



Prevalence of use and reported side effects of herbal medicine among adults in Saudi Arabia



Suhaib Ibrahim Alkhamaiseh^{a,b}, Mohamad Aljofan^{c,*}

^a Department of Clinical Pharmacy, College of Pharmacy, University of Hail, Saudi Arabia

^b Department of Pharmaceutical Chemistry, College of Pharmacy, Jerash University, Jordan

^c Department of Biomedical Science, Nazarbayev University School of Medicine, Nur-Sultan, 010000, Kazakhstan

ARTICLE INFO

Keywords:

Herbal medicines
Prevalence
Knowledge
Attitude
Practice
Side effects

ABSTRACT

Objective: Despite the availability of well characterized and scientifically proven medicines, many people prefer the use of the less known herbal therapies that have no-scientific or evidence-based values as their first line of treatment. While this represents a growing worldwide issue, it is commonly practiced in developing countries including Saudi Arabia. Hence, the aim of the present study is to assess the prevalence of herbal medicine use, the most reported side effects and influencing factors in Saudi Arabia.

Design: A community based cross sectional survey study.

Settings: Participants were recruited by convenience sampling method from local malls and family recreation sites.

Main outcome measures: Prevalence of herbal medicine use and the associated risks.

Results: Out of the 1300 surveyed individuals, 1226 respondents (94 %) used herbal medicines for therapeutic purposes with the majority of the respondents using them based on traditional beliefs 699 (57 %) or family recommendations 417 (34 %). Young respondents < 35 year olds who live in urban cities, showed a significantly better knowledge about herbal medicines use and the associated risks than their counterparts ($p < 0.001$). Despite the high percentage of reported side effects (46 %), more than half of the respondents 702 (54 %) use herbal medicines as their first line of therapy. However, the most reported reasons for the use of herbal medicine are the belief that they are safer, more effective and cheaper to buy than the standard medicines.

Conclusion: There is a high prevalence use of non-scientifically proven herbal medicine and a low level of knowledge about their risks amongst participants.

1. Introduction

Herbal medicines have been widely used since ancient times, and they are gaining more momentum despite the advancements in modern healthcare. While it is quite popular amongst people in Asia and Africa, their use is rapidly spreading in the developed countries like the United States of America,^{1-6,8-36} UK and other European countries.^{2,3} However, industrialized countries prefer to use 'Alternative' or 'Complementary' Medicines (CAM) terms instead of herbal or traditional medicines.⁴

The American National Institute of Health classified herbal medicines as any products originating from plants and used to preserve or recover health.⁵ Plants and herbs have been the preferred choice for treating various disease symptoms and clinical problems through much of human history with some data suggests that during the early years of

the 20th century, 59 % of the products in the US were based on herbs or herbal combinations.^{6,7} The herbal medicinal market is continuing to grow with recent estimates suggest that the retail sales of herbal supplements to be as high as \$7 billion in the US alone.⁸

Generally, herbal medicines are complex mixture of two or more active constituents and sometimes contain unidentified components that may increase the possibility of drug interactions and adverse drug reactions, particularly drugs with narrow therapeutic index such as digoxin. Generally, herbal medicines are complex mixture of two or more active constituents and sometimes contain unidentified components that may increase the possibility of drug interactions and adverse drug reactions, particularly drugs with narrow therapeutic index such as digoxin.^{9,10} While herbal medicines are a recognized member of the complementary and alternative medicine group, many of these herbs are still missing scientific evidence to prove their effectiveness and

* Corresponding author at: Department of Biomedical Science, Nazarbayev University School of Medicine, Kerey & Zhanibek Khans 5/1, Nur-Sultan, 010000, Kazakhstan.

E-mail address: Mohamad.aljofan@nu.edu.kz (M. Aljofan).

<https://doi.org/10.1016/j.ctim.2019.102255>

Received 25 July 2019; Received in revised form 11 October 2019; Accepted 22 November 2019

Available online 25 November 2019

0965-2299/ © 2019 Elsevier Ltd. All rights reserved.

safety.⁸ The major causes of safety issue of herbal medicines are concerned with improperly processed or prepared herbal products,¹¹ lack of suitable quality control, inadequate labeling and absence of appropriate patient information.¹²

A study by Chong et al. 2015, that analyzed the records of 61 patients who consumed corticosteroid-adulterated proprietary in Chinese medicines, claimed that out of the total reviewed cases, 38 patients suffered major complications and nine admitted to intensive care, including two patients who died 30 days after admission.¹³ Despite these figures, some people prefer to use herbal medicines over conventional evidence-based medicines.

Recently, it was estimated that about 80 % of the world populations are using herbal medicines for primary care in the forms of extracts such as teas and other active principles.¹⁴ Several studies showed that the most common factors that people reported as the main reasons for the use of herbal medicine are beliefs such as that herbal medicines are free of side effects, and their low cost compared to standard treatments.^{15, 16}

Additionally, the use of herbal medicine is influenced by cultural practice, beliefs prior experiences, gender, age, health status, ethnicity, and education.¹⁷⁻¹⁹ A study by Al Akeel et al. 2018, showed a high prevalence of traditional medicines usage in Saudi Arabia.²⁰ While the study did not investigate the usage of herbal medicine in particular, or the influencing factors, the study indicated a high number of traditional medicine consumption that is somewhat linked to cultural practices and beliefs.

The majority of herbal products consumed in Saudi Arabia are unregulated and of unknown constituents, origins or preparation methods. These products lack scientific and evidence-based values and are mostly consumed in the absence of medical advice, putting the consumer's lives at eminent risks.²¹ Farrington et al. 2018, claimed that the majority of herbal preparations in Asia, including Saudi Arabia could potentially contain harmful substances or drugs that may have a significant negative impact on health and could either contribute to or cause death.²²

We have previously shown the prevalence of pharmacy malpractice of therapeutics including prescribed medicines,²³ and off label uses of different medicines,²⁴⁻²⁶ thus we would like to determine the therapeutic malpractices in the general population. Therefore, the aim of the current study is to determine the prevalence of use of unregulated herbal medicines in Saudi Arabia and determine public knowledge, attitude and practice towards consumption of these products. Specifically the study aims to determine the use of unregulated herbal products that lack scientific and evidence-based values and excluded the regulated complementary therapies from pharmacy outlets.

2. Methods

2.1. Ethics approval

A submission, including full project proposal was made to the Scientific Research Ethical Committee (SREC) at the University of Hail in the Kingdom of Saudi Arabia. The proposal was approved by the Committee.

2.2. Calculating sample size

To calculate the sample size of the study, the absolute error was estimated to be 5 % and a 95 % confidence level was used, thus, the minimum required sample size for this study is 368 participants. In addition, the attrition rate (i.e., to consider non-respondents) was 20 %. Therefore, the required number of participants was 442.

2.3. Study design

This is a cross sectional questionnaire based study that was carried

out in four major cities in the northern regions of Saudi Arabia, between February and Oct 2017. Participants were randomly selected by convenience sampling method at shopping centers and recreational parks, and were consented to participate after they were given full details of the study and its intended aims. All participants were made aware that this study is for research purposes only and their participation was voluntary. They were not asked for their names or contact information ensuring the privacy of survey respondents. The questionnaire was designed in English then translated to the local spoken language Arabic by proficient speakers of both languages and was revised to be suitable to the general population.

The questionnaire used in the current study was developed to evaluate the participant's knowledge, attitude and practice (KAP) regarding herbal medicines use and the associated health risks. The questionnaire was validated with a pilot run using a group of randomly selected individuals. Based on that the final version of the questionnaire was used in this study.

2.4. Study setting

2.4.1. Study population (inclusion/exclusion)

Inclusion: We only included people of both genders who ≥ 18 years of age at the time of surveying. Exclusion: People who were less than 18 years old, and those who did not consent to participate were excluded from the study.

2.4.2. Data storage

All data collection forms were kept in a secure setting, only available to the principal investigator in accordance with the requirement of the SREC at the University of Hail.

2.4.3. Statistical analysis

Data were recorded on a data collection form and entered on a Microsoft Office Excel® (2010) spreadsheet. Statistical data analyses and tables were generated using Microsoft Office Excel® (2010). A chi-squared test was used to test for significance and a *priori* level of $p < 0.01$ was considered statistically significant.

3. Results

3.1. Demographic data

A total of 1500 questionnaires were distributed, but only 1300 were completed given an overall response rate of 86.7 %. Out of the total 1300 respondents, 879 (67.6 %) were females with 991 (76.3 %) of the participants are under the age of 34 years. The majority of the participants, 1184 (91 %) were from urban areas and 772 (59.4 %) reported to have undergraduate degrees, which reflects a true image of the region's urban dwellers of this age group. The characteristics of the studied population is shown in Table 1.

3.2. Prevalence and knowledge score association with demographic characteristics

In this study we clearly defined medicinal plants, herbs, as any natural product either plant or biological materials/preparations that was used or intended to be used for therapeutic purposes or alleviation of disease signs and symptoms without medical advice or supervision. Out of the 1300 surveyed individuals, 1226 respondents (94 %) indicated that they have used herbal medicines for therapeutic purposes (Table 2). When asked about the source of information and therapeutic uses of the herbs, the majority of the respondents claimed to self-treat based on traditional beliefs 699 (57 %) or family recommendations 417 (34 %) (Fig. 1).

Table 1
Demographic Characteristics of the Respondents (n = 1300).

Variables		Number	Percentage (%)
Gender	Male	421	32.4
	Female	879	67.6
Age (in years)	18–24	673	51.8
	25–34	318	24.5
	35–44	184	14.2
	45–54	87	6.7
	55–64	32	2.5
	> 64	6	0.5
Place of residence	Urban	1184	91.1
	Rural	116	8.9
Educational level	No formal education	102	7.8
	High School	382	29.4
	Undergrad	772	59.4
	Postgraduate	44	3.4
Monthly income	< 2400	506	38.9
	2500–4999	200	15.4
	5000–10,000	368	28.3
	> 10,001	226	17.4

Table 2
Prevalence of herbal medicines usage associated with demographic data.

Sociodemographic data		Have you used herbal medicines?		
		Yes	No	Percentage % use
Gender	Male	387	34	92
	Female	839	40	95
Age	18–24	627	46	93
	25–34	303	15	95
	35–44	182	2	99
	45–54	77	10	89
	55–64	31	1	97
	> 65	6	0	100
Place of residence	Urban	1118	66	94
	Rural	108	8	93
Educational level	No formal education	97	5	95
	High school	379	3	99
	Undergraduate	710	62	92
	Postgraduate	40	4	91
Monthly income	< 2400	478	28	94
	2500–4999	189	11	95
	5000–10000	361	7	98
	> 10000	196	30	87

3.3. Multivariate analyses for knowledge scores

After adjusting for all demographic variables in the multivariable model, respondents with high income (> 10,000 Saud Arabia Riyals) per month, showed a significantly higher knowledge about the appropriate use of herbal medicine and their potential side effects and risk. Also, urban residence ($\beta = 0.25$, 95 % CI: 0.53, 0.65; $p < 0.001$) and younger age ($\beta = 0.555$, 95 % CI: 0.35, 0.76; $p < 0.001$) were significantly associated with good knowledge score in the multivariable regression analyses (Table 3).

3.4. Attitudes toward herbal medicine usage

To determine the respondents experience with herbal medicine, we asked whether they have experienced any side effects following the consumption of herbal medicine, almost half of the respondents 564 (46 %) reported that they have experienced variable side effects including allergies 147 (12 %), diarrhea 147 (12 %) and others (Fig. 2A). Nonetheless, 899 (69.2 %) believed that the experience of side effects is a normal part of the healing process and will continue to use herbal medicine when needed. When respondents asked for why do they use herbal medicines instead of other standard therapy, a total of 846 respondents out of the 1226 users (69 %) claimed that they use them

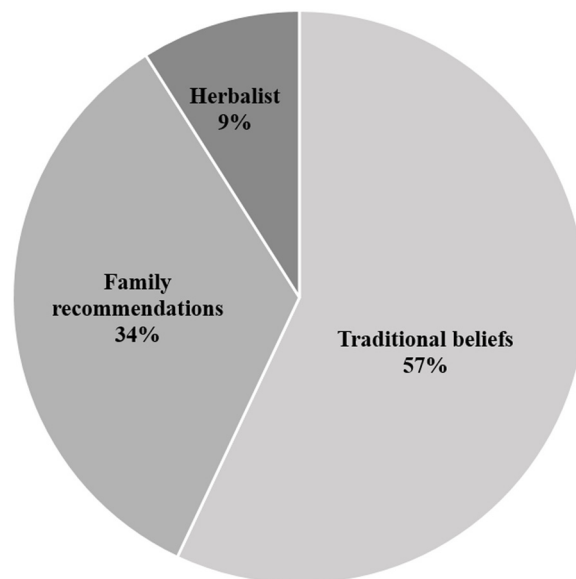


Fig. 1. Source of herbal information.

The chart shows the sources of herbal medicine uses. These are the reference points that the respondents follow for their treatment regimens. These references include traditional practices, for example practices that have been passed through generations; family recommendations such as suggested by an elderly member of the extended family; and information sourced from herbalist, these are usually people who claim to have the required experience to carry out treatment using herbal medicines.

because herbal medicines have no side effects, 455 respondents (37 %) believed that herbal medicines are more effective and have more benefits than the standard therapy, and 273 (22 %) opted to use herbal medicines as they are cheaper to purchase than the standard medicines (Fig. 2B).

3.5. Practice

More than half of the respondents 702 (54 %) said that they use herbal medicine as their first line of therapy, with 86 respondents (6.6 %) frequently use it on a daily basis (Fig. 3). Interestingly, after adjusting variables in the demographic data in the multivariable model, we found that respondents, regardless of gender, and place of residence, who are more than 35 years of age ($\beta = 0.41$, 95 % CI: 0.36, 0.46; $p < 0.001$), with high school education ($\beta = 0.36$, 95 % CI: 0.12, 0.25; $p < 0.001$), and average income between 5,000–10,000 SAR per month ($\beta = 0.65$, 95 % CI: 0.25, 0.36; $p < 0.001$) are likely to use herbal medicines frequently and willing to recommend it to others including minors (Table 4).

4. Discussion

The current study shows a significantly high prevalence of herbal medicine use amongst Saudis, which is comparable to the previously reported study by Elolemy et al. 2012, that surveyed about 500 participants of whom 85 % have reportedly used herbal medicines.²⁷ Similarly, a study by Al-Faris et al. 2008, that surveyed more than 1400 participants from the Riyadh area reported the usage prevalence to be at 68 %.²⁸ While there is no difference in practice between the reported areas or the figures, we notice a continual increase in the prevalence of usage of non-scientifically proven preparations. These preparations, which sold/recommended by non-health professionals, are usually falsely labeled as effective, safe and chemical-free while containing non-labeled synthetic pharmacological ingredients or even toxic agents.

Our results show that the most likely reason for the increase in use is that the consumer’s believe in the safety of herbal medicine, which is in

Table 3
Demographic association with knowledge score.

Variables	β (95 % CI)	P	β (95 % CI)	P
Male vs Female	0.240 (0.117, 0.363)	0.012	0.221 (0.172, 0.453)	0.152
Age (Reference 18)	0.555 (0.348, 0.763)	< 0.001	0.371 (0.162, 0.686)	< 0.001
Urban vs rural	0.254 (0.534, 0.646)	< 0.001	0.243 (0.120, 0.366)	< 0.001
Education (Ref no formal education)	0.341 (0.198, 0.386)	0.013	0.612 (0.495, 0.991)	0.260
Income (Ref < 2400)	0.442 (0.348, 0.802)	< 0.001	0.481 (0.399, 0.682)	0.001

agreement with previous studies from Saudi that suggested the most influencing factor for herbal usage being the believe in the success and safety of herbal medicines.^{28,29} However, this factor seems to be a universal one, as reported by Jang et al. 2017, who studied the prevalence of herbal medicine usage in South Korea, which suggested that 64 % of the users believed that herbal medicines were safe.⁸ The belief that herbal medicines are safe is widely spread across many different countries and cultures, and arguably the reason for this is not that it is true, but rather due to the under reporting of toxic side effects of herbal and traditional medicines.

There was no difference in herbal medicine uses between the different genders, but working class respondents who are over than 35 years of age with high school education or more are likely to use herbal medicines and willing to recommend it to others. These findings are not consistent with other findings from Saudi Arabia, which reported that most users of herbal medicines were females,^{20,27-29} older than 60,^{28,29} and illiterate or have no formal education,^{20,28} or that of McLennan, which investigated the prevalence of herbal medicine uses and costs in Australia. They reported that the users were more likely to be educated premenopausal females.³⁰ However, the differences noticed in these findings could possibly be due to our larger sample size, 1300 compared to other studies that included 500 or less participants, or to the more diverse geographic locations (four provinces scattered in the northern part of Saudi Arabia) of our population compared to these studies that only focused on one province. The difference in sample size might affect the power of statistical analysis and might lead to different findings, as the statistical differences in small sample size population might be diluted in a larger sample size and become not significant.³¹

The results showed that general knowledge about herbal medicines was significantly affected by the participant’s socioeconomic background, urban dwellers, and age, the younger respondents were found to be more knowledgeable compared to the older ones. The young cohort of respondents have a better access to information through social media or their educational institutes, thus they are expected to be more knowledgeable in this regard, which is also the case for respondents from urban areas who would have access to information through health education centers available throughout the urban areas. However, the

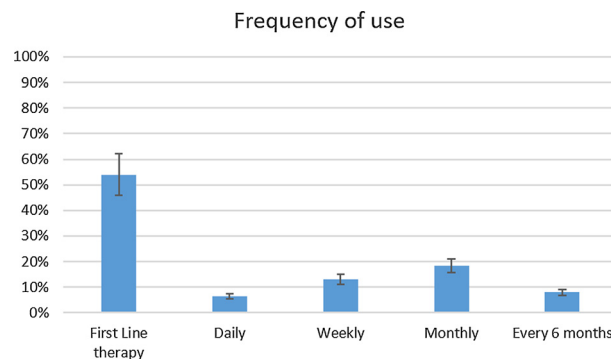


Fig. 3. Frequency of herbal medicine use. The figure shows the practice of respondents in terms of herbal medicines usage. The majority of respondents claimed that they often opt to use herbal medicines as their first line of treatment instead of standard therapy and a few respondents use herbs on a daily basis.

Table 4
Association of practice and demographics.

Variable	Prefer herbal medicine over standard medicines	
	β (95 % CI)	P-Value
Age	≤ 34 year olds vs ≥ 35 year olds	0.411 (0.356, 0.456) < 0.001
Education level	\leq No formal education vs \geq high school	0.361 (0.120, 0.251) < 0.001
Monthly income	≤ 4999 SAR vs ≥ 5000	0.650 (0.248, 0.363) < 0.001

usage specific knowledge, such as doses and therapeutic procedures of herbs appeared to widely depend on traditional practices or family recommendations, both of which lack the necessary scientific basis. This is an alarming finding that require urgent intervention from the responsible authority as such practices place individuals and public

A. Side effects

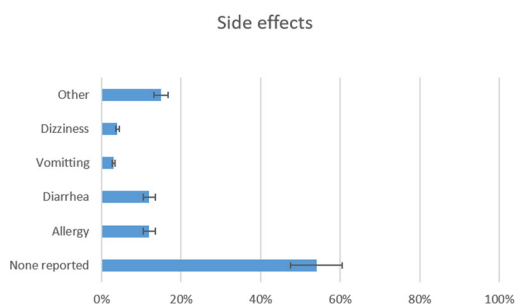
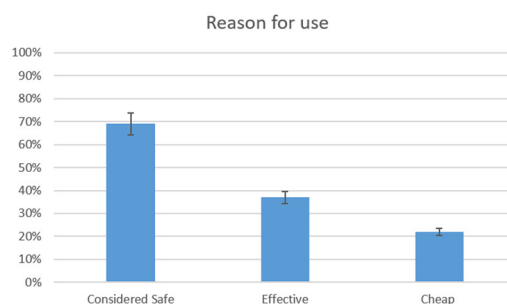


Fig. 2. Respondent’s attitude towards herbal medicines.

The respondents were asked for their experiences with herbal medicine use including side effects (A). Reporting of no side effects does not mean that the herbs did not cause side effects, but rather no obvious side effects were notices. Also, the most common reasons for using herbal medicines (B) were reported as the belief that herbal medicines are safe to use, effective in treating various diseases and cheap to purchase.

B. Reasons for use



health as a whole at a great risk. This risk is evident by the number of side effects reported with almost half of the respondents claimed to have experienced some form of side effects. These of course are the obvious side effects that the participants have experienced following the usage of unregulated herbal preparations, as it is not feasible to measure/report the asymptomatic ones as they are likely to go unnoticed.

In addition to the respondents' belief about the safety of herbal medicines, some participants claimed that herbal's affordability and availability make them a more convenient option to use than the standard therapy. A number of studies from Saudi Arabia and other countries have also reported that the cost of herbal medicine make them an attractive option for many people particularly those from a low socioeconomic background. For instance, Wang et al. 2011, reported that a significant number of adults in the United States use alternative therapies as they are cheaper than prescription medications.³² This finding is supported by similar studies that listed cost as an influencing factor amongst herbal medicine users including; from Australia,³⁰ Saudi Arabia,^{27–29} Lebanon,³³ Serbia,³⁴ South Korea,⁸ as well as many others.

Alarmingly, more than half of the respondents reported that they use herbal medicine as their first line of therapy, including some who consistently use herbal medicines daily and are willing to recommend the use to minors. This finding is similar to previous reports that suggested some herbal preparations or products are consumed for therapeutic purposes on a daily basis. For instance, Myrrh, which is an oleo gum resin obtained from *Commiphora molmol*, and *Balsamodendron myrrh* trees,³⁵ has been reported to be widely used among Saudis for the treatment of microbial infections and wound healing.³⁶ However, prolonged use of Myrrh or use in high concentrations can be toxic and induce unregulated inflammation and abortion in pregnancy.^{35, 36} The chronic use of non-scientifically proven herbals and in the absence of medical recommendation represent a high risk practice that will not only affect the individuals, but the society as a whole. Therefore, there is an urgent need to regulate the usage of herbal medicine such as improving public health education and training on herbal medicine use and risks as well as providing herbal medicine specialized centers and clinics if possible.

5. Limitations and bias

The first drawback of the study is that there are more female participants than males, which may indicate an unequal distribution of the sample and does not represent the actual male to female ratio in the kingdom. This may in fact be due to the recruitment of the respondents who were recruited mostly at shopping centers and recreation sites that are usually frequented by women more than men. This can be overcome by including other potential recruiting sites such as coffee shops or traditional males meeting places. The second limitation is that the study was done in sections of the northern regions of Saudi Arabia and may not be applicable to the whole population. However, there are no differences in terms of practices between the different areas of Saudi Arabia and the determined prevalence in this study is comparable to previously reported studies from other regions. Other drawbacks of the study including the failure to ask the respondents whether they inform their healthcare providers about their herbal medicine use or not, as well as not investigating the diseases or the indications for which the herbals are used. These questions would have enabled healthcare providers to be aware of these practices when dealing with patients. Nevertheless, healthcare providers in the region should be aware of the high percentage of herbal medicine use, and are encouraged to discuss potential use with their patients in order to avoid future complications.

6. Conclusion

The current study represent one of the very few studies that have surveyed a large number of participants in Saudi Arabia with more than

86 % response rate. There is a low level of knowledge about the risk of herbal medicine amongst participants and a significantly high number of consumption of non-scientifically proven herbal products for therapeutic purposes, sometimes as a first line therapy. Participants' belief in herbal medicines, their affordability and availability are the most important factors that influenced the participant's usage. Therefore, health education about the use and risk of herbal medicine should be widely distributed to target as many people as possible.

Funding

Not applicable.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Declaration of Competing Interest

The authors declare that these is no conflict of interest.

Acknowledgement

The authors would like to thank the University of Hail – College of Pharmacy for providing the resources needed to conduct this study. Also, would like to thank Prof Faye Foster for reviewing the manuscript.

References

- Eisenberg DM, et al. Unconventional medicine in the United States. Prevalence, costs, and patterns of use. *N Engl J Med.* 1993;328(4):246–252.
- Calapai G. European legislation on herbal medicines: a look into the future. *Drug Saf.* 2008;31(5):428–431.
- Nissen N. Practitioners of Western herbal medicine and their practice in the UK: beginning to sketch the profession. *Complement Ther Clin Pract.* 2010;16(4):181–186.
- WHO. *Traditional medicine.* . 16 Nov 2016; Available from: 2003; 2003http://www.who.int/mediacentre/factsheets/fs134/en/.
- Tyler VE. Herbal medicine: from the past to the future. *Public Health Nutr.* 2000;3(4A):447–452.
- Swerdlow J. Heal NP, ed. *Medicine changes: late 19th to early 20th century.* Vol. 110–191. Washington, DC: National Geographic Society; 2000.
- Aljofan M, et al. Anti-hepatitis B activity of isoquinoline alkaloids of plant origin. *Arch Virol.* 2014;159(5):1119–1128.
- Jang S, et al. Characteristics of herbal medicine users and adverse events experienced in South Korea: a survey study. *Evid Based Complement Alternat Med.* 2017;2017:4089019.
- Ernst E. Herb-drug interactions: potentially important but woefully under-researched. *Eur J Clin Pharmacol.* 2000;56(8):523–524.
- Zhang Z-J, et al. An epidemiological study of concomitant use of Chinese medicine and antipsychotics in schizophrenic patients: implication for herb-drug interaction. *PLoS One.* 2011;6(2):e17239.
- Zhang J, et al. Quality of herbal medicines: challenges and solutions. *Complement Ther Med.* 2019;20(1):100–106.
- Raynor DK, et al. Buyer beware? Does the information provided with herbal products available over the counter enable safe use? *BMC Med.* 2011;9:94.
- Chong YK, et al. Corticosteroid adulteration in proprietary Chinese medicines: a recurring problem. *Hong Kong Med J.* 2015;21(5):411–416.
- Shraim NY, et al. Community pharmacists' knowledge, practices and beliefs about complementary and alternative medicine in Palestine: a cross-sectional study. *BMC Complement Altern Med.* 2017;17(1):429.
- Ernst E, Marz R, Sieder C. A controlled multi-centre study of herbal versus synthetic secretolytic drugs for acute bronchitis. *Phytomedicine.* 1997;4(4):287–293.
- Karimi A, Majlesi M, Rafeian-Kopaei M. Herbal versus synthetic drugs; beliefs and facts. *J Nephrotherapeutics.* 2015;4(1):27–30.
- Firenzuoli F, Gori L. Herbal medicine today: clinical and research issues. *Evid Based Complement Alternat Med.* 2007;4(Suppl 1):37–40.

18. Winkler AS, et al. Attitudes towards African traditional medicine and christian spiritual healing regarding treatment of epilepsy in a rural community of Northern Tanzania. *Afr J Tradit Complement Altern Med*. 2010;7(2):162–170.
19. Arcury TA, et al. Herbal remedy use as health self-management among older adults. *J Gerontol: Series B*. 2007;62(2):S142–S149.
20. Al Akeel MM, et al. Herbal medicines: Saudi population knowledge, attitude, and practice at a glance. *J Family Med Prim Care*. 2018;7(5):865–875.
21. Aljofan M, Alkhamaiseh SI. Prevalence and factors influencing use of herbal medicines during pregnancy in hail, Saudi Arabia: a cross-sectional study. *Sultan Qaboos Univ Med J*. 2019;19(3).
22. Farrington R, et al. Potential forensic issues in overseas travellers exposed to local herbal products. *J Forensic Leg Med*. 2018;60:1–2.
23. Alshammari TM, et al. Pharmacy malpractice: the rate and prevalence of dispensing high-risk prescription-only medications at community pharmacies in Saudi Arabia. *Saudi Pharm J*. 2017;25(5):709–714.
24. Aljofan M, et al. Off label antiviral therapeutics for henipaviruses: new light through old windows. *J Antivir Antiretrovir*. 2010;2(1):1–10.
25. Aljofan M, Abduzhappar G. Metformin: a stroke of luck. *Electron J Gen Med*. 2019 16(3):em143.
26. Aljofan M, Riethmacher D. Anticancer activity of metformin: a systematic review of the literature. *Future Sci OA*. 2019;5(8):FSO410.
27. Elolemy AT, Albedah AM. Public knowledge, attitude and practice of complementary and alternative medicine in riyadh region, Saudi Arabia. *Oman Med J*. 2012;27(1):20–26.
28. Al-Faris EA, Al-Rowais N, Mohamed AG, et al. Prevalence and pattern of alternative medicine use: the results of a household survey. *Ann Saudi Med*. 2008;28(1):4–10.
29. Suleiman AK. Attitudes and beliefs of consumers of herbal medicines in Riyadh, Saudi Arabia. *J Community Med Health Educ*. 2014;4(269).
30. MacLennan AH, Wilson DH, Taylor AW. Prevalence and cost of alternative medicine in Australia. *Lancet*. 1996;347(9001):569–573.
31. Rashrash M, Schommer JC, Brown LM. Prevalence and predictors of herbal medicine use among adults in the United States. *J Patient Exp*. 2017;4(3):108–113.
32. Wang CC, Kennedy J, Wu CH. Alternative therapies as a substitute for costly prescription medications: results from the 2011 national health interview survey. *Clin Ther*. 2015;37(5):1022–1030.
33. El Khoury G, Ramadan W, Zeeni N. Herbal products and dietary supplements: a cross-sectional survey of use, attitudes, and knowledge among the lebanese population. *J Community Health*. 2016;41(3):566–573.
34. Samojlik I, et al. Consumers' attitude towards the use and safety of herbal medicines and herbal dietary supplements in Serbia. *Int J Clin Pharm*. 2013;35(5):835–840.
35. Massoud A, et al. Preliminary study of therapeutic efficacy of a new fasciolocidal drug derived from *Commiphora molmol* (MYRRH). *Am J Trop Med Hyg*. 2001;65(2):96–99.
36. Al-Mobeeriek A. Effects of myrrh on intra-oral mucosal wounds compared with tetracycline- and chlorhexidine-based mouthwashes. *Clin Cosmet Investig Dent*. 2011;3:53–58.