ORIGINAL ARTICLE

A cross sectional study- knowledge, attitudes and practices of general population regarding herbal products and dietary supplements in Karachi

Wajeeha Khalid, Sidra Zahid, M. Jamaluddin, Muhammad Tanveer Alam

Abstract:

Objectives: To determine the prevalence of the use of herbal products and dietary supplements, and assess public perception regarding these products.

Material and Methods: A descriptive cross-sectional study was conducted in all the six districts of Karachi (a metropolitan city of Pakistan) using a Knowledge, Attitude and Practices survey questionnaire. Participants were given the questionnaires in English to fill out anonymously and the questionnaires collected upon completion. Respondents not comfortable with English were provided the aid of an interpreter conversant in regional languages. Data gathered from the survey was entered into SPSS version 20.0 for analysis.

Results: ,Use of herbal products and dietary supplements was widespread in the sample (1193, 82.3%). A desire to improve health status (p<0.001) and younger age (p<0.001) significantly correlated with use of supplements, while gender (p>0.409) and education levels (p>0.005) were not significant predictors.

Conclucsion: Cultural and religious beliefs were found to be the chief forces in determining individuals' attitudes to complementary and alternative medicine. The majority of respondents perceived herbal products and dietary supplements to be safe for consumption. The use of herbal products and dietary supplements and is common among the Pakistani population. Since a large portion of the supplement industry in the country operates unregulated, there is a pressing need for increased government oversight to ensure public safety.

Keywords: Herbal products, alternative medicines, dietary supplements, knowledge, attitude, practices

Karachi Medical and Dental College (KMDC), and Abbasi Shaheed Hospital, Karachi
M Jamaluddin
MT Alam
W Khalid

Jinnah Medical and Dental College, Karachi
S Zahid

Correspondence:
Dr. Wajiha Khalid, Surgical Unit-II and Urology, Abbasi Shaheed Hospital, Karachi
Cell: +92 336-2521357
Cell: +92 300-2167612
Email: wajeeha786@gmail.com, drmjdin@gmail.com

Introduction:

For approximately 40-90% of the world's population, particularly those residing in developing nations, traditional and herbal medications are the primary form of medicinal therapy.[1] In a study, conducted by Bailey et al, greater than 50% of all participants reported using at least one dietary supplement highlighting robust growth in dietary supplement market globally.[2,3] Similarly, the adoption of herbal products around the world is also expanding as 80% of population rely on it.[3] In Pakistan, Complementary and Alternative Medicine (CAM), comprising of herbal products (HP) and dietary supplements (DS) plays an integral role in the health care system. Factors such as widespread acceptance of functional foods rise in consumer confidence and demand to include natural products and food supplements in preventive health have fueled growth internationally substantially over the last decade.[4] In spite of the well documented adverse effects and toxicities of many over the counter drugs, patients show reluctance in consulting their primary care physicians before starting these medications.[3,5,6]

High rates of complementary and alternative Medicine use have been demonstrated among patients suffering from chronic diseases such as hypertension, HIV and infectious diseases.[7] Unfortunately, it is difficult to ascertain the safety, efficacy, extent and pattern of CAM usage.[8] De-

W Khalid, S Zahid, M Jamaluddin, MT Alam

spite widely prevalent use there is a paucity of practice oriented books of phytotherapy and literature regarding the possible adverse effects due to adulteration of herbal products and concomitant use of other medicines like vitamin and mineral supplements.[10-12] Knowledge of registered practitioners in the country, commonly known as hakims, is the only authentic reservoir that will exhaust with time on account of limited literature.

Despite a pressing need for research into the risks posed by use of alternative medicinal treatments (for example drug-drug interactions between herbal product and dietary supplements) there is a dearth of studies conducted on this subject in Pakistan. This is particularly concerning considering the widespread use of CAM therapy in the country. In addition to this, no legislative measures and policies are being adopted by the national drug authorities to shape and frame harmonized methods for proper regulation of traditional medicine and lab-based investigations concerning the use of harmful plant products, contamination with toxic substances and allergies to specific combinations.[14] Un registered small manufacturers and establishments continued to operate in defiance of the action taken against them by the Drug Regulatory Authority of Pakistan which sets an example of the non-standardized regulation of traditional medicine in the country[9] High prevalence of the use of HP and DS coupled with the easy access to them is leading to a major health risk of individuals from high dosage, for example vitamin-D toxicity has reportedly been increasing.[12] Drugs interaction also accounts one major drawback causing decrease efficacy and adverse effects.[13]

The primary objective of this study was to assess the prevalence of the use of herbal products and dietary supplements among adult residents of Karachi, while the secondary objective was to explore public perception regarding safety, extent of disclosure with family doctors, sources of information about herbal products and dietary supplements as well as the role of culture and religious beliefs in embracing alternative medicine as a therapeutic measure.

Material and Methods:

This descriptive, cross-sectional study was conducted in Karachi, over a period of 4 months from September 2017 to January 2018, through Surgical Unit-II, Abbasi Shaheed Hospital, Karachi after approval from the ethical committee of the hospital. The study population consisted of general public from all the six districts of Karachi, the metropolitan area. The potential pool of study participants consisted of adults aged 18-80 years. Subjects who were not willing to participate or did not give the consent, <18 or >80 years old and those not residents of the Sindh province were excluded. Respondents were approached by randomly selecting houses of different residential areas, educational institutes and tertiary care hospitals of both the private and government sectors ensuring participation of both middle and higher economic communities living. Permission to conduct the survey was sought from all the concerned departments of the hospitals. The sample size was determined using Open Epi, version-3 open source calculator-SSPropor. A total of 1,500 people were approached to participate in the study out of which 50 refused to give consent. Informed consent was taken from the remaining 1450 people who completed the interview. Therefore, the co-operation rate was 96.67%. No imputation method was used nor incentives offered for participation and only those 1,450 people were included in the study of whom we had complete data. A structured questionnaire was compiled and was thoroughly reviewed for relevance, before being administered in the study. The questionnaire was pilot tested for content, read-ability, and comprehension on 25 people and modifications were made as necessary so that it was simple to comprehend and yet give accurate results. Participants were assured confidentiality and given the pre-coded questionnaires, which were completed anonymously and collected after completion. A standardized interviewing method was employed for the participants who were not comfortable with English. Urdu (the national language) and other commonly spoken languages of the province like Sindhi were used to eradicate any mis-communication. The interviews

A cross sectional study- knowledge, attitudes and practices of general population regarding herbal products and dietary supplements in Karachi

108

Table-1: Baseline Socio-demographic Characteristics and Health Status of Participants (1450) consumption in last 12 months

	Herbal products	Dietary Supplements	Both	None	P-value
Gender					
Male (37%)	85	183	179	102	0.409
Female (62%)	118	308	320	155	
Qualification					
Un-educated (3.5%)	8	16	18	13	0.005
Metric (9.2%)	17	33	58	25	
Inter/A levels (48.5%)	85	260	246	113	
Graduates (34.6%)	84	151	161	106	
Familiarity					
Not at all (24.8%)	29	42	190	98	<0.001
Some what (60.8%)	119	380	249	127	
Very familiar(14.3%)	50	66	60	31	
Reason for usage					
For specific disease(17%)	70	50	81	0	<0.001
Health maintenance (61.9%)	90	333	308	0	
Increase energy (8.1%)	9	52	34	0	
supplement diet (9.5%)	8	40	65	0	
Other (3.2%)	17	12	10	0	
Pattern of usage					
Daily (24.4%)	48	126	180	0	<0.001
Weekly (10.3%)	37	62	51	0	
Monthly (15.7%)	24	183	21	0	
Occasionally (29.6%)	74	114	242		
Ailments for which supplements were used					
Fever/pain (19.9%)	29	39	166	0	<0.001
Beauty care (39.9%)	80	254	138	0	
Respiratory (3.1%)	12	15	9	0	
Cardiac (2.4%)	7	11	10	0	
Gynae/obs(7.7%)	13	19	59	0	
Weight loss (9.5%)	28	56	28	0	
Others (17.4%)	25	91	90	0	
Effects over symptoms					
Helpful (58.5%)	154	375	160	0	<0.001
No effect (24.8%)	30	92	171	0	
Worsen symptoms (16.7%)	9	19	170	0	
Adverse effect					
Yes (36.9%)	31	161	203	0	<0.001
No (63.2%)	156	301	268	0	
What adverse effect noted					
CNS disturbance (43.3%)	57	66	169	0	<0.001
GIT problems (39.6%)	19	80	167	0	
Cardiac (8.3%)	8	48	0	0	
Others (8.8%)	1	49	7	0	

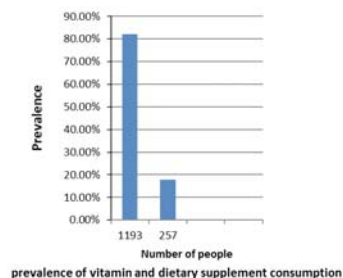*Figure 1:*

prevalence of vitamin and dietary supplement consumption

were asked such as, well knowing of herbal products and dietary supplements with association of fatty acids, proteins, probiotics and homeopathic medicine. Second section inquired about the public opinion and explored the attitudes regarding the products using a 5-point Likert scale. Third section was directed to provide individual's information regarding the practices and pattern of use. Herbal products were defined as plant-based medicines or extracts to maintain health and to prevent, alleviate or cure specific diseases. Dietary supplements were defined as products taken orally that contain one or more ingredients (such as vitamins, minerals or amino acids) that are intended to supplement one's diet and are not considered food. The collected data were entered into and analyzed by using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. The catagorical variables were expressed in terms of frequencies and percentages while continuous variables were reported in terms of mean and standard deviation. Pearson's Chi-square test of independence was used to access association between sociodemographic factors and consumption of either or none of the products with miscellaneous variables of practices. In all cases , P-value < 0.001 was considered statistically significant.

Results:

The great majority of the total survey population of 1,450 consumed herbal products and/ or dietary supplements (1193, 82.3%) (Fig. 1). Of survey population the majority were females (901, 62.1%) as compared to males (549, 37.9%). There was no significant relation of gender (p=0.409) with consumption. Most of the respondents were educated; over half

were conducted by three interviewers who were trained to follow the same interview protocol in order to eliminate interviewer bias. Questions

Table-2: Herbal Products and Dietary Supplements Survey: Baseline Measures of Participants Attitude (1450)

	Strongly Agree N (%)	Agree N (%)	Neither Agree nor Disagree N (%)	Disagree N (%)	Strongly Disagree N (%)
a) Culture/religious beliefs influence our attitude towards herbal products and dietary supplements	273(18.8%)	695(47.9%)	258(17.8%)	140 (10.2%)	76 (5.2%)
b) Herbal study is presently excluded from medical curriculum; it should be taught	268(18.5%)	765(52.8%)	311(21.4%)	79 (5.4%)	27 (1.9%)
c) Herbal/dietary products are completely safe because they are made from natural ingredients	167(11.5%)	783(54.0%)	333(23.0%)	148(10.2%)	19 (1.3%)
d) Herbal/dietary products are more effective in treating illness than pharmaceutical drugs	212 (14.6%)	429(29.6%)	412(28.4%)	300(20.7%)	97 (6.7%)
e) Herbal /dietary products are safe in pregnancy and infancy	174 (12.0%)	546(37.7%)	520(35.9%)	162(11.2%)	48 (3.3%)
f) It is important to consult a doctor before its use	484 (33.4%)	674(46.5%)	141 (9.7%)	7 (5.3%)	74 (5.1%)

Table-3: Shows the knowledge regarding dietary supplements and herbal products

	N	%
Dietary Supplements		
Vitamins/Minerals	1133	78.1
Proteins/fatty acids	191	13.2
Probiotics	51	3.5
Homeopathic medicines	74	5.1
Herbal products		
Herbals/other botanicals	870	60%
Minerals	272	18.8%
Probiotics	73	5%
Homeopathic medicines	234	16.1%

Table-4: Shows the source of recommendation

	N	%
Friends/Relatives	677	57.1%
Media	147	12.4%
Doctors/pharmacist	298	25.1
Medical students	29	2.4%
Newspaper/magazines	33	2.9%

(704, 48.5%%) had studied up to intermediate standard/A-levels, close to a tenth (134, 9.3%) had matriculated and over a third (502, 34.6%) had gone to complete their studies up to graduate level. A small minority (55, 3.7%) were uneducated. There was no significant correlation of education level with HP or DS use (p=0.005). A significant correlation was established between usage and familiarity with herbal products/dietary supplements (p=<0.001). Most respon-

dents indicated familiarity with herbal products or dietary supplements; the vast majority expressing being at least some what familiar (875, 60.8%) while a smaller percentage indicated being very familiar (207, 14.3%) with HP or DS. About a quarter of respondents (359, 24.8%) indicated no familiarity with HP or DS. Demographic data are outlined in table-1. The most popular reason for reported for use of Health Products and Dietary Supplements was health maintenance (733, 61.9%). The second most popular reason respondents adopted HP and DS was use as alternatives to allopathic medications in order to treat a specific disease (202, 17%). Other respondents used HP and DS to supplement their diets (113, 9.5%) or increase energy levels (96, 8.1%). A small minority of patients used HP and DS for reasons not including those listed above (39, 3.2%). With regards to pattern of use; the largest proportion of the survey population comprised those respondents who used herbal products and dietary supplements occasionally (430, 29.6%) followed by those who used HP & DS daily (354, 24.4%). A weekly pattern of use was the least popular among respondents (150, 10.%), while the remaining respondents adopted a monthly pattern use (228, 15.7%). With reference to specific ailments, beauty care (472, 39.9%) was the most common medical cause to elicit use of HP or DS. Fever (234, 19.9%) was the second most common medical complaint to cause usage of herbal products and dietary supplements, followed by weight loss (112, 9.5%) and gynecological/ obstetric complaints (91, 7.7%). Respondents also used HP and DS to treat respiratory (36, 3.1%) and cardiac symptoms (28, 2.4%) issues among other miscellaneous complaints (206, 17.4%). Use of HP and DS had a significant positive correlation with reported improvement in symptoms (p<0.0001) with over half of all respondents reporting HP and DS being helpful (689, 58.5%). Close to one-fifth of respondents (293, 24.5%) felt that herbal products and dietary supplements had no appreciable effects on their symptoms while the remaining respondents who used HP and DS stated that they found the products to worsen their symptoms (198,
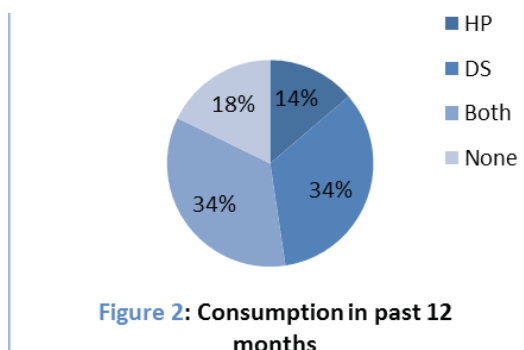
A cross sectional study- knowledge, attitudes and practices of general population regarding herbal products and dietary supplements in Karachi

110

Figure 2: Consumption in past 12 months

Figure 2:

16.7%). Around a third of the survey population (34.4%) reported the concurrent use of HP and DS (Fig. 2). Another third (34%) used dietary supplements alone while a smaller percentage (14%) elected to use solely herbal products. A minor proportion (18%) or the survey population did not use either herbal products or dietary supplements.

Table-2 displays data gathered from a Likert scale covering patients' attitudes towards CAM. When asked whether cultural or religious beliefs influenced their decision to take herbal products and/or dietary supplements, close to a fifth of respondents (273, 18.8%) strongly affirmed the statement and a further half (695, 47.9%) expressed agreement. Only a minority did not attribute their attitude to cultural or religious beliefs, with a tenth (140, 10.2%) expressing disagreement with the question in addition to a smaller portion that expressed strong disagreement (76, 5.2%). The remainder of respondents (258, 17.8%) were neutral on the question. The majority of respondents when asked if herbal study ought to be made part of medical school curriculum either expressed agreement (765, 52.8%) or strong agreement (268, 18.5%). Of the remainder, most were neutral (311, 21.4%) with only a few respondents opposing the idea. On the question of the safety of HP and DS, the majority once again expressed agreement (783, 54.0%) or strong agreement (167, 11.5%), with around a fifth choosing to remain impartial (333, 23.0%). Participants were more evenly split on the question of whether herbal products and dietary supplements were more effective at treating illness than conventional pharmaceuticals; while several respondents expressed

agreement (429, 29.6%) or strong agreement (212, 14.6%), similar numbers were impartial (412, 28.4%) or disagreed in favor of pharmaceuticals (300, 20.7%). Most respondents sympathized with the view that supplements should only be taken after soliciting a physician's advice, with large portions expressing agreement (674, 46.5%) or strong agreement (484, 33.4%). Over a third of respondents agreed that HP and DS are safe to consume in pregnancy (546, 37.7%) while a similar number was undecided on the question (520, 35.9%).

Table-3 summarizes the extent to which population displayed knowledge regarding dietary supplements and herbal products. The majority of the survey population considered dietary supplements to be vitamins or minerals (1133; 78.1%). The remainder understood dietary supplements to be proteins or fatty acids (191; 13.2%), probiotics (51; 3.5%), or homeopathic medicines (74; 5.1%). A large part of the survey population (870; 60%) understood herbal products to be herbs or other botanicals. A minority (73; 5%) considered herbal products to be probiotics, and the remainder understood them to be minerals (272; 148.8%) or homeopathic medicine (734; 16.1%).

Table-4 shows that the major source of recommendations was friends/and relatives (677; 57.1%) and doctors/pharmacist (298; 25.1%). Other sources included media (147; 12.4%), medical students (29; 2.4%), and newspapers/magazines (33; 2.9%).

Discussion:
The use of complementary and alternative medicine was widespread in the survey population. This finding bears worrying implications, especially in cases of patients choosing to treat chronic, debilitating ailments with untested supplements. Moreover, due to the unregulated nature of the supplement industry, the potential adverse effects of the herbal products and dietary supplements available on the market, particularly when it comes to drug-drug interactions, are currently unknown, and so the short-term and long-term risks posed to patients' health cannot

be reliably ascertained.

According to our data, individuals younger than 28 years of age were significantly more likely to consume both dietary supplements and herbal products, in contrast to previous studies where supplement use tended to increase with age.[2] This may be due to the recent introduction of branded CAM products in the Pakistani market, which may make them more appealing and more marketable (through the use of social media and other internet-based forums) to the younger segments of the population. This is a troubling finding due to the greater potential of exposure to harmful products over an extended period in otherwise healthy individuals, compounded by the fact that individuals in this age subset according to our findings were significantly more likely to consume both herbal products and dietary supplements concurrently. Gender did not bear any significant influence over patients' choice to use CAM, again in contrast to previous studies.[5] Education was not a significant predictor of use of HP or DS in our study (p=0.005), also in contrast to similar studies conducted previously.[5]

The most significant predictor of use, in line with the findings of previous studies,[18,19] was a desire to improve or maintain health status. In the Pakistani population, this may be attributable to a general mistrust of allopathic medicine and pharmaceuticals; reliance on traditional forms of medicine, such as that practiced by traditional doctors known as "hakims" or other forms of CAM such as homeopathy, is high. This displays a pressing need within the formal health industry to establish better patient-physician relationships to get patients to select physicians as their preferred source of health information and care.

General trends in the data highlight that the majority uses herbal products and dietary supplements on the recommendation of a friend or relative, re-affirming the societal role of culture and religion in informing individuals' adoption of CAM. Respondents began use of HP & DS on the recommendation of friends and/or

relatives even when they strongly believe that consultation with a doctor before use is a must. Only a quarter of our sample indicated that doctors or pharmacists as their primary source of recommendation for adopting herbal products or dietary supplements. This may be because nearly two thirds of our sample considered supplements to be safe for consumption, and thus may have seen consultation with a physician before beginning use of a supplement unnecessary, even if they considered it advisable. Another factor may have been that most of our sample also adjudged HP and DS to be more effective than pharmaceuticals. Keeping this in view we believe there is a need for randomized controlled trials exploring the safety and efficacy of HP and DS products. This is especially pressing because worryingly, the respondents' belief of HP and DS being safe extended even to the use of these products in pregnancy and infancy, which could lead to vulnerable individuals being exposed to potentially hazardous products. It is imperative to verify the impact of assorted modes of CAM including HP and DS on various health conditions, establishing potential morbidity associated with their use and determining comparative efficacy if any with pharmaceutical regimens. The information gained from these trials needs to consequently be made available to the public.

There was a general agreement among the sample about the need to introduce CAM as a subject in undergraduate medical curriculum to furnish students with the fundamental education about the therapeutic advantages and dis-advantages of herbal products and dietary supplements that would rectify their approach while giving medical advice to their patients.

As postulated, respondents who consumed both herbal products and dietary supplements simultaneously were more likely to report suffering from adverse effects, pointing to the dangers of drug-drug interactions of untested products. This outcome is in consistent with other studies delineating the adverse effects of these products when taken without proper dose adjustments in accordance to the pharmacokinetic and pharmacodynamic properties and metabolism of the

drug.

In our sample the foremost category of ailments for which respondents sought out supplementation was "beauty care". Individuals choosing to utilize CAM for cosmetic purposes may be particularly vulnerable to being lured by deceptive marketing strategies of "miracle-" or "wonder-drugs". Pakistan has high societal expectations of beauty, particularly with regards to young people, and as such these individuals may be driven to experiment with dubious products to achieve their desired cosmetic results. Taking this into consideration, cosmetic regulations outlined under Drug Regulatory Authority of FDA Act-25 must be reviewed prior to the marketing of these CAM products as 'cosmetics'.

Results clearly indicated that people with chronic disease prefer the use of both products and suffer the adverse effects more comparatively to the healthy individuals who have no chronic complaint. The incidence of adverse effects might have been greater in this group due to already present allopathic regimens for their chronic condition. Whether CAM was chosen as an exclusive treatment or complementary to other medicine is not part of our study but if it is the latter, it could lead to insufficient treatment and occurrence of adverse effects respectively. Moreover, in accordance with the results, symptoms got alleviated with dietary supplements and herbal-derived formulations when used alone but the condition got worsen or had no effect when consumed concomitantly. This is a strong indicator of possible drug-drug interactions in individuals who in addition to HP and DS are taking conventional drugs as well. Results clearly indicated that people with chronic disease prefer the use of both products and suffer the adverse effects more comparatively to the healthy individuals who have no chronic complaint. The incidence of adverse effects might have been greater in this group due to already present allopathic regimens for their chronic condition.

Product labels and leaflets for HP and DS should be made to include recommended dosage, pattern of use, cautions, adverse effects and potential drug interactions that would help consumers to make rational decisions before purchasing these products. A multi-disciplinary approach between physicians, nutritionists and toxi-cologists in Pakistan is required to enforce appropriate regulatory measures to benefit the health care system of the country where CAM is gaining popularity with growing pace. This study has several limitations which need to be considered. Firstly, it did not include people of provinces other than Sindh and thus these results cannot be generalized to other cities in the country. Secondly, the outcome is response dependent and no tool or method could access the authenticity of the answers given by the respondents. Thirdly this was a cross-sectional study nature which evaluates the knowledge, attitude, use and practices of the respondents at a single point in time and individuals' inclinations could possibly change over time in relation to the beliefs regarding herbal products/dietary supplements.

Conclusion:
Our study documented a high prevalence of herbal product and dietary supplement usage in the Pakistani population. Significant predictors of use were a desire to improve or maintain health status and young age. Gender and education levels were not significant predictors of use. Cultural and religious mores had a significant role in shaping respondents' views towards complementary and alternative medicine. The majority of the survey population considered herbal products and dietary supplements safe for consumption. Due the unregulated nature of the supplement industry in Pakistan, there is a dire need for the authorities to step in and provide oversight to allow the public to make informed choices about supplement selection and to prevent the sale of products injurious to human health.

Role and contribution of authors:

Dr. Wajeeha Khalid, collected the data and referenes and did the initial writeup

Sidra Zahid helped in collecting the data and refences

Prof M. Jamaluddin critically review the article and made the final changes in the article.

Dr. Muhammad Tanveer Alam critically review the article and gave the useful advices for discusiosn and conclusion writing.

References:

1. Andel V, Carvalherio G. Why Urban Citizens in Developing Countries Use Traditional Medicines: The Case of Suriname. Evidence-Based Complementary And Alternative Medicine 2013;Article ID 687197,13pages.
2. Baily R, Gahche J, Miller P, et al. JAMA Intern Med. 2013;173(5):355-361.
3. Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Front Pharmacol. 2013; 4: 177.
4. Lahteenmali L. Claiming health in food products. Food Quality and Preference 2013;27(2):196-201.
5. Tam D, Paterniti D, Good J, et al. Patient EducCouns. 2013 Jun; 91(3): 287–294.
6. Dickinson A, Mackay D, Wong A. Nutr J. 2015; 14: 66.
7. Mollaoglu M., Aciyurt I. Use of complementary and alternative medicine among patients with chronic diseases. ActaClinicaCroatica 2013;2:181-188.
8. Hao Xu, Ke-ji Chen. Complementary and alternative medicine: Is it possible to be mainstream? Chinese Journal of Integrative Medicine 2012;8(6):403-4.
9. Hussain S, Malik F, Khalid N, et al. Alternative and Traditional Medicines Systems in Pakistan: History, Regulation, Trends, Usefulness, Challenges, Prospects and Limitations. 2012 DOI: 10.5772/28224
10. Zhang J, Wider B, Shang H, et al. Quality of herbal medicines: Challenges and solutions. Complementary Therapies in Medicine 2012;20(1-2):100-6.
11. Folashade O, Egharevba, Omoregie H, et al. Standardization of herbal medicines - A review. International Journal of Biodiversity and Conservation 2012;4(3):101-12.
12. Dwyer J, Coates P, Smith M. Dietary Supplements: Regulatory Challenges and Research Resources. Nutrients. 2018 Jan; 10(1): 41.
13. Tsai H, Lin H, Pickard S, et al. Evaluation of documented drug interactions and contraindications associated with herbs and dietary supplements: a systematic literature review. IJCP 2012; 66(11):1056-78.
14. Saeed M, Muhammad N, Khan H, Zakiullah. Assessment of Heavy Metal Content of Branded Pakistani Herbal Products. Tropical Journal of Pharmaceutical Research August 2011; 10 (4): 499-506.