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Effects of Basic Science Courses and Associated Factors on the Academic Status of Medical Students in Kermanshah University of Medical Sciences

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Abstract

Background: The academic status of students makes up an essential component of educational assessments.
Objectives: The present study was conducted to evaluate the effect of basic science courses on the academic status of medical students in Kermanshah University of Medical Sciences (KUMS), Kermanshah, Iran.
Methods: The demographic information of the medical students collected in the present cross-sectional study over a three-year period included age, gender, quota for the Iranian university entrance examination (UEE), interval between receiving high school diploma and admission to university, type of high school diploma, high school GPA and score of specialized and general courses in the UEE. Moreover, the academic data included scores of courses, GPA of the basic science courses and score of the comprehensive basic sciences exam were collected using a questionnaire, and analyzed in SPSS V. 16 using descriptive statistics, one-way ANOVA, Tukey's test and the chi-square test.
Results: The majority of the students (94.7%) had a high school diploma in experimental sciences and belonged to regions 2 (51.6%) and 3 (37%) of the UEE. Significant differences were observed between different groups of the students admitted to university in terms of age ($P < 0.05$), although no significant differences were identified in terms of gender, type of high school diploma, UEE quota and high school GPA. The highest scores of specialized courses in percentage in the UEE were associated with biology and chemistry. Significant correlations were also observed between the GPA of basic science courses and high school GPA in all the three groups of students admitted to university ($P < 0.05$).
Conclusions: The academic status and related factors were found to be nearly the same in the medical students of KUMS in three successive years of admission, and they were affected by constant factors, including high school GPA and GPA of basic science courses.

Keywords: Medical Students, Academic Status, GPA

1. Background

The principal mission of a university is to train expert workforce required for the community, facilitate the development of the country, develop research and promote knowledge. In this regard, medical universities should focus on teaching based on community requirements, recognition of problems, development and implementation of programs and elimination of weaknesses of teaching processes (1). A monitoring system is therefore required to be established in the education system of universities to determine the strengths and weaknesses, and promote the quality of education (2, 3).

On the other hand, failing to care for the quality of education and the skills required to be learnt while increasing the number of students admitted to universities can cause irreparable and unfavorable effects on the medical community. Regularly evaluating the teaching process, and accurately analyzing the academic status of students are therefore crucial for developing, modifying and improving educational programs (4-6).

The main concerns of university authorities and students' families include the students' academic achievement and preventing their academic failure (7-11). Academic achievement and the associated factors are a prior-

ity for research on education, and draw the attention of education managers in universities (6, 12). Identifying the effective factors in the academic status of students is a major step towards the sustainable development of a community (10, 13). As the most valuable asset of an education system, the academic achievement of students is influenced by their personality traits and different educational and socioeconomic factors. Assessing these factors can not only help more effectively revise educational programs and enhance the quality of education, but also it prevents academic failure as a major issue in education systems (14-16).

Evaluating academic status is crucial, especially in medical students, as their future incompetence can impose irreparable damage on the health of the public (7-10). A previous study by the authors addressed academic status and related factors in the dentistry students of Kermanshah University of Medical Sciences (KUMS) (12). Medical students require more accurate monitoring in the early years of admission to university given their high risk of failure and probation (17, 18). Given the key role of the medical education system and its graduates in the health of the public, analyzing academic status and the associated factors can help with planning and decision making based on true and accurate information (19).

The basic sciences stage in general medicine is of paramount importance among the four consecutive stages of this program, as it lays the scientific foundations for the upcoming courses and higher-level programs. In addition, medical students in Iran should adapt themselves to specific conditions of the university, homesickness and new social relationships, while sustaining the heavy burden of courses in the early years of admission to university.

2. Objectives

The present study was therefore conducted to investigate academic status and the associated factors in the medical students of KUMS in their basic sciences program, and determine the strengths and weaknesses of the education system.

3. Methods

The present cross-sectional study investigated the data of 268 medical students admitted to KUMS in three consecutive years after excluding 22 guests and transfer students. The students' demographic information extracted from their academic profiles and the educational affairs management system and recorded in the relevant forms included age, gender, quota of the university entrance examination (UEE), interval between receiving high school diploma and admission to university and type of high school diploma, whereas their academic information comprised high school GPA, GPA of the basic sciences stage, scores of specialized and general courses in the UEE, scores of different basic science courses, the number of failures in each course and the number of conditional semesters. This study was approved by the Research Ethics Committee of KUMS, and all the data were collected using the student code.

The data were collected using a questionnaire designed in a previous study (12). The initial data were encoded, and the quantitative data were analyzed in SPSS V. 16 using descriptive statistics, one-way ANOVA, Tukey's test and chi-square test. The Pearson correlation coefficient was used to determine correlations between the variables. $P < 0.05$ was set as the level of statistical significance.

4. Results

Out of the 268 medical students of KUMS admitted in 2009 - 2011, 59.3% were female, 94.7% had a high school diploma in experimental sciences, and 51.6% had been admitted to the university from region 2 of the UEE and 37% from region 3. Moreover, although their high school GPA was 18.09/20, their GPA decreased during 2009 - 11. The interval between receiving their high school diploma and admission to university was also below two years. Significant differences were observed between the three groups admitted to the university in terms of age ($P < 0.05$), although no significant differences were found in terms of gender, type of high school diploma, quota for the UEE and high school GPA (Table 1).

No significant differences were observed among the three groups in terms of the scores of courses in the UEE, including biology, chemistry, mathematics, physics, English language, Arabic language, Islamic thoughts and Persian literature ($P < 0.05$). The highest scores were also associated with biology and chemistry as the specialized courses, and Islamic thoughts and literature as the general courses (Table 2).

Analyzing the mean scores of the main courses of basic science found the highest scores to be associated with theoretical courses of head and neck anatomy (15.77) and genetics (14.67), and the lowest to be related to histology (11.95) and medical physics (12.32). The highest practical score was reported as 16.15 for practical biochemistry (Table 3). Investigating the correlation of educational records before admission to the university with the academic status associated with basic science courses found biology (in all the three years) and mathematics (in two years) to be significantly correlated with the GPA of the basic science courses (Table 4).

Table 1. General Characteristics of the Medical Students, i.e. GPA, Age, Region and Diploma

Admission Year	Number	High School GPA	Mean Age	Percentage of Female Students	Experimental Sciences Diploma (%)	Region 1 (%)	Region 2 (%)	Region 3 (%)	Other Region (%)
2009	83	18.20	19.10	55.8	94.8	6.5	58.4	29.9	5.2
2010	85	18.06	19.50	61.2	95.3	3.5	49.4	35.5	11.8
2011	100	18.02	19.20	61	94	-	47	46	7
Mean	89	18.09	19.26	59.33	94.7	5	51.6	37	8

Table 2. Comparing the Scores of Different Courses in the UEE in the Medical Students

Admission Year	Biology (%)	Chemistry (%)	Mathematics (%)	Physics (%)	English Language (%)	Arabic Language (%)	Islamic Thoughts (%)	Persian Literature (%)
2009	74.42	61.56	34.77	53.16	44.05	58.92	59.39	56.83
2010	68.07	65.15	34.50	38.72	55.77	58.53	68.18	64.55
2011	70.08	66.70	40.31	39.80	46.42	44.18	69.51	46.93
Mean	70.70	64.69	36.80	43.38	48.38	53/20	66.11	55.56
P value	0.01	0.02	0.03	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Table 3. Mean Scores of Principal Theoretical and Practical Courses in the Students and Their Statistical Difference

Lessons	2009	2010	2011	Total	P Value (Theory)
Biochemistry-1	13.20	13.74	14.16	13.73	0.005
Biochemistry-2	13.39	13.28	13.56	13.42	-
Anatomy (Thorax)	13.49	16.55	13.65	14.53	< 0.001
Histology-1	12.13	13.38	12.60	12.70	0.001
Histology-2	12.17	11.74	11.95	11.95	-
Anatomy (limbs)	14.47	13.51	13.59	13.83	-
Microbiology	12.69	12.39	12.47	12.51	< 0.001
Virology	13.90	14.54	13.80	14.07	0.04
Physiology-1	12.54	12.84	13.28	12.93	-
Physiology-2	12.50	12.61	14.11	13.15	< 0.001
Genetics	15.09	15.03	14.08	14.67	0.001
Immunology	12.40	12.03	12.59	12.36	-
Embryology	14.30	13.28	12.44	13.26	< 0.001
Anatomy (head)	16.66	14.52	16.10	15.77	< 0.001
Pathology	14.20	14.52	14.56	14.44	-
Parasitology	13.63	13.73	13.99	13.80	-
Medical Physics	11.62	12.35	12.80	12.32	< 0.001
Nutrition	11.57	13.45	13.44	12.82	< 0.001

Analyzing the correlation of the scores of specialized courses of the UEE in the first group of students admitted to the university showed the most significant correlation between high school GPA and the scores of biology and mathematics. Significant correlations were also observed between high school GPA and the scores of other UEE courses (Table 5). In the second group of students admitted to the university, this correlation was reported for the score of mathematics, although the scores of biology and physics were also found to be significantly correlated with high school GPA. In the third group of students, the highest correlation was observed for biology, although

Table 4. Comparing the GPA of Basic Science Courses with the GPA of the Courses in the UEE

	Pearson Correlation	P Value
Basic sciences mean (2009)		
Mathematics	0.15	0.1
Biology	0.3	0.008
Physics	-	0.61
Chemistry	0.14	0.22
Basic sciences mean (2010)		
Mathematics	0.24	0.02
Biology	0.32	0.003
Physics	0.17	0.12
Chemistry	0.19	0.08
Basic sciences mean (2011)		
Mathematics	0.24	0.01
Biology	0.34	0.001
Physics	0.06	0.5
Chemistry	0.18	0.07

the score of mathematics was also significantly correlated with high school GPA (Table 6).

Table 5. Correlation Between the GPA of Basic Sciences Courses and High School GPA

	Pearson Correlation	P Value
Total mean (2009) / high school GPA	0.53	< 0.001
Total mean (2010) / high school GPA	0.33	0.002
Total mean (2011) / high school GPA	0.38	0.002

Analyzing the first group showed the highest correlation between this course and immunology, biochemistry and physiology-2. Biology was also significantly correlated with all the other basic science courses, except for histology, physiology-1, pathology and parasitology. In the second group, biology had the highest correlation with genetics and histology. The correlations of biology with biochemistry, anatomy, virology and physiology were also found to be significant. In the third group, biology had the highest correlation with anatomy, immunology and physiology. It also had a significant correlation with histology, biochemistry, parasitology and embryology (Table 7).

5. Discussion

The present study found no significant differences among the students in terms of high school GPA, type of high school diploma, region (quota) of the UEE and gender; nevertheless, these groups were found to be significantly different in terms of age, and their mean age increased over the time. An increase in age upon admission to university appears to be the case in the majority of Iranian students. The mean age (19.30 years) obtained in a study in Shahed University, Tehran, Iran (20) was consistent with the mean age in the present study. The relative increase in age upon admission to university compared to before the admission indicates a prolonged interval between receiving high school diploma and university admission potentially due the increasing difficulty level of the UEE and the students' failure to gain higher scores required for admission to medicine.

The reduction in the students' high school GPA can indicate the reduced effect of this factor on the UEE. The reduction observed in the number of students receiving high school diploma in experimental sciences is also consistent with the study conducted in the School of Medicine of Lorestan University of Medical Sciences, Khorramabad, Iran (21). Reductions in high school GPA and non-experimental sciences diploma are the factors affecting academic failure, as reflected in studies conducted in the education sector (2, 4, 12).

The correlation of the UEE with basic science courses followed a certain and consistent pattern. The highest scores in percentage in the UEE were associated with the specialized courses of biology and chemistry, and the general courses of Islamic thoughts and Persian literature. The students with a higher high school GPA acquired a higher GPA in basic sciences, suggesting a significant correlation between these courses, which is consistent with the results of other studies (4, 11, 15, 17, 21-23). Furthermore, the GPA of the basic sciences program was significantly and positively correlated with biology and mathematics courses in the UEE. Education authorities are therefore recommended to pay attention to this correlation when predicting the academic status of medical freshmen.

The previous study of the authors assessed the academic status and the relevant factors in the dentistry students of KUMS (12). Most of these factors are the same as those found in the present study, including age, region of the UEE and high school GPA; nevertheless, the academic status of the students in the basic sciences program was better than that of the present study students. This discrepancy of the results can be associated with the higher motivation of the dentistry students and other factors such as their low population in classes, i.e. below 30, and the university's staff paying more attention to new educational courses.

After completing the basic sciences program, the students should pass the comprehensive basic sciences exam (CBSE) to be admitted to the physiopathology program (24). The CBSE score was found to be significantly and pos-

Table 6. Correlation Between GPA and the Score of Specialized Courses in the UEE

Diploma High School GPA	Pearson Correlation			P Value		
	2009	2010	2011	2009	2010	2011
Mathematics	0.42	0.38	0.24	< 0.001	< 0.001	0.01
Biology	0.36	0.3	0.34	0.001	0.006	0.001
Physics	0.27	0.3	0.06	0.02	0.005	0.5
Chemistry	0.33	0.18	0.18	0.004	0.1	0.07

Table 7. Correlation Between the Score of Biology and That of Basic Science Courses

Biology	Pearson Correlation			P Value		
	2009	2010	2011	2009	2010	2011
Biochemistry-1	0.38	0.34	0.33	0.001	0.002	0.001
Biochemistry-2	0.31	0.29	0.27	0.006	0.008	0.006
Anatomy (Thorax)	0.30	0.32	0.40	0.04	0.003	< 0.001
Histology-1	0.30	0.32	0.21	0.009	0.07	0.003
Histology-2	0.16	0.2	0.29	0.1	0.003	0.008
Anatomy (limbs)	0.28	0.20	0.29	0.01	0.06	0. 03
Microbiology	0.27	0.20	0.15	0.02	0.09	0.1
Virology	0.30	0.26	0.22	0.009	0.02	0.03
Physiology-1	0.16	0.26	0.40	0.2	0.01	< 0.001
Physiology-2	0.36	0.23	0.25	0.002	0.004	0.01
Genetics	0.33	0.43	0.25	0.005	< 0.001	0.01
Immunology	0.45	0.21	0.39	< 0.001	0.07	< 0.001
Embryology	0.24	0.10	0.22	0.04	0.3	0.03
Pathology	0.16	0.13	0.15	0.18	0.2	0.1
Parasitology	0.1	0.19	0.03	0.4	0.1	0.005
Nutrition	0.3	0.12	0.18	0.04	0.3	0.06

itively correlated with that of specialized courses, and the highest correlation to be associated with the scores of biochemistry, histology, immunology and microbiology. Analyzing the courses tested in the CBSE, histology and embryology had a good status.

Given the key role of biology in the nationwide UEE, the present study investigated its relationship with basic science courses. The correlations of this course in the UEE with many major courses of the basic sciences program were found to be noticeable. Biology was reported to have the highest positive correlations with immunology, biochemistry-1, physiology-2, anatomy and genetics. Moreover, the correlation of mathematics in the UEE with the GPA of basic sciences program and the correlation of physics in the UEE with physics and computer courses at the university were found to be significant.

In the basic sciences program, the highest scores of the theoretical courses were associated with head and neck anatomy and genetics, and the lowest with histology-2 and medical physics. In the School of Medicine in Birjand University of Medical Sciences, the statuses of biochemistry, embryology and virology were better than those of other courses, which is inconsistent with the findings of the present study (25). In the School of Medicine in Hamadan University of Medical Sciences, the highest score was associated with the specialized course of English and the lowest with limb and trunk anatomy (5), which is inconsistent with both the present study and the previous study in 2008 (25). In the School of Medicine of Lorestan University of Medical Sciences, the highest scores were found for parasitology and mycology, and the lowest for medical physics, which is consistent with the present research in terms of the score of physics (21). The differences in the mean scores of basic science courses among different faculties of medicine can be explained by differences in factors such as methodology, test type, teachers' compe-

tence and experience, educational facilities used in each course and their quality as well as students' interest in the courses.

In line with the present study, the scores of basic science courses in the School of Medicine in Zahedan University of Medical Sciences, Zahedan, Iran had the highest correlation with the mean scores of microbiology, parasitology and physiology-2 (7). In Khazaei et al. (25), the status of biochemistry, embryology and virology was desirable, which is consistent with the present study. Furthermore, a significantly positive correlation was observed between high school GPA and the CBSE score. The positive role of high school GPA in the academic achievement of students at different faculties is noticeable (5, 12).

Education plays a vital nationwide role in growth and productivity. The main educational medical factors and the programs were found to be similar in different countries, although student selection methods were somehow different. After graduating from high school, Iranian students are selected based on a nationwide examination, namely the Konkoor exam. Given the many effective factors in this system and their difference from those in other systems, comparing the academic status of Iranian medical students with that of medical students from other nations is difficult.

5.1. Conclusions

The academic status of the students in the basic sciences program and the associated factors were nearly same in the medical students of KUMS admitted in three different years. The contributors included constant factors such as high school GPA and the GPA of basic science courses. The scores of biology and chemistry play a key role in succeeding in the UEE and admission to medical schools, and biology plays the most significant role in the academic status of students in the basic sciences program. The course of biology can therefore be used as an index for predicting the academic status of students.

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Footnotes

Authors' Contribution: Data collection: Mohammad Rasool Khazaei, Fatemeh Abbasi, and Hassan Yeghanehrad; writing manuscript: Mohammad Rasool Khazaei and Elham Niromand; data Analysis: Mohammad Rasool Khazaei and Elham Niromand; study design, and manuscript revision: Mozafar Khazaei.

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