

Knowledge and Practice of Medical Students on Healthy Lifestyle: A Cross-Sectional Study in Shiraz

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Abstract

Background: Physicians are one of the most important groups directly associated with public health and their health related lifestyle has a significant impact on their patient's behaviors. Several studies showed that the majority of medical students did not have appropriate and healthy behaviors. The aim of this study was to determine the prevalence of risky lifestyle knowledge and behaviors among Shiraz medical students.

Methods: This cross-sectional survey was conducted in 2011. Using a stratified random sampling method, 400 medical students were selected to fill in the questionnaires. The questionnaire contained 33 questions including demographic data, healthy lifestyle knowledge and behavior (including physical activity, fruit and vegetable consumption, water drinking, etc), perception of stress and student's health information resource. The association between demographic factors and participants' knowledge, practice and stress score was determined. The correlation between the participants' knowledge and behavior scores was calculated.

Results: The mean knowledge and attitude scores were 2.8 and 3.6, respectively. In 40% of knowledge and 80% of practice questions, the percentage of the correct answer was below 50%. There was a significant correlation between the participants' knowledge and behavior scores ($P < 0.05$).

Conclusion: This study raises the voice of concern with medical students' knowledge and behavior on healthy lifestyle measures. There is a need for re-thinking, planning and reviewing these concepts of pure reason which is essential in their future professional career. Health considerations, health surveillance and care systems which are based on evidence, reasonability and rationality still have to be paramount.

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Introduction

The pattern of death and disease has changed through the 21st century, shifting from communicable and infectious diseases to lifestyle related diseases. Currently, non-communicable diseases comprise 43% of the illness burden all over the world, a figure expected to enhance

to 60% by 2020.¹ Cardiovascular diseases, malignancies and motor-vehicle accidents are three prevalent causes of the morbidity and mortality in Iran.² It has been estimated that half of all deaths may occur due to a limited number of lifestyle behaviors and preventable measures. Tobacco product consumption, improper diet, insufficient physical activities, as well as motor vehicle

accidents and drug abuse are the major causes of death.³

Several studies have been conducted in Iran indicating that the majority of medical students did not have appropriate dietary intake, physical activity and sleep pattern.⁴⁻⁶ Also, one study showed that some of students had some malnutrition and inappropriate lifestyles.⁷

Physicians are one of the most important groups directly associated with public health and their health related behaviors have a significant impact on their patient's behaviors as a role model. On one hand, medical students have to study hard, and on the other hand, clinical ward work which is a risky environment puts them at a higher vulnerability to diseases. A lot of doctors' behaviors later in life are rooted in their performance at their studentship period. There is a special concern with medical students for rethinking, planning and reviewing their health behaviors which has a high place in their future professional career.⁸⁻¹⁰

One study conducted among medical students in Malaysia showed that the prevalence of overweight and obesity was 14.8% and 5.2 %.¹¹ Evaluation of healthy lifestyle among Greek university students demonstrated that healthy eating is more frequent among female students than males but they have less physical activity than males.¹² One study showed that there was a positive correlation between medical student's healthy behavior and their responsibility toward effective preventive counseling with patients.¹³

To the best of our knowledge, there is a shortage of evidence in Iran concerning the predictors of risky lifestyle behaviors among medical students. The aim of this study was to describe the knowledge and behaviors of Shiraz medical students about healthy lifestyle and also to determine the correlation between participant's knowledge and practice.

Methods

This cross-sectional survey was conducted in Shiraz University of Medical Sciences (SUMS) throughout 2011. Medical education program at SUMS includes orderly five groups including: basic sciences (three years), pathophysiology courses (one year), studentship (one year), externship (one year) and internship (one year).

According to the sample size formula ($P: 50\%$, $Z: 1.96$, $d: 0.05$), sample size was calculated as 384, but to ensure the accuracy of the results, it was considered to be 400. The research protocol of this study was approved by the Ethics Committee of the Shiraz University of Medical Sciences. Using proportionate stratified random sampling, each year of education was considered as a stratum; then, based on the ratio of students to total students per group, the sample size in each group was calculated for the basic

sciences, pathophysiology, studentship, externship, and internship medical students' groups as 151, 71, 75, 55 and 48 individuals, respectively. Then participants were selected through random sampling method using a random number table, based on the students' ID number. The authors asked medical students who were in the basic or clinical training period of their education to fill out the self-reported questionnaire after obtaining verbal informed consent. Medical students who were not interested were excluded from this study.

Content validity of the questions was checked through consultations with five professors and professional experts in this field and getting their opinions. One hundred participants were randomly selected and then a pilot study was performed on them to evaluate the internal consistency of the questionnaire with Kuder-Richardson Formula 20 (Total KR20: 0.87, for knowledge questions: 0.82, for practice questions: 0.79).

The questionnaire contained 33 questions including demographic data, healthy lifestyle knowledge (6 questions) and behavior (10 questions), perception of stress and student's health information resource. Demographic data consisted of questions on age, gender, marital status, educational level (basic science, physiopathology, studentship, externship and internship), and living location (landlord, tenant, student's dormitory). Other questions evaluated the participant's knowledge and behavior about fruit and vegetable consumption, physical activity, drinking water, sleep pattern and their behaviors about fastening seatbelt, using sunscreen, obeying speed limits, current smoking and using illicit drugs. Participants were asked about smoking all or part of a cigarette or using any illicit drugs within the 30 days before filling out the questionnaire.^{14,15} Two questions about participants' weight and height were asked and we calculated their Body Mass Index (BMI) as the indicator of their behavior about gaining healthy weight. Also participants were asked about quantitative amounts of BMI that is recommended as normal for the population, that BMI 18.5–24.9 was the correct answer. The participants were classified according to their BMI to three classes: BMI < 18.5: under healthy weight; BMI 18.5–24.9: healthy weight and BMI 25–29.9: Overweight.¹⁶ Then we recoded the participants' BMI to healthy and unhealthy weight. Healthy weight was as the correct answer for participants' behavior about gaining healthy weight.

The Perceived Stress Scale (PSS) that has been validated in previous studies was applied to assess the participants' perception of stress. Ten questions on feeling and thoughts during the last month were asked using 5 point Likert scale (never, almost never, sometimes, fairly often, very often). The scores above the 20.4 indicated low perception of stress and those

below 8 were indicator of highly perceived emotional stress.⁵ The participants were asked to describe their satisfaction of life and job according to Likert score and their general health status (good, fair, and poor). Finally, we recoded the answers as “have satisfaction” or “have no satisfaction”.

The correct answers for knowledge questions were scored as 1 and the incorrect ones as 0. Then the knowledge questions for each participant were added to calculate the knowledge score. Also, the practice score was calculated in the same manner. The participants' answers were compared with recommended guidelines about consumption of fruit and vegetables, regular physical activity, drinking water and sleep pattern; if the students reported similar behaviors, we scored their question as 1 and other answers were scored as 0.¹⁷ As to other behavioral questions like obeying speed limits, fastening seatbelt and using sunscreen or tobacco, if the students followed correct behaviors, we scored their questions as 1 and other answers were scored as 0. The response rate was 90% but approximately 45 participants filled out their questionnaires incompletely.

Analyses were done using SPSS software, version 15. To analyze the data, one-way ANOVA test and independent sample t-tests were used to compare the students' knowledge, behaviors and non-parametric tests including Mann-Whitney U test and Kruskal–Wallis test were used to compare the perceived stress level between groups. The correlation coefficient between knowledge and practice score was calculated. The statistical significance level was set at 0.05.

Results

Totally, 400 medical students participated in this study. The participants' gender distribution consisted of 56.2% female. The mean age of the participants was 21.5±1.9 years and most of them were single (92%). The median and mode of their family size were both 5.

The mean±SD for BMI was 21.2±2.9 kg/m². Overall, the mean±SD of the participants' knowledge and practice score was 2.8±1.1 and 3.6±1.5, respectively. The median and inter-quartile range (IQR) for the participants' knowledge and practice score was 3 (IQR: 2-4) and 4 (IQR: 3-5), respectively.

The range of knowledge questions was 0 to 6 and for practice questions it was 0 to 10. Approximately, 36.8% of the medical students mentioned that they did not have any physical activity in their life (29.3% of males and 42.6% of females). Five percent of the participants reported that they have five times or more physical activity in their life (8% of males and 2.7% of females). Approximately, 52% of the students reported using sunscreen (80.4% of females and 13.5% of males). Fastening seatbelt at all times as a driver or front seat passenger was reported to be practiced among 39% of the respondents (males=37.7% and females=40.1%). About 22.2% of the students reported that they always observed speed limits (8.9% of male and 33.5% of female students). In this study, the BMI level in 9% of the participants was above 25 and there was a significant difference between male and female students. In addition, 12.4% of male and 6.4% of female students were overweight or obese. Approximately, 16% of the participants reported that they smoked cigarette (males=24.5%, females=9.9%) and 16.9% of them reported that they used illicit drugs (males=18.6%, females=15.7%). About 26% of the subjects were satisfied with their life and 46% of them were satisfied with their job. Eleven percent of them described their general health status as fair or poor. Other descriptive results are demonstrated in Table 1.

Most of the students (58.3%) reported their teachers in the school, university and mass media resources (52.4%) as the source of their information. Only 37.2% of the students reported physicians and health care workers as their sources for health information.

The relationship between demographic factors and knowledge/practice score is mentioned in Table 2. There was a relationship between the knowledge scores and participants' gender. The practice score of the participants was associated with their gender, marital status and educational level. Medical students' living place and educational level were not associated significantly with knowledge score and only students' educational level was associated significantly with practice score ($P<0.05$). Post-Hoc analysis with Tukey test demonstrated that interns had worse behaviors than students ($P<0.05$). There was only a significant association between stress score and living place ($P<0.05$) and other demographic factors were not associated with stress score significantly. There

Table 1: The frequency of the correct answers about water consumption, sleep duration need, fruit and vegetable consumption and BMI

Subject of the Question	Knowledge Questions			Practice Questions		
	Correct answers N (%)			Correct answers N (%)		
	Female	Male	Total	Female	Male	Total
Water consumption	160(71.1)	99(56.6)	259(64.6)	43(19.1)	41(23.4)	84(21)
Sleep duration need	131(58.2)	87(49.7)	218(54.2)	102(45.3)	65(37.1)	167(41.9)
Fruit consumption	98(45)	46(26.3)	144(36.6)	39(17.4)	7(4)	46(11.6)
Vegetable consumption	35(16.4)	22(12.7)	57(14.7)	20(8.9)	10(5.7)	30(7.5)
BMI	180(89.6)	163(95.3)	343(92.2)	161(74.2)	144(83.2)	305(78.2)

was a significant correlation between participants' knowledge and behavior scores ($P < 0.05$, $r = 0.179$).

Discussion

The participants' mean score for knowledge questions was 2.8 from 6 questions and that of practice was 3.6 from 10 questions. These findings bring a question to the mind about the adequacy of their knowledge and practice. In most of the knowledge and all practice questions, the percentage of correct answers was below 50%. Less than 10% of the participants had adequate physical activity and less than 25% consumed adequate amount of fruit, vegetables and daily intake of water. Another study showed that despite awareness of the benefits of exercise, only 35% of the students had a regular schedule of physical activity, while there was slightly better adherence to exercise by males (40%) than females (32%).¹⁸ Another study conducted on young American population showed that their mean intake of water was less than the recommended amount.¹⁹ Medical students from our neighboring countries had similar status. Only 50% of them had healthy diet and 33% of them were inactive.²⁰ Other studies estimated that college students had no healthy behavior especially on fruit and vegetable consumption and physical activity.^{6,21,22}

Asking about the healthy lifestyle on water consumption, fruit and vegetable consumption, sleep duration and BMI with respect to knowledge and practice showed that the medical students got better scores in knowledge questions than practice. This finding emphasizes the importance of healthy behavior education in medical students. Targeting medical students' knowledge and attitude to change their behavior is essential. The interventional studies have demonstrated the importance of educational program to improve the participants' healthy behaviors.^{23,24}

About one quarter of medical students and 17% of the participants in this study reported smoking cigarette and using illicit drugs, being very high for this social group of our community. This prevalence is worrying and should be a trigger for Iranian policy makers to take appropriate measures. The prevalence

of smoking among medical students was reported in another study about 14.4%.²⁵ A study conducted in Shiraz showed that the prevalence of cigarette smoking was 18.48% among students, 12.5% among pre-externship students, 7.19% among externship students and 16.95% among internship students.²⁶ One population based study in Shiraz in 2001 estimated that approximately 26% of men and 3.6% of women were current cigarette smokers.²⁷ One study among nursing students showed that 27.3% of them used drugs once or more in their lives.²⁸ Strict policies and regulations about access to and consumption of several tobacco products in the college environment may improve preventive efforts in this regard.

Results of this study showed that less than 40% of the medical students fasten seatbelt and observe speed limits at all times, that it is surely low. Another study in Iran reported that only 14.0% of male and 19.0% of female students used seatbelt at all times.²⁹

Only 50% of medical students reported using sunscreen. In contrast to this study, one population based study in Kuwait reported that 80% of the participants used sunscreen regularly in their life.³⁰ One part of this difference may be explained by the degree of risk perception according to difference between sun shining duration and its severity in various regions. One study conducted in Tehran showed that only 32% of adult population used sunscreen most of the time.³¹ Approximately 12% of male and 6% of female students were overweight or obese. Another study on Isfahani college students showed that the overall percentage of overweight students was 16% (2.2% were obese) and the BMI level above 25 was more common among the males than females.³² One population based study in Shiraz demonstrated that 25% of adult men were overweight and 2.5% were obese. The prevalence of overweight and obesity in women was 30% and 8%.³³ Medical students are to recommend the patients and community members to protect themselves against sun exposure and advise people to have physical fitness; therefore, they should do these behaviors themselves as a role model.

In this study, female students obtained better

Table 2: The association between demographic factors and participants' knowledge/practice and stress score

	Knowledge score			Practice Score		
	mean	SD	P value	mean	SD	P value
Age (Year)			>0.05			>0.05
18-22	2.80	1.02		3.62	1.47	
22-27	2.78	1.14		3.79	1.78	
Gender			<0.05			<0.005
Female	2.94	1.11		4.14	1.56	
Male	2.64	0.99		3.10	1.40	
Marriage			>0.05			<0.05
Single	2.82	1.05		4.33	1.96	
Married	2.59	1.21		3.62	1.47	

scores of knowledge and practice about healthy lifestyle than males. Single participants and students who had passed the hospital courses in their education years had the worst practice score than other participants. There is no way to ignore the fact that medical students spend the final years of their studies in hospital wards and stay awake on call many nights. This may influence their perception about their lifestyle and they do not have enough time to pay more attention to their personal needs. On the other hand, married students pay more attention to their health perhaps because they are responsible for their family members and they are a role model for other members of the family. Marriage helps people to have better emotional style and well-being, so this positive feeling pushes them toward better behaviors.^{34,35}

Living in dormitory exposed medical students to additional levels of stress than living in the household. Lack of the family support, disturbance in the family relationships, distance from home and other problems may play a role in this regard.³⁶ Further studies are recommended to be conducted to determine the risk factors of stress in these students and design effective interventions to decrease it.

The positive relationship between knowledge and practice helped us to consider the importance of setting the outlook of educational programs on healthy behaviors to improve the students' lifestyle. This study had some limitations. Due to self-report query in this study, recall bias was unavoidable. Social desirability bias may lead to over- or under-reporting.

In fact, more comprehensive research on this topic may contribute to better management of burden of diseases across the communities by health care systems and policy makers. Assessment of the students' lifestyle behaviors of other majors and comparisons among them warrant further attention.

Conclusion

Medical students are important role models for general population so paying more attention to their personal lifestyle is necessary. Compared to general population, their lifestyle was far better in some respects but it is not sufficient and governments should design programs to improve medical students' knowledge and behaviors to maximize the level of accurate and healthy lifestyle.

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Conflict of Interest: None declared

References

- 1 Asgari F, Aghajani H, Haghazali M, Heidarian H. Non-communicable diseases risk factors surveillance in Iran. *Iran J Public Health*. 2009;38(1):119-22.
- 2 Jafari N, Abolhassani F, Naghavi M, Pourmalek F, Moradi Lakeh M, Kazemeini H, et al. National burden of disease and study in Iran. *Iran J Public Health*. 2009;38(1):71-3.
- 3 Hendricks KM, Herbold N, Fung T. Diet and other lifestyle behaviors in young college women. *Nutr Res*. 2004;24(12):981-91.
- 4 Bandi MFG, Kaffashi S. Sleep pattern in medical students and residents. *Arch Iran Med*. 2009;12(6):542-9.
- 5 Baradaran-Rezaei M, Shirvani M, Fathi-Azar E. Comparative Study of the Physical Activity Among Students Medical and Non-medical Universities of Tabriz. *Iran J Nurs*. 2008;21(55):77-87.
- 6 Alizadeh M, Ghabili K. Health related lifestyle among the Iranian medical students. *Res Biol Sci*. 2008;3(1):4-9.
- 7 Mortazavi Z, Shahrakipour M. Body mass index in Zahedan University of Medical sciences students. *Tabib-e-Shargh*. 2002;4(1):81-6.
- 8 Boo NY, Chia GJ, Wong LC, Chew RM, Chong W, Loo RC. The prevalence of obesity among clinical students in a Malaysian medical school. *Singapore Med J*. 2010;51(2):126-32.
- 9 Symons CW, Cinelli B, James TC, Groff P. Bridging student health risks and academic achievement through comprehensive school health programs. *J Sch Health*. 2009;67(6):220-7.
- 10 Ball S, Bax A. Self-care in Medical Education: Effectiveness of Health-habits Interventions for First-year Medical Students. *Acad Med*. 2002;77(9):911-7.
- 11 Gopalakrishnan S, Ganeshkumar P, Prakash MV, Christopher, Amalraj V. Prevalence of overweight/obesity among the medical students, Malaysia. *Med J Malaysia*. 2012;67(4):442-4.
- 12 Tirodimos I, Georgouvia I, Savvala TN, Karanika E, Noukari D. Healthy lifestyle habits among Greek university students: differences by sex and faculty of study. *East Mediterr Health J*. 2009;15(3):722-8.
- 13 Duperly J, Lobelo F, Segura C, Sarmiento F, Herrera D, Sarmiento OL, et al. The association between Colombian medical students' healthy personal habits and a positive attitude toward preventive counseling: cross-sectional analyses. *BMC Public Health*. 2009;9:218.
- 14 Centers for Disease Control and Prevention. Vital Signs: Current Cigarette Smoking among Adults Aged ≥ 18 Years with Mental Illness - United States, 2009-2011. *MMWR*. 2013;62(5):81-7.
- 15 AARP public policy institute. Prevalence of illicit drug use in older adults: the impact of the baby boom generation. Washington, DC: AARP public policy institute; 2010. Available from: assets.aarp.org/

- rgcenter/ppi/health-care/i41-illicit-drug.pdf [access at: 2013.04.26]
- 16 Adult Body Mass Index (BMI) Chart. Available from: healthvermont.gov/family/fit/documents/RevisedBMI3-07.pdf [access at: 2013.04.26]
 - 17 Food for health, Dietary guidelines for Australians a guide to healthy eating. Canberra: Australian government, Department of health and aging, National health and medical research council;2005. 25 p. Available from: http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n31.pdf[access at: 2013.04.26]
 - 18 Pinto BM, Cherico NP, Szymanski L, Marcus BH. Longitudinal changes in college students' exercise participation. *J Am Coll Health.* 1998;47(1):23-7.
 - 19 Kant AK, Graubard BI. Contributors of water intake in US children and adolescents: associations with dietary and meal characteristics—National Health and Nutrition Examination Survey 2005–2006. *Am J Clin Nutr.* 2010;92(4):887-96.
 - 20 Carter AO, Elzubeir M, Abdulrazzaq YM, Revel AD, Townsend A. Health and lifestyle needs assessment of medical students in the United Arab Emirates. *Med Teach.* 2003;25(5):492-6.
 - 21 Silliman K, Rodas-Fortier K, Neyman M. A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Californian J Health Promot.* 2004;2(2):10-19.
 - 22 Garousi Behshid SH, Pourhossieni O. a study on the lifestyle of the iranian university students. *IJPBS.* 2008;2(2):41-5.
 - 23 Steptoe A, Wardle J, Cui W, Bellisle F, Zotti AM, Baranyai R, et al. Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990-2000. *Prev Med.* 2002;35(2):97-104.
 - 24 Ha EJ, Caine-Bish N. Effect of nutrition intervention using a general nutrition course for promoting fruit and vegetable consumption among college students. *J Nutr Educ Behav.* 2009;41(2):103-9.
 - 25 Nazary A, Ahmadi F, Vaismoradi M, Kaviani K, Arezomandi M, Faghizadeh S. Smoking among male medical sciences students in Semnan, Islamic Republic of Iran. *East Mediterr Health J.* 2010;16(2):156-61.
 - 26 Ahmadi J, Khalili H, Jooybar R, Namazi N, Aghaei PM. Cigarette smoking among Iranian medical students, resident physicians and attending physicians. *Eur J Med Res.* 2001 Sep 28;6(9):406-8.
 - 27 Ahmadi J, Khalili H, Jooybar R, Namazi N, Mohammadagaei P. Prevalence of cigarette smoking in Iran. *Psychol Rep.* 2001;89(2):339-41.
 - 28 Ahmadi J, Maharlooy N, Alishahi M. Substance abuse: prevalence in a sample of nursing students. *J Clin Nurs.* 2004 Jan;13(1):60-4.
 - 29 Mohammadi G. Prevalence of seat belt and mobile phone use and road accident injuries amongst college students in Kerman, Iran. *Chin J Traumatol.* 2011;14(3):165-9.
 - 30 Al-Mutairi N, Issa BI, Nair V. Photoprotection and vitamin D status: A study on awareness, knowledge and attitude towards sun protection in general population from Kuwait, and its relation with vitamin D levels. *Indian J Dermatol Venereol Leprol.* 2012;78(3):342-9.
 - 31 Mousavi F, Golestan B, Vaseie M, Vaseie L, Khajeh-Kazemi R. Knowledge, attitude, and practice of adults to the protective actions against sun in northwest Tehran, Iran. *Arch Iran Med.* 2011 Mar;14(2):126-31. doi: 011142/AIM.0011.
 - 32 Moafi A, Rahgozar S, Ghias M, Ahar EV, Borumand A, Sabbaghi A, et al. A Study on Body Mass Index, Blood Pressure, and Red Blood Cell Indices in New Entering Students of the University of Isfahan. *Int J Prev Med.* 2011;2(4):280-5.
 - 33 Pishdad GR. Overweight and obesity in adults aged 20-74 in southern Iran. *Int J Obes Relat Metab Disord.* 1996;20(10):963-5.
 - 34 Wood W, Rhodes N, Whelan M. Sex differences in positive well-being: A consideration of emotional style and marital status. *Psychol Bull.* 1989;106(2):249.
 - 35 Jamila WANW, Aziza ME, Huata FL. Knowledge, Attitude and Dietary and Lifestyle Practices on Bone Health Status among Undergraduate University Students in Health Campus, Universiti Sains Malaysia, Kelantan. *Health and the Environment Journal.* 2010;1(1):34-40.
 - 36 Baum A, Davis GE. Reducing the stress of high-density living: an architectural intervention. *J Pers Soc Psychol.* 1980 Mar;38(3):471-81.