




Significance of Pharmacognosy: Students' Perspective

Erum Shah^{1*} , Tehseen Quds¹, Faheema Siddiqui², Syed Waleed Ahmed Bokhari³, Nimra Mazhar⁴, Ghazala Ishrat⁴, Muhammad Mohtasheem ul Hasan⁵

¹Department of Pharmacognosy, Dow College of Pharmacy, Dow University of Health Sciences, Ojha Campus, Karachi, Pakistan.

²Department of Pharmacology, Dow College of Pharmacy, Dow University of Health Sciences, Ojha Campus, Karachi, Pakistan.

³Department of Pharmacognosy, Faculty of Pharmacy, Hamdard University, Karachi, Pakistan.

⁴Faculty of Pharmacy, Salim Habib University, Karachi, Pakistan.

⁵Department of Pharmacognosy, Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi, Karachi, Pakistan.

Abstract

Background and objectives: The use of herbal medicine dates back to ancient times when humans used to consume natural substances such as medicinal plants to treat various diseases. Advancement in technology increases the importance of natural medicines in health care. Numerous drugs have been derived from natural sources and the alternative system of medicine mainly utilizes herbs and other natural sources or their extracts to treat different diseases. These herbs also possess herb-drug, food-drug interactions and other side effects; therefore, the knowledge of pharmacognosy is mandatory for pharmacists in order to work efficiently in their field. The present study was conducted to evaluate the significance of pharmacognosy from the viewpoint of pharmacy students. **Methods:** An online survey was conducted in which students from all the recognized institutes of pharmacy located in Karachi, Pakistan were given a questionnaire to evaluate their knowledge about the significance of pharmacognosy. **Results:** Majority of students were satisfied with the curriculum of pharmacognosy in the Pharm-D curriculum and they believed that one can't be a good pharmacist without studying pharmacognosy. They have the concept of herb-drug and food-drug interactions. They have studied the doses and side effects of herbal drugs in their undergrad curriculum, and they will consider studying pharmacognosy in their postgrad program. **Conclusions:** The results of this study indicate that pharmacy students of various institutes of Karachi, Pakistan are well aware of the importance of pharmacognosy.

Keywords: food-drug interactions; herbal medicine; herb-drug interactions; pharmacognosy

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Introduction

History of usage of natural medicines to cure different ailments is as old as the history of mankind. Through the advancement in technology, significance of natural medicines in health care also increases. Emergence of molecular biology and combinatorial chemistry

aided to re-attain the interest of scientists towards drug development from natural sources [1,2]. Inclusion of natural medicines in prescription medications as well as utilization of non-prescription products like herbal supplements, dietary supplements, vitamins, nutraceuticals and

* Corresponding author: erum.shah@duhs.edu.pk

minerals are increasing day by day all over the world. In this scenario, pharmacists play a key part in providing assistance about safe and effective usage of natural products; therefore, they must be well aware of the uses and side effects of natural medicines [3]. Different courses of pharmacognosy are taught in Pharm-D program in different institutes of Karachi, Pakistan in order to make the future-pharmacists well aware with the knowledge of natural medicines [4].

Pharmacognosy is basically the science of physical, chemical, biochemical and biological study of crude drugs from natural sources including plants, animals, minerals, microorganisms and marine organisms [5]. In the past, the subject was mainly related to identification, collection, preparation and storage of plant-origin drugs but in the recent times this subject is undergoing major changes due to the advancement of chromatographic techniques and biotechnological tools. Nowadays this subject is categorized as an interdisciplinary science which integrates chemical, biological and biotechnological tools for new drug discovery [6]. Currently, the scope of pharmacognosy encompasses crude drugs and medicinal substances such as vitamins, antibiotics, enzymes, allergens, allergenic extracts, hallucinogens, poisonous plants, teratogens and other toxicological substances. Furthermore, excipients such as colouring, flavouring, emulsifying, fillers and anesthetic agents, sweeteners, disintegrants and adhesives are also a part of pharmacognosy [7]. In the recent era, scientists are focused on the isolation and characterization of active principles from natural sources, phytochemical screening, and development of new analytical techniques for analysing quality of the herbal products. Ethnobotanical and ethnopharmacological research have also become a significant part of pharmacognosy [8].

A number of biologically active substances have been isolated from plants, microorganisms and other natural sources. These include morphine, atropine, caffeine, ephedrine, digoxin, galantamine, cholchicine, vincristine and taxol. Many antiviral and anticancer drugs in clinical practice are derived from natural sources. e.g., vincristine and vinblastine from *Catharanthus roseus* (L) G. Don, taxol from *Taxus baccata* L., precursor of acyclovir from a marine sponge and a fungal metabolite "apicidin" having

antiprotozoal property from *Fusarium pallidoroseum* [9]. A commonly available antimalarial drug, artemether, is derived from artemisinin, a sesquiterpene lactone from the plant *Artemisia annua* L. Galantamine, a drug used in the treatment of Alzheimer's disease was first isolated from *Galanthus woronowii* Losinsk. An anticholinergic inhaled bronchodilator tiotropium (based on ipratropium) was derived from atropine, a bioactive source from *Atropa belladonna* L. and is currently used for the treatment of chronic obstructive pulmonary disease (COPD) [10]. Similarly, a large number of plant derived medicines are prescribed by the physicians in the western countries in the recent era including acarbose, dronabinol, capsaicin, irinotecan, docetaxel, paclitaxel and tacrolimus [11].

The World Health Organization (WHO) also emphasizes on the usage of alternative medicine for improving preventive and curative health [12]. Due to the diversity of natural origin drugs and developing interest in the herbal drugs, pharmacognosy has become an important part of Pharm-D syllabi in Pakistan. That's why it was necessary to investigate the knowledge and significance of pharmacognosy among the students of pharmacy in Pakistan. Therefore, this study has been designed to assess the students' perspective regarding the importance of pharmacognosy.

Material and Methods

Ethical considerations

The ethical approval of this study was taken from Institutional Bioethical Committee, University of Karachi and the approval number is IBC KU-258/2022. All students were informed prior to the survey that their response will remain confidential, and their personal details will not be shared with anyone.

Study design

This study was conducted in Karachi, Pakistan from June 2021 to March 2022. Students from various institutes of Karachi offering Pharm-D program were included in the survey. An online pre validated modified close-ended questionnaire was prepared and circulated through email and other social media platforms to the students. A total number of 328 students responded to this questionnaire.

Statistical analysis

One way Anova was used to perform this survey. The statistics regarding the students' perspective about the significance of pharmacognosy in the field of pharmacy was determined through this research. The results are shown in the form of percentages. SPSS version 21 was used to analyse the survey results.

Results and Discussion

Both male and female students from 2nd year Pharm-D to 5th year Pharm-D and M. Phil (Pharmacognosy program) participated in this study. A majority of institutes offering the degree of pharmacy in Karachi participated in this research. The results are shown in Figures 1 and 2.

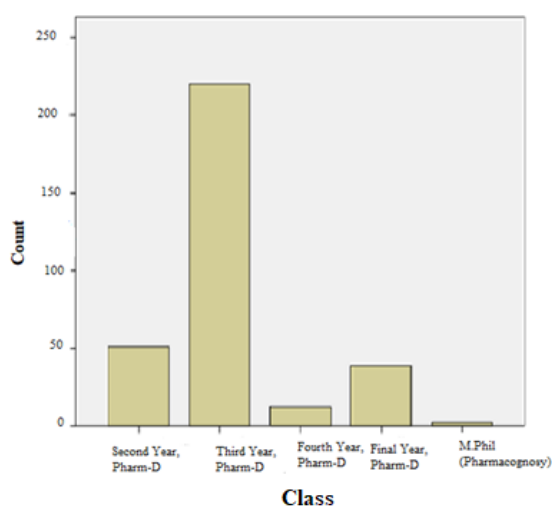


Figure 1. Data of respondents according to their year of study

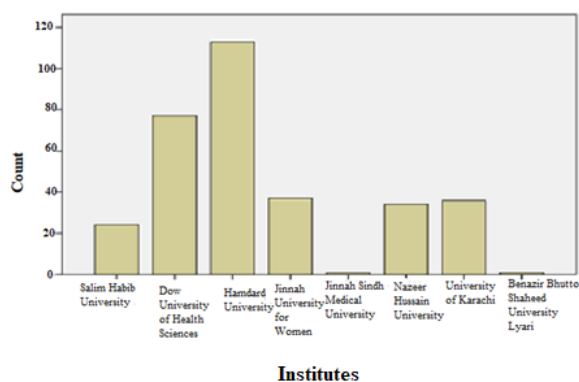


Figure 2. Data of respondents with respect to their institutes

As pharmacognosy is an essential part of Pharm-D curriculum in all the institutes of Karachi, the

students were asked about their level of satisfaction with the curriculum. About 87.5% of the students were satisfied with the curriculum of pharmacognosy in the Pharm-D program. Institute wise data has also been interpreted in order to check the clear picture of the scenario. Results are mentioned in Table 1 and Figure 3.

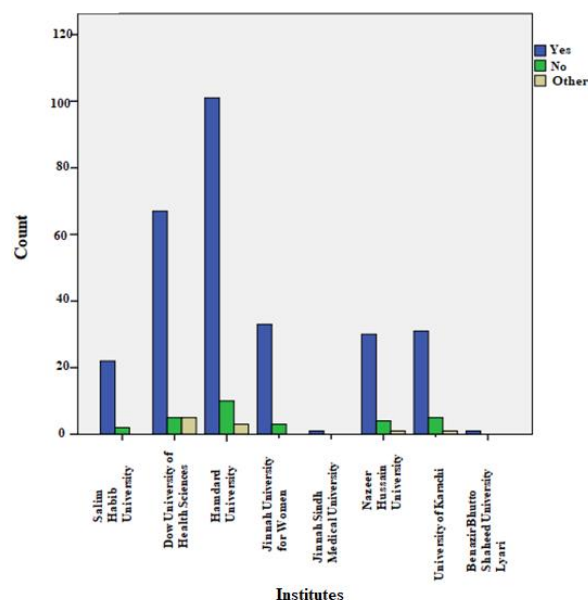


Figure 3. Students' level of satisfaction with the current syllabus of Pharmacognosy with respect to their institutes

As pharmacognosy is the study of medicinal plants and other natural sources from which many synthetic drugs have been derived and complementary and alternative medicine is also significantly being used in this region of the world to treat numerous diseases, a series of questions were asked regarding the significance of pharmacognosy and the implementation of the knowledge of pharmacognosy in their daily living activities. About 96.9% of the students participated in this study responded that they were well aware with the significance of pharmacognosy and 82.4 % survey-participants indicated that one cannot become a good pharmacist without studying pharmacognosy. Students from all the institutes participated in this survey agreed that one can't become a good pharmacist without studying pharmacognosy (Figure 4) and 59% of the respondents indicated that the knowledge of pharmacognosy helped in understanding the usage and side effects of natural origin drugs. Descriptive results are mentioned in Table 1.

The students are learning various courses of

pharmacognosy in the Pharm-D curriculum which also includes clinical pharmacognosy which is the integration of pharmacognosy and clinical practice and is significantly effective for the correct application of herbal medicines with respect to their therapeutic effects as well as adverse effects. Therefore, we assessed their knowledge about doses and interaction of drugs as well. About 66.7% of the respondents indicated that they have studied doses of herbal/natural drugs in Pharm-D program, 76.1% participants indicated that they have studied the adverse effects of herbal medicine during Pharm-D (Figures 5 and 6). Majority of the participants (95.1%) were aware about food-drug interactions and a significant number of the students knew about herb-drug interactions (figures 7 and 8 show institute-wise data). Also, 63.1% of the respondents thought that complementary and alternative medicines are effective in treating various diseases. Detailed results are mentioned in Table 1.

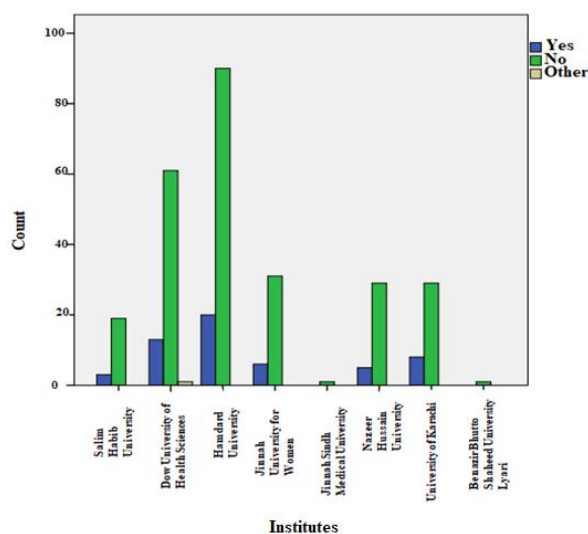


Figure 4. Institute-wise data regarding the importance of knowledge of pharmacognosy for all the pharmacists

Various universities in Karachi are offering M. Phil and Ph.D programs in the field of pharmacognosy, that’s why students’ interest in pursuing postgraduate education in pharmacognosy was also assessed through this research. About 48% of the respondents indicated that they would continue studying pharmacognosy in their postgrad degree, whereas 28.17% of the participants indicated that they would check the market value with respect to the availability of jobs before studying pharmacognosy in their postgrad programs.

Results are mentioned in detail in Table 1. Traditional medicine has been utilized all over the world and more than 80% of the world’s population still depends on the herbal/natural medicine to fulfil their basic health care needs. Natural substances also play significant role in the development of new drugs because the natural sources are considered to be the most important sources for the isolation of new chemical entities for drug development [13].

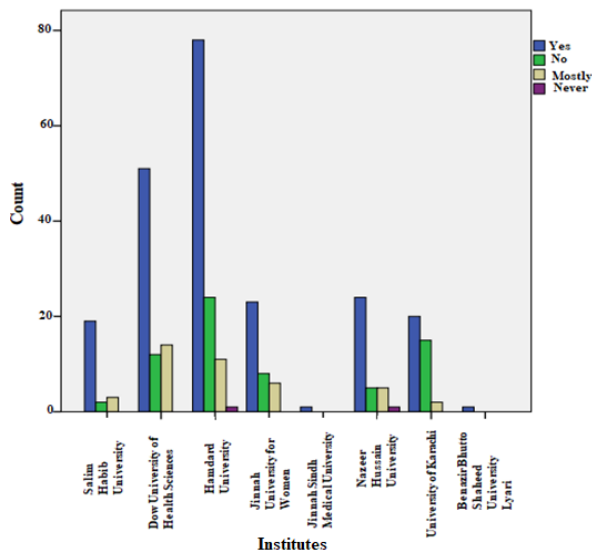


Figure 5. Institute-wise data about students studying doses of herbal drugs in their pharmacognosy curriculum

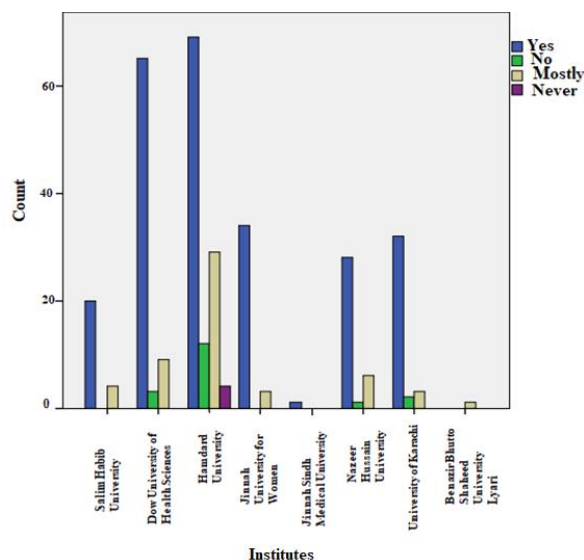


Figure 6. Institute-wise data about students studying adverse effect of herbal drugs in their pharmacognosy curriculum

Table 1. The questionnaire and the responses

Opinion	Frequency	Percentage	Mean Score	Standard deviation
Do you study pharmacognosy in the Pharm-D curriculum?				
Yes	328	100%	1.0	0.0
No	0	0%		
Are you satisfied with the curriculum of pharmacognosy in the Pharm-D program?				
Yes	287	87.5%	1.15	0.43
No	29	8.84%		
Other	11	3.35%		
Are you aware with the importance of pharmacognosy in the field of pharmacy?				
Yes	318	96.9%	1.03	0.173
No	10	3.1%		
Do you feel that without studying pharmacognosy one can become a good pharmacist?				
Yes	58	17.6%	1.83	0.3
No	270	82.4%		
Have you ever used natural/herbal medicine?				
Yes	215	66.15%	1.52	0.79
No	50	15.38%		
Mostly	59	18.15%		
Never	1	0.3%		
Has the knowledge of pharmacognosy ever helped you in understanding the use and side effect of naturally-origin drugs?				
Yes	193	59%	1.91	1.13
No	2	0.6%		
To some extent	99	30.3		
To a great extent	33	10.1		
Have you ever studied the doses of herbal/natural drugs in your pharmacognosy curriculum during Pharm-D?				
Yes	218	66.7%	1.47	0.73
No	66	20.2%		
Mostly	41	12.5%		
Never	2	0.6%		
Have you ever studied the adverse effect of herbal/natural drugs in your pharmacognosy curriculum?				
Yes	249	76.1%	1.43	0.81
No	19	5.8%		
Mostly	55	16.8%		
Never	4	1.2%		
Do you understand the concept of food-drug interaction?				
Yes	311	95.1%	1.0	0.24
No	16	4.9%		
Do you understand the concept of herb-drug interaction?				
Yes	150	45.9%	1.91	0.92
No	60	18.3%		
To some extent	113	34.6%		
To a great extent	4	1.2%		
Have you studied the concept of complementary and alternative medicine in Pharm-D curriculum?				
Yes	200	61.16%	1.05	0.24
No	127	38.82%		
Do you think that the complementary and alternative medicines are effective in treating different diseases?				
Yes	202	63.1%	1.57	0.84
No	56	17.4%		
Mostly	62	19.3%		
Never	1	0.31%		
Studying the effects of herbal/natural-origin medicine, do you think that pharmacognosy has any future in the upcoming years?				
Yes, great future	190	58.3%	1.82	0.98
No future	05	1.2%		
To some extent	131	40.2%		
Other	1	0.3%		
Will you continue studying pharmacognosy after completing your recent degree?				
Yes	155	48%	3.52	1.46
No	62	19.2%		
Mostly (will see the market value)	15	4.6%		
Never	91	28.17%		

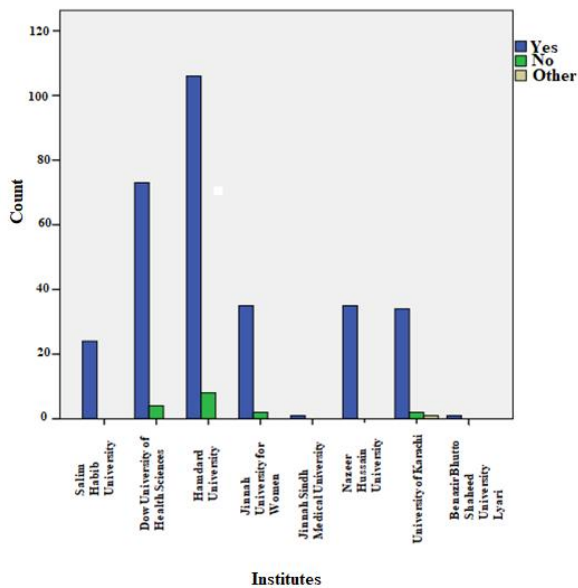


Figure 7. Institute-wise data showing the students' knowledge about food-drug interactions

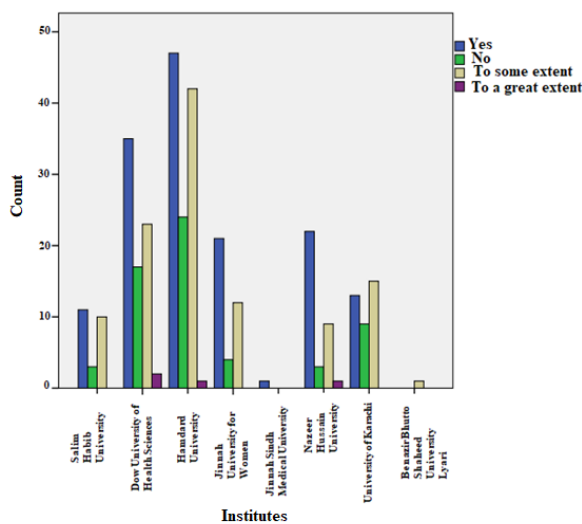


Figure 8. Institute-wise data showing the students' knowledge about herb-drug interactions

In the “13th revision of WHO Essential Medicine List” almost 300 drugs are reported which are basic to the practice of medicine and among them 44 are unmodified natural products, 25 are semisynthetic products which are derived from natural sources and more than 70 synthetic drugs derived from natural products pharmacophore or synthetic copies of natural products [14]. This clearly indicates the significant contribution of natural products in the recent drug development as well as health care.

In this study, students from 2nd year Pharm-D till 5th year Pharm-D and some postgrad (M. Phil) students have responded to the survey. This is

because the students in Karachi, Pakistan start studying pharmacognosy in the 2nd year of Pharm-D program. The present study was the first attempt to assess the student’s viewpoint regarding the importance of pharmacognosy. The response of majority of the students indicated that they are well aware with the importance of pharmacognosy, and one cannot be a good pharmacist without studying pharmacognosy. Cahlíková et al. also reported that the knowledge of traditional medicine is as important for pharmacists as the modern developments in the advances of pharmaceutical sciences [15].

Clinical pharmacognosy is attributed to the clinical application of herbal medicines and formulations. It is essential for a pharmacist to know about the doses, adverse effects, interactions besides the therapeutic effects of the herbal drugs. In this study, most of the students of the pharmacy institutes in Karachi responded that they had studied the doses, adverse effects, herb-drug interaction and food-drug interaction in their pharmacognosy curriculum.

This clearly indicates that majority of the institutes offering Pharm-D program also include the important aspects of clinical pharmacognosy in the Pharm-D curriculum. Clinical pharmacognosy should remain a part of Pharm-D program because it can enhance the knowledge of herbal drugs, their safety, efficacy and toxicity among students. A study conducted by Quds et al. strongly supported the current study as it described that more than 90% of students considered clinical pharmacognosy an interesting subject which enhances their knowledge about herbal drugs and they considered that pharmacists should have adequate knowledge regarding herbal drugs to offer consultancies in order to prevent various drugs and food interactions [16]. The importance of clinical pharmacognosy is also emphasized by Kazemi et al. who indicated that the vast use of herbal medicine in this era has prompted the importance of clinical pharmacognosists who should have the diverse knowledge of herbal medicines, their side effects, interactions and can ensure the rationale use of herbal medicine in the population. Moreover, the toxicity data of the herbal medicines, their contraindications and the precautions associated with their use also need to be established in order to ensure the safe use of herbal drugs [17].

The results of the present study indicate that most of the students belonging to different institutes of Karachi studied the concept of complementary and alternative medicine and they believed that complementary and alternative medicines are effective in treating various diseases. More than half of the students felt that pharmacognosy has a bright future in the upcoming years which reveals that students are well aware with the importance of pharmacognosy and its contribution in the novel drug development and its role in the traditional system of medicine.

Students gave positive responses when they were asked about their postgrad study plans. Most of the students responded that they may study pharmacognosy in their postgrad degree and some indicated that they would preferably check the market value of pharmacognosy before getting enrolled in a postgrad degree. This shows that students are interested in pharmacognosy and they may continue studying if they are sure of their economic growth. Several herbal industries are established nowadays and international pharmaceutical industries also work on herbal bioactives and formulations. The world health organization also described the drastic increase in the utilization of herbal drugs in the upcoming years which specifies that without effective study of different subjects of pharmacognosy, a pharmacist won't be able to meet the future challenges.

Limitations of the study: In this study, students from various Pharmacy colleges in Karachi were selected as participants of the study thus the sample size is small. In the future researches, students from pharmacy colleges of other cities of Pakistan and other countries of the world may also be included in order to understand the broader aspect of the study. Moreover, in the present study only the students' perspective was determined with respect to the significance of pharmacognosy, therefore, the future researchers may take the opinion of faculty members regarding the importance of pharmacognosy.

Conclusion

Students are well aware with the significance of pharmacognosy in various sections of pharmacy including novel drug development and complementary and alternative medicines.

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Author contributions

Erum Shah and Tehseen Quds played major role in designing the research proposal and in writing and editing the research paper; Syed Waleed Ahmed Bokhari, Nimra Mazhar, Ghazala Ishrat and Faheema Siddiqui participated in data collection from the students belonging to different institutes of Karachi; Faheema Siddiqui performed the statistical calculations; Muhammad Mohtasheem ul Hasan supervised the study.

Declaration of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the accuracy and integrity of the paper content.

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Abbreviations

WHO: world health organization; COPD: chronic obstructive pulmonary disease