulness. *Sleep Med Rev* 1998;2:117-28.
10. Elmenhorst D, Elmenhorst EM, Luks N, Maass H, Mueller EW, Vejvoda M, *et al.* Performance impairment during four days partial sleep deprivation compared with the acute effects of alcohol and hypoxia. *Sleep Med* 2009;10:189-97.
11. Zhou X, Ferguson SA, Matthews RW, Sargent C, Darwent D, Kennaway DJ, *et al.* Mismatch between subjective alertness and objective performance under sleep restriction is greatest during the biological night. *J Sleep Res* 2012;21:40-9.
12. Uehli K, Miedinger D, Bingisser R, Dürr S, Holsboer-Trachsler E, Maier S, *et al.* Sleep quality and the risk of work injury: A Swiss case-control study. *J Sleep Res* 2014;23:545-53.
13. Swanson LM, Arnedt JT, Rosekind MR, Belenky G, Balkin TJ, Drake C, *et al.* Sleep disorders and work performance: Findings from the 2008 national sleep foundation sleep in America poll. *J Sleep Res* 2011;20:487-94.
14. American College of Emergency Physicians. Emergency Physician Shift Work 2017; Available from: <https://www.acep.org/Clinical-Practice-Management/Emergency-Physician-Shift-Work/#sm.0000pm567judad49xid2h9o279wa1>. [Last accessed on 2018 Jan 10].
15. Johns MW. A new method for measuring daytime sleepiness: The Epworth sleepiness scale. *Sleep* 1991;14:540-5.
16. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193-213.
17. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh sleep quality index. *J Psychosom Res* 1998;45:5-13.
18. Arnau RC, Meagher MW, Norris MP, Bramson R. Psychometric evaluation of the beck depression inventory-II with primary care medical patients. *Health Psychol* 2001;20:112-9.
19. Beck AT, Steer RA, Ball R, Ranieri W. Comparison of beck depression inventories -IA and -II in psychiatric outpatients. *J Pers Assess* 1996;67:588-97.
20. Almetrek M. Effect of shift-work on sleeping quality of male factory workers in Saudi Arabia. *Natl J Physiol Pharm Pharmacol* 2014;4:61-8.
21. Alshahrani SM, Baqays AA, Alenazi AA, AlAngari AM, AlHadi AN. Impact of shift work on sleep and daytime performance among health care professionals. *Saudi Med J* 2017;38:846-51.
22. Folkard S, Lombardi DA, Tucker PT. Shiftwork: Safety, sleepiness and sleep. *Ind Health* 2005;43:20-3.
23. Spurgeon A, Cooper CL. Working Time, Health and Performance. In: *WellBeing in Organizations*, Cooper C, Robertson I, editors. London; 2001. p. 91-124. ISBN: 0471495581.
24. Gold DR, Rogacz S, Bock N, Tosteson TD, Baum TM, Speizer FE, *et al.* Rotating shift work, sleep, and accidents related to sleepiness in hospital nurses. *Am J Public Health* 1992;82:1011-4.
25. Leger D. The cost of sleep-related accidents: A report for the national commission on sleep disorders research. *Sleep* 1994;17:84-93.
26. Barger LK, Cade BE, Ayas NT, Cronin JW, Rosner B, Speizer FE, *et al.* Extended work shifts and the risk of motor vehicle crashes among interns. *N Engl J Med* 2005;352:125-34.
27. Lockley SW, Cronin JW, Evans EE, Cade BE, Lee CJ, Landrigan CP, *et al.* Effect of reducing interns' weekly work hours on sleep and attentional failures. *N Engl J Med* 2004;351:1829-37.
28. Angerer P, Schmook R, Elfantel I, Li J. Night work and the risk of depression. *Dtsch Arztebl Int* 2017;114:404-11.
29. Tahghighi M, Rees CS, Brown JA, Breen LJ, Hegney D. What is the impact of shift work on the psychological functioning and resilience of nurses? An integrative review. *J Adv Nurs* 2017;73:2065-83.
30. Ker K, Edwards PJ, Felix LM, Blackhall K, Roberts I. Caffeine for the prevention of injuries and errors in shift workers. *Cochrane Database Syst Rev* 2010:CD008508.
31. Richter K, Acker J, Adam S, Niklewski G. Prevention of fatigue and insomnia in shift workers-a review of non-pharmacological measures. *EPMA J* 2016;7:16.
32. Rajaratnam SM, Howard ME, Grunstein RR. Sleep loss and circadian disruption in shift work: Health burden and management. *Med J Aust* 2013;199:S11-5.
33. Iwata N, Ichii S, Egashira K. Effects of bright artificial light on subjective mood of shift work nurses. *Ind Health* 1997;35:41-7.

Epistaxis: What Do People Know and What Do They Do?

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Abstract

Aim: The aim of this study is to assess the current knowledge of the first-aid management of epistaxis and misconceptions among the general Saudi population. **Methods:** A survey questionnaire was developed and was distributed through text message, E-mail, social networks, various websites, and web forums among the Saudi population. Responses were collected over a period of 2 months. Knowledge was assessed based on correct responses to six main questions. Five to six correct answers were considered as excellent knowledge, 3–4 as good knowledge, and 2 and below as poor knowledge. **Results:** There were 1760 individuals who responded to the survey, 577 (32.8%) were males. There were 828 respondents (47%) who received information on the first-aid management of epistaxis, the most common source of information was through a relative or a friend (15.7%). Only 199 respondents (11.3%) will apply pressure to control epistaxis, 99 (5.6%) knows where to correctly press, and 84 (4.78%) will correctly tilt the head forward. There were 132 respondents (7.5%) who thought that patients should be brought to the ER in all cases of epistaxis. There were 1111 respondents (63.2%) who have poor knowledge of first-aid management of epistaxis. **Conclusion:** There is poor knowledge of the first-aid management of epistaxis in the surveyed Saudi population. Increased awareness and information dissemination programs on the first-aid management of epistaxis can improve knowledge and recall among the general population.

Keywords: Epistaxis, first aid, general population, knowledge, Saudi

INTRODUCTION

Epistaxis commonly referred to as “nosebleed” remains to be one of the most common ENT emergencies presenting to the accident and emergency departments (AED) worldwide. In the United States, around 1.7% of all AED visits are due to epistaxis, and about 1 in 200 ED visits in the US is due to epistaxis.^[1] The incidence usually is bimodal affecting mostly those younger and the older population (<10 years old and >70 years old).^[1] Epistaxis that occurs in children younger than 10 years usually is mild and originates in the anterior nose, whereas epistaxis that occurs in individuals older than 50 years is more likely to be severe and to originate posteriorly.^[2] However, the incidence of epistaxis declines in adulthood, but approximately one-half of all adults with epistaxis had nosebleeds during childhood.^[3]

A multitude of causes of epistaxis in children has been reported from nose picking and idiopathic causes, to trauma, medications, nasopharyngeal mass, bacterial nasal colonization, allergic rhinitis, and to the less common cause such as an ectopic intranasal tooth.^[4-10] In adults, recurrent

epistaxis is found to be related to trauma, bleeding disorders, and neoplasia apart from the causes mentioned above similar to children.^[11] Some studies tried to find association or a cause and effect between epistaxis and hypertension but were not successful.^[12] Treatment of epistaxis has undergone significant changes over the years from the uncomfortable posterior nasal pack to the newly developed packing devices, indigenous hemostatic agents, and endoscopic surgical approaches.^[9]

In most of the cases, epistaxis usually occurs in an out-of-the-hospital setting. Thus, it is very important for nonhealth professional people to understand and to know some first aid measures for epistaxis. Unfortunately, these people have very poor knowledge of first aid measures for epistaxis.^[13] A survey conducted among 500 members of the public on how they would deal with a nosebleed revealed that

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only 50 of 443 responses (11.3%) have the knowledge on how to deal with epistaxis.^[14] Other studies also showed very poor knowledge of the first-aid treatment of epistaxis not only in public but also among health professionals.^[15] In one survey among health professionals, the most common first aid measures for epistaxis were pinching the nose (94%), nasal packing (80.6%), and sitting leaning forward position (76.1%), and only 38.1% of respondents revealed the correct site for pinching the nose.^[16] In the modern digital age, people usually use the Internet as sources of information, particularly YouTube. However, studies showed that many videos on how to manage epistaxis were found to proffer inappropriate and dangerous “alternative” advice.^[17]

There were very few and recent studies that investigated on how lay people deal with epistaxis when it occurs to them or their family and relatives. For this reason, we conducted this study to assess the current knowledge of the first-aid management of epistaxis and misconceptions among the general Saudi population.

METHODS

We conducted a descriptive study using a survey questionnaire that was developed to address the objectives of the study. The survey tool consisted of questions regarding the demographic profile of the respondents (age, gender, nationality, educational level, and place of residency) and questions on knowledge and sources of information about epistaxis. Identifiers such as name, address, and contact numbers of respondents were not asked to ensure confidentiality and protection of the respondents.

The survey tool was setup online using the surveymonkey.com (San Mateo, CA, USA) and was piloted on 10 respondents for clarity, errors, and technical issues before distribution. The actual survey was done by distributing the link to the surveymonkey through text message, E-mail, social networks, various websites, and web forums among the Saudi population along with the consent for participation in the survey/study. Responses were collected over a period of 2 months from September to October 2016. Data collected after the 2 months collection period were downloaded from the survey site as Microsoft Excel 2013 worksheet and was checked for the completeness of data.

Assessment of knowledge of first-aid management of epistaxis

Correct responses on six questions regarding the first-aid management of epistaxis including applying pressure on the nose, correct area of the nose where to apply pressure, duration of applying pressure, tilting the head, and packing and use of ice packs to control bleeding. Correct responses were given 1 point, and the sum of all responses was obtained. Five to six correct answers of six questions were considered as excellent knowledge, 3–4 as good knowledge, and 2 and below as poor knowledge.

Statistical analysis was performed using the IBM Statistical Package for the Social Sciences Software (SPSS) version 23.0 (SPSS Inc., Chicago, IL, USA). Data are presented as numbers,

means, and percentages. Chi-square test (χ^2) was used for statistical significance between categorical variables and independent *t*-test for continuous variables. Factors that are correlated with knowledge of the first-aid management of epistaxis was done using the χ^2 test and the Pearson correlation test. The value of $P \leq 0.05$ was considered as statistically significant. The study complied with all institutional ethical requirements and was approved by the Institutional Review Board of the College of Medicine, King Saud University, Riyadh, Saudi Arabia.

RESULTS

There were 1760 individuals who responded to the survey, 577 (32.8%) were male and 1183 (67.2%) were female. Saudis constituted 96.3% of the respondents. There were 586 respondents (33.3%) who were aged 26–35 years old and 442 respondents (25.1%) were aged 19–25 years old. There were 1000 respondents (56.8%) who had a Bachelor’s degree in college, and only 14 (0.8%) were not educated. There were 1057 respondents (60.1%) from the Central region. Table 1 shows the detailed demographic profile of the respondents.

There were 828 respondents who claimed that they received information on the first-aid management of epistaxis. The most common sources of information include a relative or friend (15.7%), Internet (14.5%), first-aid course (12.1%), leaflets (11.1%), and television (10.6%) [Table 2].

Table 1: Demographic characteristics of 1760 survey respondents

| Demographic characteristics | <i>n</i> (%) |
|-----------------------------|--------------|
| Age groups (years) | |
| <18 | 97 (5.5) |
| 19-25 | 442 (25.1) |
| 26-35 | 586 (33.3) |
| 36-45 | 366 (20.8) |
| >45 | 269 (15.3) |
| Gender | |
| Males | 577 (32.8) |
| Females | 1183 (67.2) |
| Nationality | |
| Saudi | 1695 (96.3) |
| Non-Saudi | 65 (3.7) |
| Place of residence | |
| Central region | 1057 (60.1) |
| Northern region | 73 (4.1) |
| Southern region | 57 (3.2) |
| Eastern region | 228 (13.0) |
| Western region | 345 (19.6) |
| Educational level | |
| Postgraduate | 270 (15.3) |
| Bachelors | 1000 (56.8) |
| Secondary | 396 (22.5) |
| Less than secondary | 80 (4.5) |
| Not educated | 14 (0.8) |

Respondents who had a previous encounter with somebody who had epistaxis

There were 1386 respondents (78.8%) who have known somebody who had epistaxis. Of these respondents, 683 (49.3%) had received information on the first-aid management of epistaxis. Of the 1386 respondents who claimed that they have known somebody or have witnessed somebody who had epistaxis, 843 (60.8%) tried to stop the bleeding by applying pressure on the nose, 516 (37.2%) applied the pressure on the upper part of the nose, 482 (34.8%) said that they applied pressure for < 5 min, 29 (2.1%) said that they applied pressure for 11–20 min, 307 (22.2%) for 5–10 min, and 10 (0.7%) applied pressure for more than 20 min. There were 849 respondents (61.3%) who tried to control the bleeding by blocking the nose with a tissue paper, cotton, or any similar object. There were 1030 respondents (74.3%) who tried to stop the bleeding by changing the patient's head position, 672 (48.5%) of which by tilting the head backward. There were 674 respondents (48.6%) who tried to stop the bleeding by applying ice on the nose, head, or between the eyes. There were 423 respondents (30.5%) who claimed that the bleeding (epistaxis) recurred within a week [Table 3].

There were 97 respondents (7.0%) who claimed that they avoided hot beverages, 135 respondents (9.7%) avoided taking a hot bath, 237 (17.1%) avoided hot places, 208 (15%) avoided doing strenuous exercises, 329 (23.9%) avoided any trauma to the nose, 228 (16.5%) avoided removing nasal crustations, and 187 (13.5%) avoided cleaning the nose by puffing air. There were 222 respondents (16%) who tried to moisturize their nose with emollients, and 20 (1.4%) tried reducing smoking.

Responses to questions when asked what they will do if they will experience or will have epistaxis themselves?

When all respondents were asked if in case they will have epistaxis, will they stop it or control it by pressure? Only 199 respondents (11.3%) said that they will stop the bleeding and will control the pressure. One hundred and six respondents said that they will press on the top of the nose, whereas 93 respondents (5.3%) said that they will press at the bottom of the nose. There were 99 respondents (5.6%) who claimed that they will press the nose for > 5 min, and 93 (5.3%) for 5–10 min. Furthermore, there were 216 respondents (12.3%) who said that they will stop the bleeding by blocking the nose with a tissue paper, cotton or any similar object, 268 (15.2%) will try to control the bleeding by changing the head position (184 backward and 84 forward), 197 (11.2%) will control the bleeding by placing ice on the nose, head or between the eyes, and 45 (2.6%) will try using other methods [Table 4].

Among the things that the respondents thought to exacerbate epistaxis include the following; drinking hot beverages (1.5%), hot baths (3.9%), exposure to hot places and hot weather (8.3%), strenuous exercises (8.9%), sneezing (3.8%), and smoking (4.3%). There were 121 respondents (6.9%) who thought that moisturizing the nose reduces the risk for epistaxis.

Table 2: Sources of information regarding epistaxis and its first-aid treatment in 1760 respondents

| Sources of information on epistaxis and its first-aid treatment | n (%) |
|---|------------|
| Relative or friend | 277 (15.7) |
| Internet | 256 (14.5) |
| First aid course/seminar | 213 (12.1) |
| Leaflets | 196 (11.1) |
| Television | 187 (10.6) |
| Doctor | 162 (9.2) |
| Teacher at school | 146 (8.3) |
| Newspapers and magazines | 70 (4.0) |
| Nurse | 46 (2.6) |
| Radio | 19 (1.1) |

Table 3: Responses to questions of 1386 respondents who had an experience with a patient who had epistaxis and their experience on the first-aid treatment of epistaxis

| Questions and responses | n (%) |
|---|-------------|
| Tried to stop the bleeding by pressure | 843 (60.8) |
| Applied the pressure on the | |
| Bottom of the nose | 323 (23.3) |
| Upper part of the nose | 516 (37.2) |
| No response | 547 (39.5) |
| How long did you press on the area? | |
| <5 min | 482 (34.8) |
| 5-10 min | 307 (22.2) |
| 11–20 min | 29 (2.1) |
| >20 min | 10 (0.7) |
| No response | 558 (40.3) |
| Tried to stop the bleeding by blocking the nose with a tissue paper, cotton or any similar object | 849 (61.3) |
| Tried to stop the bleeding by changing the position of the head? | 1030 (74.3) |
| How will you change the position of the head in nose bleeding? | |
| Tilt the head forward | 352 (25.4) |
| Tilt the head backward | 672 (48.5) |
| No response | 362 (26.1) |
| Tried to stop the bleeding by applying ice on the nose, head or between the eyes | 674 (48.6) |
| Used other methods to stop the bleeding | 183 (13.2) |
| Epistaxis recurred within a week | 423 (30.5) |
| Avoided hot beverages | 97 (7.0) |
| Avoided taking a hot bath | 135 (9.7) |
| Avoided hot places/hot weather | 237 (17.1) |
| Avoided doing strenuous exercises | 208 (15.0) |
| Tried to avoid nasal trauma | 329 (23.7) |
| Tried to remove nasal crustations | 228 (16.5) |
| Tried cleaning the nose by puffing air | 187 (13.5) |
| Tried to moisturize your nose with emollients | 222 (16.0) |
| If a smoker, tried to reduce smoking | 20 (1.4) |

There were 132 respondents (7.5%) who thought that patients should be brought to the ER in all cases of epistaxis irregardless

Table 4. Responses to questions asked if they will experience or will have epistaxis among 1,760 surveyed respondents

| Responses | <i>n</i> | % |
|--|----------|------|
| If I have epistaxis | | |
| I will try to stop it or control it by pressure | 199 | 11.3 |
| No response | 1,561 | 88.7 |
| Applied the pressure on the: | | |
| Bottom of the nose | 92 | 5.2 |
| Upper part of the nose | 106 | 6.0 |
| No response | 1,562 | 88.8 |
| How long did you press on the area? | | |
| <5 min | 99 | 5.6 |
| 5-10 min | 93 | 5.3 |
| 11 to 20 min | 3 | 0.3 |
| More than 20 min | 0 | 0 |
| No response | 1,565 | 88.9 |
| I will try to stop the bleeding by blocking the nose with a tissue paper, cotton or any similar object | 216 | 12.3 |
| I will try to stop the bleeding by changing the position of my head? | 268 | 15.2 |
| I will change the position of my head by: | | |
| Tilting my head forward | 85 | 4.8 |
| Tilting my head backward | 184 | 10.5 |
| I will try to stop the bleeding by applying ice on the nose, head or between the eyes | 197 | 11.2 |
| I will try to use other methods to stop the bleeding | 45 | 2.6 |
| <i>Misconceptions</i> | | |
| Hot beverages exacerbate epistaxis | 27 | 1.5 |
| Hot baths exacerbate epistaxis | 68 | 3.9 |
| Exposure to hot places and hot weather exacerbate epistaxis | 146 | 8.3 |
| Doing strenuous exercises exacerbates epistaxis | 156 | 8.9 |
| Sneezing is related to epistaxis | 67 | 3.8 |
| Moisturizing the nose reduces epistaxis | 121 | 6.9 |
| Smoking causes epistaxis to recur | 75 | 4.3 |
| <i>Management of epistaxis</i> | | |
| When is the right time to go to the emergency room | | |
| Anytime | 132 | 7.5 |
| When bleeding lasts more than 20 min | 741 | 42.1 |
| When bleeding lasts more than 40 min | 253 | 14.4 |
| When bleeding lasts more than 60 min | 144 | 8.2 |
| How much bleeding is considered a large amount? | | |
| One full cup | 82 | 4.7 |
| One half cup | 267 | 15.2 |
| One third cup | 258 | 14.7 |
| One quarter cup | 428 | 24.3 |
| More than 1 cup | 69 | 3.9 |
| Best source of information to increase awareness regarding epistaxis | | |
| Social media (facebook, twitter) | 1,020 | 58.0 |
| First aid course/seminars | 845 | 48.0 |
| School teachers | 819 | 46.5 |
| Television | 780 | 44.3 |
| Internet | 717 | 40.7 |
| Leaflets | 486 | 27.6 |
| Doctor | 441 | 25.1 |
| Daily newspapers | 312 | 17.7 |
| Nurse/other healthcare | 234 | 13.3 |
| Friend | 225 | 12.8 |
| Radio | 217 | 12.3 |

of the duration of nosebleed, whereas 741 (42.1%) thought that patients should be brought to the ER when epistaxis lasts more

than 20 min. Around 428 (24.3%) of respondents thought that one-quarter cup of blood constitutes a heavy bleeding.

Table 5: Levels of knowledge of the first-aid management of epistaxis by gender among 1760 respondents

| Levels of knowledge | All patients (n=1760), n (%) | Males (n=577), n (%) | Females (n=1183), n (%) | P |
|---------------------|------------------------------|----------------------|-------------------------|--------|
| Excellent | 94 (5.3) | 33 (5.7) | 61 (5.2) | 0.6241 |
| Good | 555 (31.5) | 171 (29.6) | 384 (32.4) | 0.2301 |
| Poor | 1111 (63.2) | 373 (64.6) | 738 (62.4) | 0.3576 |

When respondents were asked about which platform would best serve to increase awareness of epistaxis, and which of the platform would reach them more effectively, 1020 respondents (58%) said social media such as facebook and twitter, 915 (52%) through first aid seminars and conferences, followed by teachers ($n = 819$, 46.5%) and television ($n = 780$, 44.3%). Table 4 shows the responses of all the respondents on what are their measures and first-aid treatment when they will have epistaxis themselves.

Knowledge of the first-aid management of epistaxis

Of the 1760 respondents, only 94 (5.3%) scored excellent in the knowledge of first-aid management of epistaxis, 555 respondents (31.5%) had good knowledge and 1111 respondents (63.2%) had poor knowledge of first-aid management of epistaxis. The gender distribution of levels of knowledge of the first-aid management of epistaxis is shown in Table 5. Knowledge is significantly correlated to “received information on first-aid management of epistaxis” ($r = 0.126$, $P < 0.001$) and “knew someone managed of epistaxis” ($r = 0.342$, $P < 0.001$). Age, gender, nationality, place of residence, and educational level are not correlated to knowledge of first-aid management of epistaxis ($P = 0.069$, $P = 0.787$, $P = 0.444$, $P = 0.653$, and $P = 0.095$, respectively). Logistic regression analysis of significant factors that affect the knowledge of the first-aid management of epistaxis revealed “having received information on the first-aid management of epistaxis” and “having known someone with epistaxis” as the most significant factors (beta = 0.101; $t = 4.459$; $P < 0.001$, and beta = 0.336; $t = 14.982$, $P < 0.001$, respectively).

DISCUSSION

To the best of our knowledge, this is the first study that investigated on the knowledge and misconceptions on the first-aid management of epistaxis in Saudi Arabia. The study confirms that the general public of Saudi Arabia has poor knowledge on the first-aid management of epistaxis. The study results showed that 63.2% of the surveyed population had poor knowledge on the first-aid management of epistaxis. The study results fared better compared to a similar study conducted by Strachan and England in 1997, in which they found that 88.7% of their surveyed population has poor knowledge on the first-aid management of epistaxis.^[14] However, the Strachan’s study^[14] was conducted among patients who were attending the ENT department; our study was conducted on the general population, particularly on patients who were not attending any

ENT consultation during the time of the survey, which would reflect a more valid result on the surveyed population, i.e. the general public. Another possible explanation for this is the significant advancement in technology and telecommunication methods and the easy access to information nowadays through the Internet and the different social media.

Another highlight of this study is that 828 respondents (47%) have received information on the first-aid management of epistaxis, and around 78.8% have known somebody who had epistaxis. However, there were 475 respondents (57.4%) who still have poor knowledge of the first-aid management of epistaxis and were able to answer 1 or 2 questions correctly indicating poor recall of any information about epistaxis or probably even misinformation about the first-aid management of epistaxis. Many of these respondents ($n = 286$, 30.9%) got their information on epistaxis through the Internet. With the multitude of websites in the Internet that proffer management advises on epistaxis, many of these Internet sites may not be very useful and sometimes, inappropriate for the management of epistaxis. This has been explained by Mugwe in 2014, wherein several Internet sites, particularly in YouTube suggests medical advice on how to manage epistaxis, but most of these sites are unreliable and are not evidence based.^[16] Furthermore, it was found that recall with these procedures (first-aid management of epistaxis) has been found to be very low among health practitioners, what more with ordinary individuals who are not health practitioners? This probably explains why despite the information that our respondents have received, there were still a significant number of respondents who scored poor and very low on the questions regarding management of epistaxis.

Among the respondents who have witnessed somebody with epistaxis, 60.8% claimed that they tried to stop the bleeding by applying pressure. However, when they were asked if they (themselves) will have epistaxis, only 11.3% said that they will stop the bleeding by applying pressure. Furthermore, 22.2% of those who witnessed somebody with epistaxis said that they applied the pressure correctly for 5–10 min. In contrast, only 5.3% will apply pressure on their nose for 5–10 min when they (themselves) will have epistaxis. The disparity in the percentages in the responses to questions between what they have observed and what they will do when they (themselves) will have epistaxis holds through with other questions. Percentages of correct responses were lower when they will have epistaxis themselves compared to when they observed what is done to somebody with epistaxis. The explanation is very clear. Respondents do not actually know or much more, not sure whether what they have observed what is being done to somebody who has epistaxis is “correct” or does not know/is not sure of what is the correct approach to management for epistaxis if they will have it themselves.

There were also a few of our respondents who thought that hot beverages, hot bath and hot weather can intensify nosebleeds. The explanation for these changes in humidity and temperature have an effect on the capillaries in the nose,

particularly vasodilation which increases blood flow through all capillaries, including the nose, increasing the chance for a bleed, and also the mucous membranes of the nose becomes more sensitive to changes in humidity and weather (also in cold weather, nosebleeds are also very common). Information on these other factors that can increase the likelihood of a nosebleed such as changes in the weather may not be tackled that often during a doctor–patient conversation, and much less often in conversations among friends, relatives who are not health practitioners or even health-related workers.

Another highlight of this study is, around 7.5% of our respondents thought that patients should be brought to the ER in all cases regardless of the duration of the nosebleed, and around 42.1% claimed that patients who bleed for more than 20 min should be brought to the ER. The knowledge of patients on when to go to the ER and have themselves treated for epistaxis is important because it can save them time and effort of rushing to the hospital when in fact they can simply manage epistaxis through simple and basic steps at home, unless they are the so-called “blood thinners” (patients who are taking medicines such as warfarin, clopidogrel, and/or aspirin). Moreover, an increase in the knowledge of first-aid management of epistaxis will greatly reduce the congestion in the ER, particularly in cold and hot weather and eventually, save on the economics aspect of health care.

Overall, the general knowledge of our respondents on the first-aid management of epistaxis is low, even though some of them claimed to have witnessed how epistaxis was managed. However, having witnessed someone being managed for epistaxis and having received formal training or information on the first-aid management of epistaxis are factors that can significantly improve their level of knowledge. This study showed that the level of education, gender and age may not significantly improve the knowledge of the first-aid management of epistaxis. First-aid management of epistaxis is more of a procedure that can be done at home. The procedure actually does not need someone to be highly educated, or be young to do it properly. All it needs is proper training and instruction on how to do it properly. Simple rationalization of why we have to press on that particular area of the nose, for how long makes a lot of difference.

The limitation of this study is its descriptive nature. Since we have conducted this study in a survey format, we were not able to assess the authenticity of the responses and not just mere “guesses” made by the respondents. However, being the first study to describe how the lay individuals think, know, and what they do in cases of epistaxis, the results of this study can serve as a background for further studies that can be conducted in this matter. Furthermore, the results of this study reflect how the “ordinary” people who are not medically inclined perceive and think of epistaxis. For local authorities and administrators of health institutions, the highlights of this study can serve as a basis for the implementation of information campaigns, workshops, training, and seminars to increase the knowledge of the general population on the first-aid management of epistaxis.

In the long run, there will be great ease in the burden of health economics and future planning, and will definitely decrease the morbidity of epistaxis.

CONCLUSION

There is a high percentage of poor knowledge of the first-aid management of epistaxis in the Saudi population. Healthcare institutions, health administrators together with the healthcare authorities of the general population, should work hand in hand to increase not only awareness and knowledge among those who have received information of epistaxis but also enhance recall and retention of the first-aid management of epistaxis. This, in turn, will decrease the morbidity of epistaxis and will be a very big help to the economic planning and aspects of the healthcare industry.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Pallin DJ, Chng YM, McKay MP, Emond JA, Pelletier AJ, Camargo CA Jr., *et al.* Epidemiology of epistaxis in US emergency departments, 1992 to 2001. *Ann Emerg Med* 2005;46:77-81.
- Bernius M, Perlin D. Pediatric ear, nose, and throat emergencies. *Pediatr Clin North Am* 2006;53:195-214.
- Paranjothy S, Fone D, Mann M, Dunstan F, Evans E, Tomkinson A, *et al.* The incidence and aetiology of epistaxis in infants: A population-based study. *Arch Dis Child* 2009;94:421-4.
- Burton MJ, Dorée CJ. Interventions for recurrent idiopathic epistaxis (nosebleeds) in children. *Cochrane Database Syst Rev* 2004;(1):CD004461.
- Brown NJ, Berkowitz RG. Epistaxis in healthy children requiring hospital admission. *Int J Pediatr Otorhinolaryngol* 2004;68:1181-4.
- Bilgen C, Karci B, Uluöz U. A nasopharyngeal mass: Leech in the nasopharynx. *Int J Pediatr Otorhinolaryngol* 2002;64:73-6.
- Whymark AD, Crampsey DP, Fraser L, Moore P, Williams C, Kubba H, *et al.* Childhood epistaxis and nasal colonization with *Staphylococcus aureus*. *Otolaryngol Head Neck Surg* 2008;138:307-10.
- Schlusser RJ. Clinical practice. Epistaxis. *N Engl J Med* 2009;360:784-9.
- Douglas R, Wormald PJ. Update on epistaxis. *Curr Opin Otolaryngol Head Neck Surg* 2007;15:180-3.
- Verma RK, Bakshi J, Panda NK. Ectopic intranasal tooth: An unusual cause of epistaxis in a child. *Ear Nose Throat J* 2012;91:242-4.
- Gifford TO, Orlandi RR. Epistaxis. *Otolaryngol Clin North Am* 2008;41:525-36, viii.
- Sarhan NA, Algamil AM. Relationship between epistaxis and hypertension: A cause and effect or coincidence? *J Saudi Heart Assoc* 2015;27:79-84.
- Lavy JA, Koay CB. First aid treatment of epistaxis – Are the patients well informed? *J Accid Emerg Med* 1996;13:193-5.
- Strachan D, England J. First-aid treatment of epistaxis – Confirmation of widespread ignorance. *Postgrad Med J* 1998;74:113-4.
- Middleton PM. Epistaxis. *Emerg Med Australas* 2004;16:428-40.
- Mugwe P, Kamau KJ, Nyambaka OK. Knowledge, attitude and practice in first aid management of epistaxis by accident and emergency clinical staff at Kenyatta national hospital. *East Cent Afr J Surg* 2014;19:17-21.
- Haymes AT, Harries V. ‘How to stop a nosebleed’: An assessment of the quality of epistaxis treatment advice on YouTube. *J Laryngol Otol* 2016;130:749-54.

Quality of Sleep in Children with Epilepsy

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Abstract

Background: Sleep disorders are a common concern among pediatric epilepsy patients. This study aimed to assess the sleep quality in children with epilepsy. **Subjects and Methods:** The present study examined parent-reported sleep problems in 34 children (20 boys and 14 girls; age 4–14 years) with epilepsy. Children's Sleep Habits Questionnaire (CSHQ) assesses sleep patterns with 33 sleep disturbance items, and each item is rated on a 3-point scale (99 total score) that describes the frequency of the behaviors. A score of 41 was used as a cutoff for identification of poor and good sleeper. **Results:** Epilepsy poor sleepers (based on CSHQ score) have more sleep impairment than epilepsy good sleepers (CSHQ score) ($P < 0.04$), and the CSHQ subscores are as follows: night awakenings ($P < 0.03$), sleep duration ($P < 0.04$), daytime sleepiness ($P < 0.04$), sleep-onset delay ($P = 0.02$), and bedtime resistance ($P = 0.02$). **Conclusions:** Although sleep problems are known to be common among young children with epilepsy, the results of this work may provide the basis for focused studies to gain deeper understanding of sleep disturbances in this population.

Keywords: Assessment, childhood, development, epilepsy, sleep

INTRODUCTION

Epilepsy is a neurological disorder affecting approximately 1% of children. Approximately 25%–50% children with epilepsy have prominent behavioral features with sleep problems.^[1,2] As many as 80% of children with epilepsy manifest these difficulties,^[3-7] regardless of whether they are measured via parental report^[8] or polysomnography.^[9]

Despite the fact that the clinical association between pediatric epilepsy and sleep has been explored in a few earlier studies,^[3-7,10,11] our clinical comprehension of this association corresponds to a model in which sleep patterns influence seizure profiles and vice versa.^[12] Sleep impairment and circadian rhythms can predict seizure pattern. For example, obstructive sleep apnea and restless legs syndrome have been reported to interfere with the effective seizure control.^[13] Moreover, epileptic episodes appear to disrupt sleep–wake cycles,^[3] and some antiepileptic medications can adversely affect sleep structure and quality.^[14] Poor rest, for example, can similarly influence the execution of intellectual tasks.^[15]

Therefore, we conducted this study to assess the effect of sleep patterns in children with epilepsy.

SUBJECTS AND METHODS

The study included 34 children between 4 and 14 years of age, with a diagnosis of epilepsy and who were followed up in the clinic from October 2015 to March 2016. Participants were diagnosed with epilepsy through clinical assessment by a qualified pediatric neurologist and were classified according to the International League Against Epilepsy classification. The present study was conducted at the Pediatric Neurology Outpatient Clinic, King Khalid University Hospital, King Saud University Medical City, Riyadh, Saudi Arabia. Informed consent was obtained from all participants' parents or guardians before enrollment in the study. The study was approved by the ethics committee in our institute.

The study participants were required to have stable medical and behavioral conditions, with no change in medication in the previous 6 months. Participants were excluded from the study if they had comorbid psychiatric disorders, such as

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autism spectrum disorder or attention-deficit hyperactivity disorder, significant vision or hearing loss, or a complex neurological disorder (e.g., cerebral palsy, neurometabolic disorders, neurodegenerative diseases, tuberous sclerosis, neurofibromatosis, and Rett syndrome).

Children’s Sleep Habits Questionnaire

Parents were interviewed by trained medical students to recall sleep behaviors occurring over a recent “typical” week.

Child sleep habits were measured using Children’ Sleep Habits Questionnaire (CSHQ) scores.^[1,15] The CSHQ is an approved instrument for both behaviorally and medically based pediatric sleep difficulty. The CSHQ is a 33-item-based psychometric assessment for eight domains: bedtime resistance, sleep-onset delay, sleep duration, sleep anxiety, night awakenings, parasomnias, disordered breathing, and daytime sleepiness. A total score can be ranged from 33 to 99 based on calculation from all of the abovementioned domains.^[1]

Higher scores are indicative of more disturbed sleep (epilepsy poor sleepers (EP-PS)). A score of 41 has been reported to be a sensitive cutoff for identification of probable sleep problems in children with epilepsy.

Statistical analysis

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 23 (SPSS Inc., IBM, Chicago, Illinois, USA) on all variables (sleep variables, subjective sleep measures, and behavioral scales). *P* < 0.05 was considered statistically significant. Mann–Whitney U-tests were used for pairwise, between-group comparisons. Spearman’s rank correlations (*r*) were used to evaluate the associations between all variables. Results were presented as mean ± standard deviation.

RESULTS

Sample demographics

The study comprised 34 children (20 boys and 14 girls), who were 4–14 years of age [Table 1]. Total sleep disturbance scores ranged from 32 to 48 (M = 40.00, SD = 3.63), with 44% of the sample (*n* = 15) meeting the diagnostic cutoff score of 41 for a sleep disorder and 56.7% (*n* = 19) falling below this cutoff score for CSHQ.

Sleep disturbance

Nineteen children with epilepsy were classified as epilepsy good sleeper (EP-GS) and 15 were classified as epilepsy poor sleepers (EP-PS), based on the CSHQ score by their parents.

The sleep histories of all participants were reviewed. In the EP-PS group, 15 of 34 children had moderate-to-severe sleep problems expressed by parents. Night awakenings were a major concern in 23 of 34 children (67%). In the EP-GS group, eight parents rated their children as having no sleep problems (23%) and seven as having mild sleep problems (20%). Several children in the EP-GS group requested to go to bed at a

scheduled time each night.

All CSHQ domain scores differed significantly between the two groups [Figure 1] and were lower in the EP-GS group than that in the EP-PS group. Children in the EP-PS group were found to experience greater sleep disturbances compared to good sleepers according to total CSHQ score (*P* < 0.04) and the following CSHQ subscores: night awakenings (*P* < 0.03), sleep duration (*P* < 0.04), daytime sleepiness (*P* < 0.04), sleep-onset delay (*P* = 0.02), and bedtime resistance (*P* = 0.02) [Table 1].

DISCUSSION

Epilepsy can significantly affect the sleep patterns in the children. This finding is consistent with the relationship between sleep and epilepsy observed in older school-aged children^[16] and adolescents.^[2]

In this study, we found that waking up in the middle of the night (night awakenings), sleep duration, daytime sleepiness, sleep-onset delay, and bedtime resistance were the most common problems among pediatric population with epilepsy according to CSHQ. Although parasomnias are common in childhood – being present in >80% of preschool-aged children^[17,18] – a marked association with epilepsy has been described by several^[3,5,7,11] but not all^[19] previous studies.

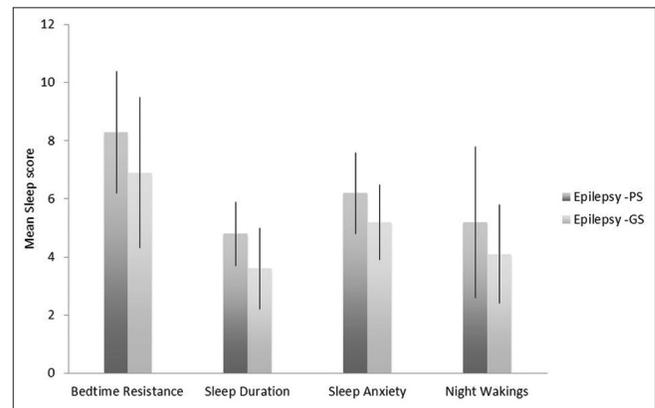


Figure 1: Participants’ characteristics and comparison of Children’s Sleep Habits Questionnaire subscales among epilepsy poor sleepers and epilepsy good sleepers for bedtime resistance, sleep duration, sleep anxiety, and night waking

Table 1: Participant characteristics and comparison of Children’s Sleep Habits Questionnaire subscales among epilepsy poor sleepers and epilepsy good sleepers

| Variable | Epilepsy-PS (n=15) | Epilepsy-GS (n=19) | P-value |
|--------------------|--------------------|--------------------|---------|
| Age (years) | 8±4.3 | 7.9±5.1 | 0.64 |
| Gender (male) | 8 | 12 | 0.12 |
| Sleep-onset delay | 1.8±0.74 | 1.5±0.06 | 0.02 |
| Daytime sleepiness | 13.6±2.1 | 10.2±2.1 | 0.04 |
| Total | 40.1±9.8 | 33±8.8 | 0.04 |

Significant at <0.05 between Epilepsy-PS and Epilepsy-GS groups with Mann–Whitney U-test. GS: Good sleeper, PS: Poor sleeper

Mechanistically, hypotheses have suggested that epileptic seizures lead to sleep fragmentation, facilitating the subsequent occurrence of parasomnias.^[18,20-22] Data on the association between epilepsy therapeutics and sleep problems are contradictory; while some studies support an association,^[4,5] other studies have found no such association.^[7,11] To date, the clinical understanding of the effect of childhood epilepsy on parent and/or caregiver sleep is relatively limited.

Limitations

One limitation of the present study was its small sample size, which may have resulted in specific effects of CSHQ measurements between the good (EP-GS) and poor sleeper (EP-PS) groups being missed due to inadequate statistical power to detect significant changes. However, data from the present study may provide a basis for a larger, more focused study examining its promising elements. An additional limitation is lack of objective assessment of sleep in children.

CONCLUSIONS

Our results suggest that sleep problems are known to be common among young children with epilepsy; the results of this work may provide the basis for focused studies to gain deeper understanding of sleep disturbances in this population. Sleep habits should be comprehensively reviewed when a sleep problem is identified in children with epilepsy.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire (CSHQ): Psychometric properties of a survey instrument for school-aged children. *Sleep* 2000;23:1043-51.
- Constantin E, Low NC, Dugas E, Karp I, O'Loughlin J. Association between childhood sleep-disordered breathing and disruptive behavior disorders in childhood and adolescence. *Behav Sleep Med* 2015;13:442-54.
- Maganti R, Hausman N, Koehn M, Sandok E, Glurich I, Mukesh BN, *et al.* Excessive daytime sleepiness and sleep complaints among children with epilepsy. *Epilepsy Behav* 2006;8:272-7.
- Batista BH, Nunes ML. Evaluation of sleep habits in children with epilepsy. *Epilepsy Behav* 2007;11:60-4.
- Byars AW, Byars KC, Johnson CS, DeGrauw TJ, Fastenau PS, Perkins S, *et al.* The relationship between sleep problems and neuropsychological functioning in children with first recognized seizures. *Epilepsy Behav* 2008;13:607-13.
- Ong LC, Yang WW, Wong SW, alSiddiq F, Khu YS. Sleep habits and disturbances in Malaysian children with epilepsy. *J Paediatr Child Health* 2010;46:80-4.
- Chan B, Cheong EY, Ng SF, Chan YC, Lee QU, Chan KY, *et al.* Evaluation of sleep disturbances in children with epilepsy: A questionnaire-based case-control study. *Epilepsy Behav* 2011;21:437-40.
- Lycett K, Sciberras E, Mensah FK, Hiscock H. Behavioral sleep problems and internalizing and externalizing comorbidities in children with attention-deficit/hyperactivity disorder. *Eur Child Adolesc Psychiatry* 2015;24:31-40.
- Virring A, Lambek R, Jennum PJ, Møller LR, Thomsen PH. Sleep problems and daily functioning in children with ADHD: An investigation of the role of impairment, ADHD presentations, and psychiatric comorbidity. *J Atten Disord* 2017;21:731-40.
- Becker DA, Fennell EB, Carney PR. Sleep disturbance in children with epilepsy. *Epilepsy Behav* 2003;4:651-8.
- Wirrell E, Blackman M, Barlow K, Mah J, Hamiwka L. Sleep disturbances in children with epilepsy compared with their nearest-aged siblings. *Dev Med Child Neurol* 2005;47:754-9.
- Montplaisir J, Laverdière M, Saint-Hilaire JM. Sleep and epilepsy. *Electroencephalogr Clin Neurophysiol Suppl* 1985;37:215-39.
- Nunes ML. Sleep and epilepsy in children: Clinical aspects and polysomnography. *Epilepsy Res* 2010;89:121-5.
- Placidi F, Scalise A, Marciani MG, Romigi A, Diomedì M, Gigli GL, *et al.* Effect of antiepileptic drugs on sleep. *Clin Neurophysiol* 2000;111 Suppl 2:S115-9.
- Goodlin-Jones BL, Sitnick SL, Tang K, Liu J, Anders TF. The children's sleep habits questionnaire in toddlers and preschool children. *J Dev Behav Pediatr* 2008;29:82-8.
- Liu X, Liu L, Owens JA, Kaplan DL. Sleep patterns and sleep problems among schoolchildren in the United States and China. *Pediatrics* 2005;115:241-9.
- Petit D, Touchette E, Tremblay RE, Boivin M, Montplaisir J. Dyssomnias and parasomnias in early childhood. *Pediatrics* 2007;119:e1016-25.
- Kotagal P, Yardi N. The relationship between sleep and epilepsy. *Semin Pediatr Neurol* 2008;15:42-9.
- Stores G, Wiggs L, Campling G. Sleep disorders and their relationship to psychological disturbance in children with epilepsy. *Child Care Health Dev* 1998;24:5-19.
- Cortesi F, Giannotti F, Ottaviano S. Sleep problems and daytime behavior in childhood idiopathic epilepsy. *Epilepsia* 1999;40:1557-65.
- Hoepfner JB, Garron DC, Cartwright RD. Self-reported sleep disorder symptoms in epilepsy. *Epilepsia* 1984;25:434-7.
- Zaiwalla Z, Stores G. Sleep and arousal disorders in childhood epilepsy. *Electroencephalogr Clin Neurophysiol* 1989;72:107.

Prevalence of Hearing Loss and Tinnitus with Correlation to the Usage of Protective Hearing Equipment among Airport Workers

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Abstract

Objectives: Epidemiological studies have shown that tinnitus and occupational hearing loss are common symptoms in the working population. Only few studies have assessed the aforementioned symptoms in this population, none of which have assessed airport field workers (AFWs), thus the need for our study. **Methods:** A cross-sectional study was conducted among AFWs at King Khalid International Airport in Riyadh. The sample size was calculated to be 380. Each was asked to fill a self-administered questionnaire and undergo pure-tone audiometry to assess hearing level. The questionnaire assessed the participants' demographics, usage of protective hearing equipment (PHE) as well as prevalence and characteristics of tinnitus if present. **Results:** Of all field workers, 300 (78%) have agreed to participate in the study. A number of 180 (60%) participants believe that PHE prevents noise-related hearing loss. Of all participants, 114 (38%) workers use PHE. No association was found between the participants' belief regarding PHE benefits and their usage of the equipment ($P = 0.473$). Tinnitus was reported by 81 (27%) of the whole sample. Most of the participants, i.e., 171 (57%) were found to have hearing impairment (>25 dB HL) at low frequencies (0.5, 1, and 2 kHz) in comparison to 144 (48%) at high frequencies (4 and 8 kHz). **Conclusion:** Even with relatively good knowledge about the importance of PHE, only few workers actually use them. Thus, frequent audiometric screening tests as well as enforcement of PHE usage by AFWs need to be introduced by the airport administrations.

Keywords: Airport workers, hearing loss, occupational, protective hearing equipment, tinnitus

INTRODUCTION

Sound and noise are part of the same auditory continuum. Noise has been defined by the National Institute for Occupational Safety and Health (NIOSH) as "any unwarranted disturbance within a useful frequency band."^[1] As a result of industrialization, noise exposure in different occupations is almost inevitable. Noise has been identified as a risk factor for multiple medical conditions including hypertension, anxiety, hearing loss, and tinnitus.^[2,3] In fact, noise is responsible for 16% of hearing loss worldwide.^[4] In the United States, approximately 22 million individuals are exposed to dangerous levels of noise each year.^[5] Approximately 10 million individuals in the US suffer from occupational hearing loss.^[6] In Saudi Arabia (Kingdom of Saudi Arabia), Ahmed *et al.* shown that the prevalence of hearing impairment in industrial workers exposed to noise is 39.3% in comparison to only 4.5% of nonnoise-exposed worker.^[7] These levels are comparable to

China where 42% of airport maintenance workers are estimated to suffer from occupational hearing loss.^[8]

Tinnitus is defined as noise, regardless of its nature, perceived in the absence of external stimulus.^[9] This noise may take multiple forms such as whistling, buzzing, or hissing and may be perceived as emanating from within the head or outside the body. The sound perceived may be subjective in nature, audible only by the patient, or objective, audible by both the patient and the examiner. Objective tinnitus is quite rare with a defined muscular or vascular pathology whereas subjective tinnitus is due to neurophysiological aberrations in the auditory pathway.^[9]

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The prevalence of tinnitus differs globally. In Japan, 11.9% of adults (45–79) are reported to have tinnitus.^[10] Similarly, 10% of industrial workers in KSA were found to have tinnitus.^[7] In the most recent survey, Kim *et al.*, 2015, surveyed approximately 20,000 adults aged between 20 and 98 and identified a prevalence of 20.7%, of which 31% reported that they were annoyed by the noise during their daily life.^[11] The study results showed that females were at a higher risk of developing tinnitus and that patients with depression are twice as likely to develop tinnitus when compared to the rest of the population. Other defined risk factors included smoking, dyslipidemia, age, and different systemic chronic diseases such as rheumatoid arthritis and thyroid diseases.^[11]

In Saudi Arabia, only few studies have assessed the prevalence of hearing loss and tinnitus in the working population, none of which have assessed airport workers. We hope that our study can shed light on this topic in our community and provide feedback regarding possible educational programs or screening strategies, if needed, directed toward this population.

METHODS

Ethical statement

The study protocol was approved by the institutional review board of King Saud University. The study was conducted in accordance with the Declaration of Helsinki. Informed consent was attained from all participants before their inclusion in this study.

Study design

This was a quantitative observational cross-sectional study.

Subjects

King Khalid International Airport is the largest airport in the Kingdom of Saudi Arabia with a total of 900 airport field workers (AFWs) distributed across three departments: maintenance, transportation, and cargo and is located in the capital city, Riyadh. In this cross-sectional study, we targeted all AFWs working at King Khalid International Airport in the year 2016 to assess the prevalence of hearing loss and tinnitus and to correlate them with the use of protective hearing equipment (PHE). All AFWs included in this study have undergone a preemployment baseline audiometry screening. Inclusion criteria included all AFWs at King Khalid International Airport. Exclusion criteria included refusal to participate.

Sample size

According to the airport administration office, there were 900 AFWs (total population). Since few studies have assessed the prevalence of tinnitus among aircraft workers in the Middle East, we assumed that 50% currently suffer from tinnitus to achieve the maximum sample size. We considered a margin of error of 5%, with a 95% confidence level, using the standard sample size formula for a single proportion:

$$N = Z_{\alpha/2}^2 P(1 - P)/d^2$$

N: Sample size

P: Proportion

d: Margin of error

*Z*_α: A normal deviate reflects the Type I error and is equal to 1.96 for 95% confidence level.

Sample size was calculated to be 384.

Data collection tools

A self-administered questionnaire was used to assess the study's objectives. Due to the study's multiethnic population, both English and Arabic languages of the questionnaire were used. The questionnaire was composed of three main parts.

Part 1 assesses participants' demographics in terms of age, gender, nationality, educational status, years spent at the airport, and usage of PHE.

Part 2 of the questionnaire addresses the prevalence of tinnitus and its characteristics. The presence or absence of tinnitus was determined by the following question "In the past 12 months, have you noticed any buzzing, ringing, or any other form of noise in the absence of any external sound?" Tinnitus severity was assessed using a subjective scale of "mild," "moderate," or "severe" as well as its impact on sleep.

Part 3 included formal audiometric testing. The testing took place in a secluded room approximately 0.5 km from runway to minimize interfering background noise. For the purpose of this study, hearing loss was divided into low (0.5, 1, and 2 kHz) and high frequency (4 and 8 kHz). A hearing loss of mild (≥ 25 and ≤ 40 dB) corresponded to hearing difficulties between moderate (40–55 dB) and severe (> 55 dB).

Statistical analysis

A pilot study was conducted on the 1st week on 10 employees to assess the clarity of the questionnaire, time needed for data analysis as well as data cleaning. Categorical variables were reported as percentage while continuous variable was reported for means and standard deviation. Chi-square test was used to compare the participants' belief regarding PHE benefits and their usage of the equipment. The results were considered statistically significant if $P \leq 0.05$. SPSS software version 21.0 (Denmark) was used for further analysis of data.

RESULTS

Demographics

Three hundred airport workers responded to the survey yielding a response rate of 78%. Our population consisted of male participants exclusively as there are no female AFWs in Saudi Arabia. Participants were of Saudi nationality (68%), high-school graduates (38%), aged between 30 and 39 (37%), and current smokers (45%). The demographics are summarized in Table 1.

In regard to years spent working in the airport, 40.3% of the respondents had worked at the airport for more than 10 years,

24% of the respondents had been employed for 1–3 years, 17.3% of the respondents had worked at the airport for 4–6 years, 11.7% of the respondents had worked at the airport for 7–9 years, and only 6.7% of the respondents had worked at the airport for <1 year.

Usage of protective hearing equipment

Only 38% of surveyed sample reported using PHE during work, of whom 50% use PHE for 1–3 h/day, 27% use it for 4–6 h, 13% use it for 7–9 h and only 10% reported using PHE all throughout their work shift. Furthermore, our survey shows that only 58% of our sample believe that PHE prevents hearing loss. Only 45% believe that PHE prevents tinnitus.

Prevalence and characteristic tinnitus

Tinnitus was reported by 27% of population. In most cases, tinnitus was bilateral (61%) and did not cause any difficulties in sleep (67%). Tinnitus reportedly affected the right ear in 19% and the left ear in 22% and was bilaterally in 59%. Only 20% of those affected by tinnitus sought medical attention.

Pure-tone audiometry

In the low-frequency group (0.5, 1, 2 kHz), a total of 43 participants were found to have some degree of hearing

loss, most of whom (79%) were measured at mild. In regard to high-frequency hearing loss (4 and 8 kHz), 36 participants were found to have some degree of hearing loss, most of whom (50%) were measured also at mild. Across all frequencies, 32 participants were found to have variable degree of hearing loss, most of whom (69%) were measured also at mild. These results are summarized in Table 2.

Possible risk factors for hearing loss were also assessed. The results of which are summarized in Table 3.

DISCUSSION

This study represents the first study to assess the prevalence of tinnitus and hearing loss among AFWs and measure their compliance in regard to the use of PHE in Saudi Arabia and probably the Middle East. Even though in our study, we did not measure the level of noise at the airport field, based on the international and global scales of noise pollution, the maximum dose of environmental noise (140 dB) a person can receive is by being within 25 m distance from an airplane takeoff.^[12] Unfortunately, few studies have been done in Saudi Arabia and the Middle East to evaluate the burden of noise-induced hearing loss (NIHL) and tinnitus in settings with high levels of noise.

Usage of protective hearing equipment

US NIOSH 1998 noted that the effective use of hearing protective devices would reduce the rate of NIHL hearing loss in noise-exposed workers.^[13] Previous studies assessing the compliance to PHE among individuals working at places with high levels of noise have generally documented low usage rates.^[14] Lusk *et al.* showed that the average usage rates of PHE among 400 construction workers ranged from 18% to 49%.^[15] In the present study, although 60% of the participants believe that PHE prevents hearing loss and 45% believe that they prevent tinnitus, only 38% actually use them. Moreover, no association was found between the participants' belief regarding PHE benefits and their usage of the equipment ($P = 0.373$).

Prevalence and characteristic of tinnitus

Tinnitus is an early warning symptom for NIHL.^[5] In a study done at South Korea by Song and Kim^[16] on manufacturing workers (noise exposure group) and design workers (control group) at shipyard, tinnitus prevalence was 24.3% and 3.6%.^[17] This study demonstrated the relationship between the high levels of noise and tinnitus. It is worth

Table 1: Demographics

| | Percentage |
|------------------|------------|
| Age | |
| >20 | 1.0 |
| 20 to 29 | 33.3 |
| 30 to 39 | 36.7 |
| 40 to 49 | 20.0 |
| 50 to 59 | 8.7 |
| 60 to 69 | 0.3 |
| >70 | 1.0 |
| Education status | |
| High school | 38.3 |
| Diploma | 34.3 |
| Bachelor | 24.3 |
| Masters | 3.0 |
| Total | 100 |
| Smoking status | |
| Current smoker | 44.6 |
| Former smoker | 17.7 |
| Never smoked | 37.7 |

Table 2: Audiometry results

| Presence and degree | Threshold range (dB HL) n (%) | | |
|-----------------------------------|-------------------------------|--------------------------|-----------------------------------|
| | Low frequency (0.5,1,2 KHz) | High frequency (4,8 KHz) | All frequencies (0.5,1,2,4,8 KHz) |
| No impairment (<25 dB HL) | 257 (85.7) | 268 (89.4) | 265 (88.3) |
| ≥25 and ≤40 (mild) | 34 (11.3) | 18 (6.0) | 22 (7.3) |
| <40 and ≤55 (moderate) | 5 (1.7) | 9 (3.0) | 7 (2.3) |
| >55 (sever) | 4 (1.3) | 5 (1.7) | 4 (1.3) |
| Total with impairment (≥25 dB HL) | 43 (14.3) | 36 (12.0) | 32 (10.9) |

Table 3: Possible risk factors for hearing loss

| | Percent | |
|----------------------------|---------|------|
| | Yes | No |
| Ear injury | 5.0 | 95.0 |
| Head injury | 9.0 | 91.0 |
| Exposure to expulsions | 2.3 | 97.7 |
| Family history of deafness | 2.0 | 98.0 |

mentioning that the severity of hearing loss was found to be significantly higher in workers with tinnitus compared to workers without tinnitus in the aforementioned study. In our study, the prevalence of tinnitus was 27% with the majority of the participants (61%) reporting bilateral tinnitus. Conversely, a similar study done in eastern Saudi Arabia demonstrated that the prevalence of tinnitus among 269 industrial workers is 11%.^[7] It included workers at steel pipes and the other manufactured air conditioning units. Tinnitus due to noise exposure is drawing less attention than NIHL. Nevertheless, the probability of tinnitus development ought to be taken into consideration in hearing preservation programs for the high association reported between noise exposure and tinnitus.^[6]

Pure-tone audiometry

Occupational NIHL hearing loss occurs among individuals that are exposed to excessive amounts of noise for long durations.^[18] In a study done at the Republic of China by Chen *et al.* on 112 airport employees, the prevalence of high-frequency hearing loss was 41.9%.^[8] While at Jomo Kenyatta International Airport in Nairobi, the prevalence of NIHL was 15.3%.^[17] Similarly, in the present study done at King Khalid International Airport, the prevalence of NIHL was found to be 12%. Several factors can contribute the disparity of the aforementioned results including duration of exposure to noise as well as the compliance to PHE, that is, concerning NIHL among airport workers. On the other hand, a fair percentage of studies have been published in the literature to assess NIHL among workers exposed to high levels of noise. One of which is a study done in Saudi Arabia by Ahmed *et al.* involving 259 industrial workers (one manufactured steel pipes and the other is air conditioning unit) which found that the prevalence of high-frequency hearing loss is 65.6%. Nevertheless, the usage of PHE or the duration of exposure to noise was not documented.^[7] In addition, a periodic annual audiometric examination in Taiwan done by Wu *et al.* on a large number of noise-exposed workers (9535) showed that a total of 3216 (34.0%) workers were found to have NIHL.^[18]

In our target population, we found that the airport administration encourages that AFWs do undergo an annual audiometric screening although there was no official surveillance system to screen for NIHL among AFWs.

The study does have some limitations. First, only one-third of the total population was included in this survey. Second, even though formal audiometric testing was conducted on the sample population, AFWs may have attempted to overstate

their performance during the test or claimed to use PHE in fear of repercussions. Nevertheless, this study provides vital information for decision-makers and acts as a foundation upon which further research may be built upon.

CONCLUSION

Even with relatively good knowledge about the importance of PHE, only few workers actually use them. Thus, frequent audiometric screening tests as well as enforcement of PHE usage by AFWs need to be introduced by airport administrations.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. National Institute for Occupational Safety and Health (NIOSH). Noise-Induced Loss of Hearing. Cincinnati, OH: National Institute for Occupational Safety and Health; 1991. Available from: <https://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf>. [Last accessed on 2018 Feb 10].
2. Jarup L, Babisch W, Houthuijs D, Pershagen G, Katsouyanni K, Cadum E, *et al.* Hypertension and exposure to noise near airports: The HYENA study. *Environ Health Perspect* 2008;116:329-33.
3. Beutel ME, Jünger C, Klein EM, Wild P, Lackner K, Blettner M, *et al.* Noise annoyance is associated with depression and anxiety in the general population- the contribution of aircraft noise. *PLoS One* 2016;11:e0155357.
4. Tak S, Davis RR, Calvert GM. Exposure to hazardous workplace noise and use of hearing protection devices among US workers – NHANES, 1999-2004. *Am J Ind Med* 2009;52:358-71.
5. Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. *Am J Ind Med* 2005;48:446-58.
6. Centre for Disease Control. Available from: <http://www.cdc.gov/niosh/topics/noise/stats.html>. [Last accessed on 2017 Feb 10].
7. Ahmed HO, Dennis JH, Badran O, Ismail M, Ballal SG, Ashoor A, *et al.* Occupational noise exposure and hearing loss of workers in two plants in Eastern Saudi Arabia. *Ann Occup Hyg* 2001;45:371-80.
8. Chen TJ, Chiang HC, Chen SS. Effects of aircraft noise on hearing and auditory pathway function of airport employees. *J Occup Med* 1992;34:613-9.
9. Han BI, Lee HW, Kim TY, Lim JS, Shin KS. Tinnitus: Characteristics, causes, mechanisms, and treatments. *J Clin Neurol* 2009;5:11-9.
10. Fujii K, Nagata C, Nakamura K, Kawachi T, Takatsuka N, Oba S, *et al.* Prevalence of tinnitus in community-dwelling Japanese adults. *J Epidemiol* 2011;21:299-304.
11. Kim HJ, Lee HJ, An SY, Sim S, Park B, Kim SW, *et al.* Analysis of the prevalence and associated risk factors of tinnitus in adults. *PLoS One* 2015;10:e0127578.
12. Yuen FK. A vision of the environmental and occupational noise pollution in Malaysia. *Noise Health* 2014;16:427-36.
13. National Institute for Occupational Safety and Health (NIOSH). Criteria for a Recommended Standard: Occupational Noise Exposure. Revised Criteria. Cincinnati: National Institute for Occupational Safety and Health; 1998. Available from: <http://www.cdc.gov/niosh/98-126.html>. [Last accessed on 2018 Feb 02].
14. Edelson J, Neitzel R, Meischke H, Daniell W, Sheppard L, Stover B, *et al.* Predictors of hearing protection use in construction workers. *Ann Occup Hyg* 2009;53:605-15.
15. Lusk SL, Kerr MJ, Kauffman SA. Use of hearing protection and perceptions of noise exposure and hearing loss among construction workers. *Am Ind Hyg Assoc J* 1998;59:466-70.

16. Song JB, Kim BK. Prevalence and characteristics of tinnitus in noise exposed workers. *Occup Health* 2002;6:16-28.
17. Anino JO, Afullo A, Otieno F. Occupational noise-induced hearing loss among workers at Jomo Kenyatta international airport, Nairobi. *East Afr Med J* 2010;87:49-57.
18. Wu TN, Liou SH, Shen CY, Hsu CC, Chao SL, Wang JH, *et al.* Surveillance of noise-induced hearing loss in Taiwan, ROC: A report of the PRESS-NHL results. *Prev Med* 1998;27:65-9.

Endoscopic Ultrasound-guided Biliary Drainage: A Tailored Approach

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Abstract

Although endoscopic retrograde cholangiopancreatography (ERCP) remains the gold standard method to achieve biliary drainage (BD) in cases of obstruction, some situations preclude this option. Alternatively, percutaneous BD is associated with a number of limitations and more recently associated risks have been found to be higher than those with nonconventional interventions such as endoscopic ultrasound-guided BD (EUS-BD). EUS-BD encompasses a number of interventions and approaches depending on the underlying cause and position of obstruction. We present a case series of six cases where EUS-BD was used when ERCP was not possible or failed at a tertiary care academic center. We also describe the different types of EUS-BD based on the nomenclature that has been proposed by the Asian EUS group (AEG). In all the cases that were presented, EUS-BD was successful with no complications or adverse events. The intervention resulted in resolution of biliary obstruction and the patients underwent the planned treatment for their underlying disease. In this case series, we introduced the concept of EUS-BD to the nonspecialist and illustrated the variability of the procedure and its agile nature when applied in the right setting and with the proper expertise and the importance of the presence a complete team approach by different specialists when caring for these patients.

Keywords: Bile duct malignancy, bile duct obstruction, endoprosthesis, endoscopic retrograde cholangiopancreatography, gallbladder malignancy, jaundice, malignant, palliative care, pancreatic neoplasms, stents

INTRODUCTION

Not uncommonly health-care providers encounter patients with biliary obstruction from numerous causes whether they are benign or malignant. Conventionally, endoscopic retrograde cholangiopancreatography (ERCP) can achieve biliary drainage (BD) in more than 90% of cases.^[1] There remains of proportion of patients where ERCP cannot achieve biliary access due to technical difficulties or, at times, the duodenoscope cannot reach the opening of the biliary system into the gastrointestinal track, either due to altered anatomy from a tumor precluding reaching the papilla or due to surgically altered anatomy, for example, in cases of like Roux-en-Y surgery, Billroth II procedures, bariatric bypass surgeries, or biliopancreatic diversion.^[2] In such cases, the classical approach was inserting a percutaneous biliary drain (PBD). These PBDs require multiple sessions for their insertion, as well having the disadvantage of an external tube that requires care and frequent flushing so as to not get obstructed.

A more recent approach has been to utilize endoscopic ultrasound (EUS) to facilitate the insertion of a guide wire after puncturing the liver through the stomach or the common bile duct (CBD) through the duodenum and utilizing that wire to facilitate access through the normal method of an ERCP which has been coined EUS-guided rendezvous technique (EUS-RV). Another method to achieve BD has been the direct insertion of stents, whether plastic or metal, through the EUS scope directly into the biliary system, which has been designated as EUS-BD^[3] [Figure 1]. Of note, all of these procedures are performed under fluoroscopic guidance and require expertise in EUS as well as proper backup from interventional radiology as well as surgery if needed.

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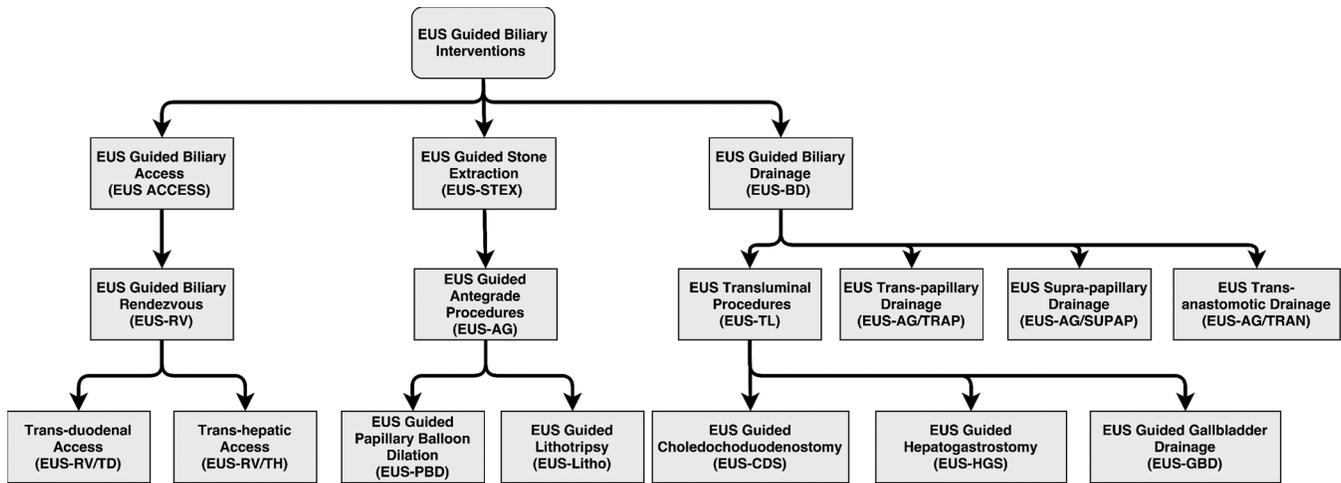


Figure 1: The different methods and the nomenclature that is used to describe endoscopic ultrasound-guided biliary interventions

ENDOSCOPIC ULTRASOUND-GUIDED ANTEGRADE INTERVENTIONS RESCUE THERAPY

A 78-year-old male who was diagnosed to have cholangiocarcinoma of the biliary system and who already underwent prior ERCPs with the insertion of self-expandable metal stents (SEMS) in the CBD and latter plastic stents due to recurrent obstruction. After a few months from his last endoscopy, he presented with recurrent biliary obstruction and nausea and vomiting. He was found to have gastric outlet obstruction due to the mass encroaching on the duodenum. After the insertion of a duodenal stent, the papilla could not be reached due to the potential compromise to the freshly inserted duodenal SEMS. An EUS-AG was performed the EUS scope was introduced into the stomach, and the left lobe of the liver was punctured from the stomach and contrast was inserted into the biliary tree to confirm the correct positioning of the needle [Figure 2a]. After that, a wire was advanced through the needle from the periphery of the liver to the left hepatic duct and then the CBD and into the duodenum through the prior placed stents. An uncovered SEMS was inserted then through the stomach wall into the CBD and positioned in a fashion that the proximal end was in the biliary system while the distal end was in the duodenum [Figure 2b]. The patient’s symptoms resolved and his managing oncologist resumed his care^[4] [Figure 2c].

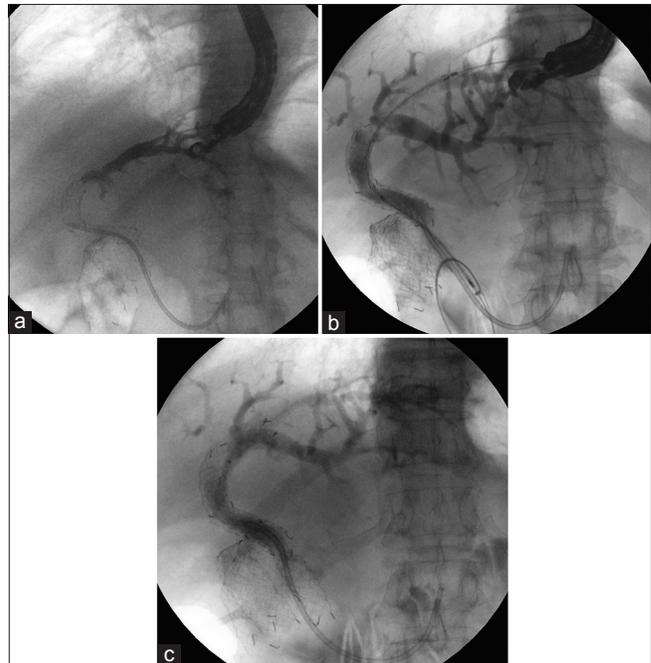


Figure 2: (a) The needle is advanced through the stomach wall and into the left lobe of the liver with contrast injected into the biliary system to guide the drainage procedure fluoroscopically. Previous metal and plastic biliary stents and a duodenal stent are seen from prior interventions. (b) A new uncovered metal stent is inserted through the track from the stomach to the liver and positioned to traverse the prior blocked stent. (c) Final result with biliary drainage achieved

ENDOSCOPIC ULTRASOUND-GUIDED RENDEZVOUS TECHNIQUE

A 71-year-old male who was known to have Type II diabetes and hypertension presented with vague abdominal pain associated with nausea and weight loss over the span of a few weeks, the examination did not demonstrate any abnormal findings apart from jaundice. His laboratory investigations demonstrated an elevated alanine transaminase (ALT) 153 units/L, aspartate aminotransferase (AST) of 66 units/L, alkaline phosphatase (ALP) 247 units/L, as well as a total

bilirubin level above 200 $\mu\text{mol/L}$ and a direct bilirubin level of 153 $\mu\text{mol/L}$. A computerized tomography (CT) demonstrated a hypoechoic mass at the head of the pancreas measuring 4 cm by 4 cm and invading the portal confluence as well as the superior mesenteric vein with numerous peripancreatic and porta hepatis lymph nodes as well as dilatation of the pancreatic duct to 7 mm. An EUS fine-needle aspiration confirmed the diagnosis of pancreatic ductal adenocarcinoma. An ERCP failed to achieve cannulation, and a EUS-RV was

performed after puncturing the CBD from the duodenum into the dilated CBD [Figure 3a] and advancing a wire till it passed through the papilla. The EUS scope was then withdrawn while keeping the wire in place using an exchange technique and then a regular duodenoscope was inserted and the guidewire was grasped using a snare and cannulation was achieved with a sphincterotomy [Figure 3b] and an uncovered SEMS was inserted with good BD [Figure 3c].

ENDOSCOPIC ULTRASOUND-GUIDED CHOLEDOCODUODENOSTOMY

A 48-year-old female present with epigastric pain and vomiting associated with progressive deep jaundice and dark urine as well as pale stools. Her initial investigations demonstrated an elevated AST (79 units/L), ALT (128 units/L), ALP (989 units/L), and a total bilirubin level of 300 $\mu\text{mol/L}$ that was mainly direct. A CT scan demonstration metastatic pancreatic cancer which was confirmed by a tissue biopsy. An ERCP failed to achieve biliary cannulation, so we proceeded to EUS-RV but was unsuccessful due to failure to advance the ERCP scope to the papilla despite initially succeeding in passing a wire through the duodenum to the CBD and out of the papilla. Hence, the scopes were withdrawn, and an EUS-CDS was planned. The EUS scope was advanced to the duodenum, and the CBD was punctured with a needle and a guidewire was advanced from the mid-CBD to the intrahepatic ducts in a retrograde fashion after confirming correct position of the needle by injecting contrast [Figure 4a]. A specially designed partially covered SEMS was used and inserted into the biliary system in an orientation where the proximal end of the stent was in the common hepatic duct while the distal part of the stent traversed the duodenal wall and into the duodenal lumen above the duodenum [Figure 4b]. BD was successful [Figure 4c].

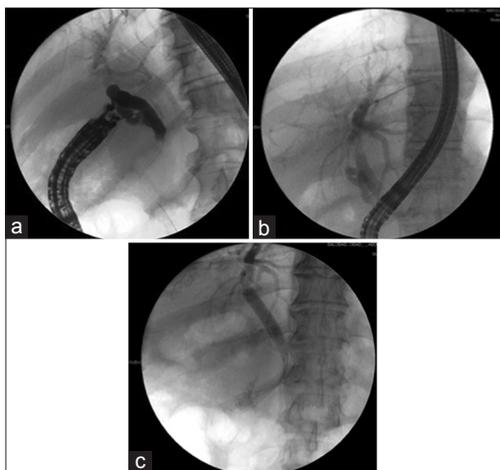


Figure 3: (a) A needle is introduced through the duodenal wall into the common bile duct and after confirmation of the position with contrast injection a wire is introduced through the needle and manipulated to reach the duodenal lumen through the papilla. (b) Cannulation is achieved with a regular duodenoscope after removing the endoscopic ultrasound scope. (c) Final result after deploying a metal stent in the biliary system

ENDOSCOPIC ULTRASOUND-GUIDED HEPATICOGASTROSTOMY

An 84-year-old female was admitted with progressive feelings discoloration of the eyes, itching, and right upper quadrant pain associated with dark urine. Here, laboratory investigations demonstrated elevated liver enzymes and high total bilirubin that was mainly to direct. A CT scan of the abdomen demonstrated a large right hepatic lobe mass that either represented a cholangiocarcinoma or gallbladder cancer. Given the patient's advanced age and multiple comorbidities, a palliative BD procedure was planned without obtaining a tissue biopsy. The duodenoscope could not be advanced to the papilla due to distortion of the anatomy from the tumor, so a EUS-hepaticogastrostomy was planned. An EUS scope was advanced to the proximal part of the stomach and under EUS ultrasound guidance a needle was introduced through the stomach and into the left lobe of the liver. After confirming correct position of the EUS needle by injecting contrast into the biliary tree [Figure 5a] a specially designed partially covered SEMS was inserted so that the proximal part would be in the left intrahepatic biliary tree while the distal portion was in the stomach [Figure 5b]. The patient's symptoms resolved and underwent palliative care.

ENDOSCOPIC ULTRASOUND-GUIDED ANTEGRADE INTERVENTIONS PRIMARY DRAINAGE

A 76-year-old female who was recently diagnosed with gallbladder cancer presented with right upper quadrant abdominal pain and jaundice. Her liver enzymes were elevated as well as her total bilirubin that was mainly direct. CT scan of the afternoon and re-demonstrated the mass in the gallbladder bed only this time associated with intrahepatic biliary dilatation

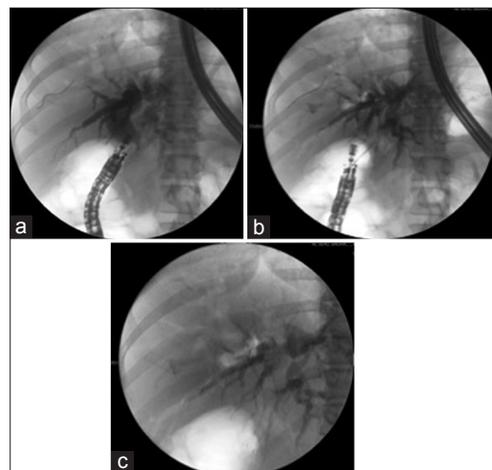


Figure 4: (a) A needle is introduced through the duodenal wall and into the common bile duct. After confirmation of proper position with contrast a wire is inserted through the needle toward the intrahepatic ducts. (b) A stent is deployed so that the proximal end is in the biliary system while the distal end traverses the duodenal wall above the papilla. (c) Final result after deploying a metal stent in the biliary system

with a transition zone at the level of the common hepatic duct. An ERCP failed due to difficult cannulation, so an EUS-AG was performed in a similar fashion to the one described earlier and achieved biliary decompression with no complications.

ENDOSCOPIC ULTRASOUND-GUIDED ANTEGRADE INTERVENTIONS IN SURGICALLY ALTERED ANATOMY

A 54-year-old male who was known to have metastatic colon cancer and underwent surgery for the primary tumor as well as liver resection for a metastatic lesion as well as a hepaticojejunostomy and chemotherapy presented with abdominal pain and jaundice. A CT scan demonstrated biliary obstruction at the hepaticojejunostomy site as well as multiple liver metastasis. Due to the difficulty anticipated in reaching the hepaticojejunostomy site with a duodenoscope an EUS-AG was performed where an uncovered SEMS was inserted through the stomach and the stent was positioned from the left hepatic duct and traversed the hepaticojejunostomy [Figure 6a and b] with good BD.

DISCUSSION

EUS-guided biliary interventions are a new application that provides alternative options to patients who are usually

undergoing palliative care. Minimizing complications, maximizing comfort and improving the quality of life are usually of paramount importance when caring for these patients. The cases as described in Table 1 demonstrate how this intervention could be agile as well as provide an alternative to the conventional PBD that usually hampers the quality of life of patients and not uncommonly results in recurrent admissions due to tube dysfunction. Results of studies that include more than 50 patients report a success rate that exceeds 90%, which is higher than those reported in smaller series.^[3] Furthermore, complication rates are around 19%, these include bleeding, cholangitis, perforation, bile leaks, pancreatitis, stent migration, and rarely death. Less serious complications include pneumoperitoneum, stent occlusion, and guidewire sheering and retention.^[3]

Although this might be an attractive option to achieve biliary drainage, it remains as a second-line therapy after attempted ERCP. This is due to the fact that expertise with these procedures is still limited and they do require proper backup with interventional radiology as well as surgery for any potential complications. Other challenges associated with this procedure is there are still limited accessories that have been developed for this procedure specifically as well

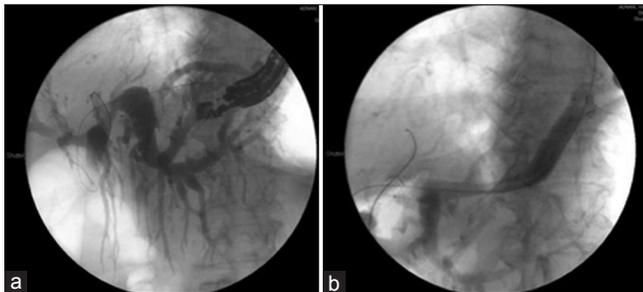


Figure 5: (a) An endoscopic ultrasound needle was inserted through the stomach wall and into the intrahepatic biliary ducts of the left lobe of the liver and after confirming correct position with injecting contrast a wire is introduced into the biliary system. (b) A specially designed partially covered metal stent is inserted so that one end is in the intrahepatic biliary system while the other end is in the proximal stomach

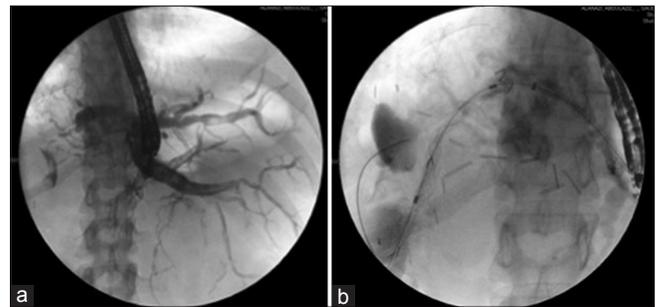


Figure 6: (a) A needle is punctured through the stomach wall and into the biliary system of the left hepatic lobe. After injecting contrast you can note that the common bile duct is not seen as the patient had a hepaticojejunostomy and the surgical clips could be seen. (b) A uncovered metal stent is inserted through the stomach and the stent is positioned so that one end is in the left hepatic duct and the other end traverses the hepaticojejunostomy

Table 1: A summary of the cases that underwent endoscopic ultrasound-guided biliary drainage

| Case number | Sex | Age (years) | Primary tumor | Location of tumor | Procedure performed | Reason for EUS-BD | Modality of use |
|-------------|--------|-------------|--|---------------------|---------------------|------------------------------|----------------------------|
| 1 | Male | 78 | Cholangiocarcinoma | Common hepatic duct | EUS-AG | Altered anatomy from tumor | Salvage drainage procedure |
| 2 | Male | 71 | Pancreatic adenocarcinoma | Distal CBD | EUS-RV | Difficult cannulation | Primary drainage procedure |
| 3 | Female | 48 | Pancreatic adenocarcinoma | Distal CBD | EUS-CDS | Difficult cannulation | Primary drainage procedure |
| 4 | Female | 84 | Cholangiocarcinoma or gallbladder cancer | Common hepatic duct | EUS-HDS | Altered anatomy from tumor | Primary drainage procedure |
| 5 | Female | 76 | Gallbladder cancer | Common hepatic duct | EUS-AG | Difficult cannulation | Primary drainage procedure |
| 6 | Male | 54 | Metastatic colon cancer | Hepaticojejunostomy | EUS-AG | Altered anatomy from surgery | Primary drainage procedure |

CBD: Common bile duct, EUS: Endoscopic ultrasound, AG: Antegrade intervention, BD: Biliary drainage, CDS: Choledocoduodenostomy, RV: Rendezvous technique, HDS: Hepatoduodenostomy

as the lack of training in the procedure as these are still being performed in high volume specialized centers. To add to that fact, centers that have this expertise also usually have a high success rate in achieving BD with ERCP even in difficult cases thus limiting the pool of patients that would qualify for such an intervention.

When the expertise is available in a center, this option should be offered to patients who fail ERCP, and there are trials at the moment comparing these EUS-guided interventions to PBD as well as percutaneous gallbladder drainage.

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Conflicts of interest

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REFERENCES

1. Adler DG, Lieb JG 2nd, Cohen J, Pike IM, Park WG, Rizk MK, *et al.* Quality indicators for ERCP. *Am J Gastroenterol* 2015;110:91-101.
2. Almadi MA, Pausawasdi N, Ratanchuek T, Yuen Bun Teoh A, Yu Ho K, Dhir V. Endoscopic ultrasound-guided biliary drainage. *Gastrointest Interv* 2016;5:203-11.
3. Dhir V, Isayama H, Itoi T, Almadi M, Siripun A, Teoh AY, *et al.* Endoscopic ultrasonography-guided biliary and pancreatic duct interventions. *Dig Endosc* 2017;29:472-85.
4. Almadi MA, Eltayeb M, Thaniah S. Endoscopic ultrasound-guided antegrade stenting in an occluded biliary self-expandable metal stent. *Saudi J Gastroenterol* 2016;22:337-40.