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The impact of study habits and personal factors on the academic achievement performances of medical students

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Abstract

Background Academic achievement is essential for all students seeking a successful career. Studying habits and routines is crucial in achieving such an ultimate goal.

Objectives This study investigates the association between study habits, personal factors, and academic achievement, aiming to identify factors that distinguish academically successful medical students.

Methods A cross-sectional study was conducted at the College of Medicine, King Saud University, Riyadh, Saudi Arabia. The participants consisted of 1st through 5th-year medical students, with a sample size of 336. The research team collected study data using an electronic questionnaire containing three sections: socio-demographic data, personal characteristics, and study habits.

Results The study results indicated a statistically significant association between self-fulfillment as a motivation toward studying and academic achievement ($p=0.04$). The results also showed a statistically significant correlation between recalling recently memorized information and academic achievement ($p=0.05$). Furthermore, a statistically significant association between preferring the information to be presented in a graphical form rather than a written one and academic achievement was also found ($p=0.03$). Students who were satisfied with their academic performance had 1.6 times greater chances of having a high-grade point average (OR = 1.6, $p=0.08$).

Conclusion The results of this study support the available literature, indicating a correlation between study habits and high academic performance. Further multicenter studies are warranted to differentiate between high-achieving students and their peers using qualitative, semi-structured interviews. Educating the students about healthy study habits and enhancing their learning skills would also be of value.

Keywords Medical students, Study habits, Academic achievement, Saudi Arabia

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Introduction

Academic performance is a common indicator used to measure student achievement [1, 2]. It is a compound process influenced by many factors, among which is study habits [2, 3]. Study habit is defined as different individual behavior in relation to studying, and is a combination of study methods and skills [2–4]. Put differently, study habits involve various techniques that would increase motivation and transform the study process into an effective one, thus enhancing learning [5]. Students' perspectives and approaches toward studying were found to be the key factors in predicting their academic success [6, 7]. However, these learning processes vary from one student to another due to variations in the students' cognitive processing [8].

The study habits of students are the regular practices and habits they exhibit during the learning process [9, 10]. Over time, several study habits have been developed, such as time management, setting appropriate goals, choosing a comfortable study environment, taking notes effectively, choosing main ideas, and being organized [11]. Global research shows that study habits impact academic performance and are the most important predictor of it [12]. It is difficult for medical students to organize and learn a lot of information, and they need to employ study skills to succeed [1, 2, 5, 13].

Different lifestyle and social factors could affect students' academic performance. For instance, Jafari et al. found that native students had better study habits compared to dormitory students [1]. This discrepancy between native and dormitory students was also indicated by Jouhari et al. who illustrated that dormitory students scored lower in attitude, test strategies, choosing main ideas, and concentration [10]. Regarding sleeping habits, Curcio G et al. found that students with a regular and adequate sleeping pattern had higher Grade Point Average (GPA) scores [14]. Lifestyle factors, such as watching television and listening to music, were shown to be unremarkable in affecting students' grades [15, 16]. Social media applications, including WhatsApp, Facebook, and Twitter, distract students during learning [16, 17].

Motivation was found to be a major factor in students' academic success. Bonsaksen et al. found that students who chose "to seek meaning" when studying were associated with high GPA scores [18]. In addition, low scores on "fear of failure" and high scores on "achieving" correlated with a higher GPA [8, 18].

Resource-wise, Alzahrani et al. found that 82.7% of students relied on textbooks assigned by the department, while 46.6% mainly relied on the department's lecture slides [19]. The study also indicated that 78.8% perceived that the scientific contents of the lectures were adequate [19]. Another study found that most students relied on the lecture slides (>83%) along with their notes, followed by educational videos (76.1%), and reference textbooks (46.1%) [20]. Striking evidence in that study, as well as in another study, indicated that most students tended to avoid textbooks and opted for lecture slides, especially when preparing for exams [20, 21].

Several researchers studied the association between different factors and academic performance; however, more is needed to know about this association in the process of education among medical students [15, 20, 22], with some limitations to the conducted studies. Such limitations include the study sample and using self-reported questionnaires, which may generate inaccurate results. Moreover, in Saudi Arabia in particular, the literature concerning the topic remains limited. Since many students are unsatisfied with their performance and seek improvement [10], the present study was designed and conducted.

Unlike other studies in the region, this study aims to investigate the relationship between study habits and personal factors and measure their influence on academic achievement. The results of this study could raise awareness regarding the effect of study habits and personal factors on students' performance and would also guide them toward achieving academic success. The study also seeks to identify the factors that distinguish academically successful students from their peers.

Methods

Study design, setting, and participants

This observational cross-sectional study, which took place between June and December 2022, was conducted among students attending the College of Medicine at King Saud University (KSU), Riyadh, Saudi Arabia. Its targeted population included all male and female medical students (first to fifth years) attending KSU during the academic year 2021/2022. Whereas, students at other colleges and universities, those who failed to complete the questionnaire, interns (the students who already graduated), and those who were enrolled in the university's preparatory year, were all excluded from the current study. The sample size was calculated based on a study conducted in 2015 by Lana Al Shawwa [15]. Using the sample size formula for a single proportion (0.79), the required sample size was 255 using a confidence interval of 95% and a margin of error of 5%. After adding a 20% margin to accommodate non-responses and incomplete responses, the calculated sample size required for this study was 306. However, our research team collected a total of 336 participants for this study to ensure complete representation.

Study instrument

The research team developed and used an electronic questionnaire. The rationale is that no standardized questionnaire measuring the study objectives was found in the literature. However, the questionnaire was tested on a pilot of 15 students to test its clarity and address any possible misconceptions and ambiguity. The study questionnaire was distributed randomly to this cohort, who were asked to fill out the questionnaire. The students reported a complete understanding of the questionnaire's contents, so the same questionnaire was used without any modifications. The questionnaire, written in English, consisted of three parts. The first part included eleven questions about the socio-demographic status of the participants. The second part contained twenty-one questions examining personal factors such as sleep and caffeine consumption. The last part included twenty-one questions regarding students' study habits. The questionnaire was constructed based on an ordinal Likert scale which had: strongly agree, agree, neutral, disagree, and strongly disagree as possible answers. The questionnaire was sent to participants through email and social media applications like Twitter and WhatsApp to increase the study response. An informed consent that clearly states the study's purpose was taken from all participants at the beginning of the questionnaire. In addition, all participants were assured that the collected data would be anonymous and confidential. Each participant was represented by a code for the sole purpose of analyzing the data. Furthermore, no incentives or rewards were given to the participants for their participation.

Study variables

Socio-demographic information (such as age, gender, and academic year), and personal factors (such as motivation, sleeping status, caffeine consumption, and self-management) were the independent variables. Study habits such as attendance, individual versus group study, memorization techniques, revision, learning style, and strategies were also independent variables.

Academic achievement refers to a student's success in gaining knowledge and understanding in various subjects, as well as the ability to apply that knowledge effectively [23]. It is a measure of the student's progress throughout the educational journey, encompassing both academic achievements and personal growth [3, 24]. Academic achievement is judged based on the student's GPA or performance score. In this study, students' GPA scores, awareness, and satisfaction regarding their academic performance were the dependent variables.

We divided the study sample into two groups based on the GPA. We considered students with high GPAs to be exposed (i.e. exposed to the study habits we are investigating), and students with low GPAs to be the control group. The purpose of this study was to determine why an exposed group of students gets high grades and what study factors they adopt. Based on this exposure (high achieving students), we concluded what methods they used to achieve higher grades. Those in the first group had a GPA greater or equal to 4.5 (out of 5), while those in the second group had a GPA less than 4.5. The students' data were kept confidential and never used for any other purpose.

Data analysis

The data collected were analyzed by using IBM SPSS Statistical software for Windows version 24.0. Descriptive statistics such as frequency and percentage were used to describe the socio-demographic data in a tabular form. Furthermore, data for categorical variables, including different study habits, motivation factors, memorizing and revising factors, and lifestyle factors, were tabulated and analyzed using the odds ratio test. Finally, we calculated the odds ratio statistic and a p-value of 0.05 to report the statistical significance of our results.

Ethical approval and consent to Participate

Before conducting the study, the research team obtained the Ethics Committee Approval from the Institutional Review Board of the College of Medicine, KSU, Riyadh, Saudi Arabia (project No. E-22-7044). Participants' agreement/consent to participate was guaranteed by choosing "agree" after reading the consent form at the beginning of the questionnaire. Participation was voluntary, and consent was obtained from all participants. The research team carried out all methods following relevant guidelines and regulations.

Results

The total 336 medical students participated in the study. All participants completed the study questionnaire, and there were no missing or incomplete data, with all of them being able to participate. As shown in Table 19.3% of participants were between 18 and 20, 44.9% were between the ages of 21 and 22, and 35.8% were 23–28 years old. In the current study, 62.5% of the participants were males and 37.5% were females. The proportion of first-year students was 21.4%, 20.8% of second-year students, 20.8% of third-year students, 18.2% of fourth-year students, and 18.8% of fifth-year students, according to academic year levels. Regarding GPA scores, 36.9% scored 4.75-5 and 32.4% scored 4.5–4.74. 23.8% achieved 4-4.49, 6.5% achieved 3-3.99, and only 0.4% achieved 2.99 or less. Participants lived with their families in 94.6% of cases, with friends in 1.2% of cases, and alone in 4.2% of cases. For smoking habits, 86.3% did not smoke, 11% reported using vapes, 2.1% used cigarettes, and 0.6% used Shisha. 91.4% of the participants did not report any

Table 1 Demographic data of participants

Variables	Categories	*n* (%)
Age	18–20	65 (19.30)
	21–22	151 (44.90)
	23–28	120 (35.80)
Gender	Male	210 (62.50)
	Female	126 (37.50)
Year of studies	1st	72 (21.40)
	2nd	70 (20.80)
	3rd	70 (20.80)
	4th	61 (18.20)
	5th	63 (18.80)
Current GPA	2.99 or less	1 (0.40)
	3- 3.99	22 (6.50)
	4- 4.49	80 (23.80)
	4.5–4.74	109 (32.40)
	4.75- 5	124 (36.90)
Living status	live alone	14 (4.20)
	with friends	4 (1.20)
	with family	318 (94.60)
Smoking Status	No smoking	290 (86.30)
	Vapes	37 (11.00)
	Cigarettes	7 (2.10)
	Shisha	2 (0.60)
Chronic Illnesses	Yes	29 (8.60)
	No	307 (91.40)
Mental Illnesses	No	279 (83.00)
	Anxiety	30 (8.90)
	Depression	20 (6.00)
	Others	7 (2.10)

chronic illnesses; however, 8.6% did. In addition, 83% had no mental illness, 8.9% had anxiety, 6% had depression, and 2.1% reported other mental illnesses.

Table 2 shows motivational factors associated with academic performance. There was a clear difference in motivation factors between students with high and low achievement in the current study. Students with high GPAs were 1.67 times more motivated toward their careers (OR=1.67, p=0.09) than those with low GPAs. Furthermore, significant differences were found between those students who had self-fulfillment or ambitions in life they had ~ 2 times higher (OR=1.93, p=0.04) GPA scores than low GPA students. Exam results did not motivate exposed or high GPA students (46%) or control students with low GPA students (41%), but the current study showed test results had little impact on low achiever students (OR=1.03, p=0.88). Furthermore, 72.6% of high achievers were satisfied with their academic performance, while only 41% of low achiever students were satisfied. Therefore, students who were satisfied with their academic performance had 1.6 times greater chances of a higher GPA (OR=1.6, p=0.08). Students who get support and help from those around them are more likely to get high GPAs (OR=1.1, p=0.73) than those who do not receive any support. When students reported feeling a sense of family responsibility, the odds (odds ratio) of their receiving higher grades were 1.15 times higher (OR=1.15, p=0.6) compared to those who did not feel a sense of family responsibility. The p-value, which indicates the level of statistical significance, was 0.6.

Table 3 shows the study habits of higher achiever students and low achiever students. Most of the high-achieving students (79.0%) attended most of the lectures and had 1.6 times higher chances of getting higher grades (OR=1.6, p=0.2) than those who did not attend regular lectures. The current study found that studying alone had no significant impact on academic achievement in either group. However, those students who had studied alone had lower GPAs (OR=1.07, p=0.81). The current study findings reported 29.8% of students walk or stand while studying rather than sit, and they had 1.57 times higher GPA chances compared to students with lower GPAs (OR=0.73, p=0.27). High achievers (54.0%) preferred studying early in the morning, and these students had higher chances of achieving good GPAs (OR=1.3, p=0.28) than low achiever groups of students. The number of students with high achievement (39.5%) went through the lecture before the lesson was taught. These students had 1.08 times higher chances of achieving than low achiever groups of students. Furthermore, students who made a weekly study schedule had 1.3 times higher chances of being good academic achievers than those who did not (OR=1.3, p=0.37). Additionally, high-achieving students paid closer attention to the lecturer (1.2 times higher). In addition, students with high GPAs spent more time studying when exam dates approached (OR=1.3, p=0.58).

Table 4 demonstrates the relationship between memorizing and revising with high and low GPA students. It was found that high achiever students (58.9%) studied lectures daily and had 1.4 times higher chances of achieving high grades (OR=1.4, p=0.16) than the other group. It was found that most of the high achievers (62.1%) skim the lecture beforehand before memorizing it, which led to 1.8 times higher chances of getting good grades in this exam (OR=1.8, p=0.06). One regular activity reported by high GPA students (82.3%) was recalling what had just been memorized. For this recalling technique, we found a significant difference between low-achieving students (OR=0.8, p=0.63) and high-achieving students (OR=1.83, p=0.05). A high achiever student writes notes before speaking out for the memorizing method, which gives 1.2 times greater chances of getting high grades (OR=1.2, p=0.55) than a student who does not write notes. A major difference in the current study was that high GPA achievers (70.2%) revise lectures more frequently than low GPA achievers (57.1%). They had 1.5

Table 2 Motivation factors associated with high and Low GPA students

			GPA**					
Motivation factors	**Categories***	***n*(%)**	**Low GPA *n* = 212 (63.1%)**	**95% CI**	***p*-value**	**High GPA *n* = 124 (36.9)**	**95% CI**	***p*-value**
Career prospects are an essential driving force for my studying.	Agree	252 (75.0)	150 (70.8)	0.78 (0.51–1.19)	0.25	102 (82.3)	1.67 (0.92–3.02)	0.09
	Neutral	66 (19.6)	50 (23.6)	Ref-1		16 (12.9)	Ref-1	
	Disagree	18 (5.4)	12 (5.7)	0.88 (0.38–1.9)	0.75	6 (4.8)	1.37 (0.47–4.02)	0.56
My main motivation for studying is to satisfy social expectations.	Agree	109 (32.4)	74 (34.9)	1.15 (0.70–1.8)	0.57	35 (28.2)	0.75 (0.44–1.4)	0.41
	Neutral	71 (21.1)	42 (19.8)	Ref-1		29 (23.4)	Ref-1	
	Disagree	156 (46.4)	96 (45.3)	1.04 (0.65–1.64)	0.86	60 (48.4)	0.94 (0.55–1.6)	0.82
Self-fulfillment is what motivates me toward studying.	Agree	261 (77.7)	152 (71.7)	0.74 (0.48–1.14)	0.17	109 (87.9)	1.9 (1.01–3.6)	**0.04**
	Neutral	60 (17.9)	47 (22.2)	Ref-1		13 (10.5)	Ref-1	
	Disagree	15 (4.5)	13 (6.1)	1.1 (0.48–2.5)	0.81	2 (1.6)	0.61 (0.12–3.02)	0.55
When exam results come out unfavorable, it motivates me to do better.	Agree	144 (42.9)	87 (41.0)	1.03 (0.66–1.6)	0.88	57 (46.0)	0.95 (0.57–1.5)	0.85
	Neutral	82 (24.4)	48 (22.6)	Ref-1		34 (27.4)	Ref-1	
	Disagree	110 (32.7)	77 (36.3)	1.2 (0.75–1.9)	0.44	33 (26.6)	0.72 (0.41–1.26)	0.25
I am satisfied with my academic performance.	Agree	177 (52.7)	87 (41.0)	0.71 (0.45–1.13)	0.15	90 (72.6)	1.6 (0.92–2.8)	0.08
	Neutral	64 (19.0)	44 (20.8)	Ref-1		20 (16.1)	Ref-1	
	Disagree	95 (28.3)	81 (38.2)	1.2 (0.76–2.01)	0.38	14 (11.3)	0.47 (0.22- 1.0)	**0.05**
Whenever I feel down, I am always supported and helped by those who are around me.	Agree	185 (55.1)	112 (52.8)	0.94 (0.63–1.42)	0.8	73 (58.9)	1.1 (0.67–1.76)	0.73
	Neutral	91 (27.1)	58 (27.4)	Ref-1		33 (26.6)	Ref-1	
	Disagree	60 (17.9)	42 (19.8)	1.1 (0.65–1.8)	0.72	18 (14.5)	0.82 (0.42–1.6)	0.57
I feel my responsibilities toward my family do affect my studying.	Agree	138 (41.1)	85 (40.1)	0.92 (0.59–1.42)	0.69	53 (42.7)	1.15 (0.67–1.96)	0.6
	Neutral	84 (25.0)	56 (26.4)	Ref-1		28 (22.6)	Ref-1	
	Disagree	114 (33.9)	71 (33.5)	0.93 (0.59–1.46)	0.76	43 (34.7)	1.13 (0.65–1.96)	0.66

*(Strongly agree + Agree) = Agree; Neutral; (Strongly disagree + Disagree) = Disagree

** High GPA >=4.5/5; Low GPA < 4.5/5

times more chances of getting high grades if they practiced and revised this method (OR = 1.5, $p = 0.13$).

Table 5 illustrates the relationship between negative lifestyle factors and students' academic performance. The current study found that students are less likely to get high exam grades when they smoke. Students who smoke cigarettes and those who vape are 1.14 and 1.07 times respectively more likely to have a decrease in GPA than those who do not smoke. Those students with chronic illnesses had 1.22 times higher chances of a downgrade in the exam (OR = 1.22, $p = 0.49$). Additionally, students with high GPAs had higher mental pressures (Anxiety = 1.2, Depression = 1.18, and other mental pressures = 1.57) than those with low GPAs.

Table 3 Association of study habits among medical students with high and low GPA

			GPA**					
Study Habits	**Categories***	***n*(%)**	**Low GPA *n* = 212 (63.1%)**	**95% CI**	***p*-value**	**High GPA *n* = 124 (36.9)**	**95% CI**	***p*-value**
I try to attend most of the lectures.	Agree	245 (72.9)	147 (69.3)	0.80 (0.47–1.3)	0.39	98 (79.0)	1.6 (0.76–3.3)	0.2
	Neutral	40x (11.9)	30 (14.2)	Ref-1		10 (8.1)	Ref-1	
	Disagree	51 (15.2)	35 (16.5)	0.91 (0.48–1.7)	0.78	16 (12.9)	1.2 (0.51- 3.0)	0.61
I prefer to study alone.	Agree	276 (82.1)	171 (80.7)	1.07 (0.61–1.8)	0.81	105 (84.7)	0.90 (0.48–1.6)	0.75
	Neutral	38 (11.3)	22 (10.4)	Ref-1		16 (12.9)	Ref-1	
	Disagree	22 (6.5)	19 (9.0)	1.5 (0.6–3.3)	0.33	3 (2.4)	0.32 (0.08–1.2)	0.09
I prefer to walk/ stand while studying rather than sitting.	Agree	75 (22.3)	38 (17.9)	0.73 (0.42–1.2)	0.27	37 (29.8)	1.57 (0.83–2.95)	0.15
	Neutral	67 (19.9)	46 (21.7)	Ref-1		21 (16.9)	Ref-1	
	Disagree	194 (57.7)	128 (60.4)	0.96 (0.62–1.4)	0.85	66 (53.2)	1.08 (0.61–1.9)	0.77
I prefer to study early in the morning.	Agree	162 (48.2)	95 (44.8)	0.85 (0.57–1.2)	0.45	67 (54.0)	1.3 (0.8–2.1)	0.28
	Neutral	101 (30.1)	69 (32.5)	Ref-1		32 (25.8)	Ref-1	
	Disagree	73 (21.7)	48 (22.6)	0.96 (0.59–1.5)	0.87	25 (20.2)	1.08 (0.59–1.9)	0.8
I try to go through the lecture before it is taught in the classroom.	Agree	106 (31.5)	57 (26.9)	0.93 (0.56–1.5)	0.79	49 (39.5)	1.08 (0.63–1.8)	0.75
	Neutral	73 (21.7)	42 (19.8)	Ref-1		31 (25.0)	Ref-1	
	Disagree	157 (46.7)	113 (53.3)	1.3 (0.79–1.9)	0.32	44 (35.5)	0.66 (0.38–1.12)	0.12
During classroom teaching, I tend to listen attentively to the lecturer.	Agree	236 (70.2)	143 (67.5)	0.89 (0.57–1.4)	0.62	93 (75.0)	1.2 (0.69–2.1)	0.48
	Neutral	62 (18.5)	42 (19.8)	Ref-1		20 (16.1)	Ref-1	
	Disagree	38 (11.3)	27 (12.7)	1.04 (0.55–1.9)	0.88	11 (8.9)	0.89 (0.38- 2.0)	0.8
I make sure to set up a weekly study schedule in advance.	Agree	151 (44.9)	84 (39.6)	0.85 (0.54–1.3)	0.49	67 (54.0)	1.3 (0.74–2.1)	0.37
	Neutral	72 (21.4)	47 (22.2)	Ref-1		25 (20.2)	Ref-1	
	Disagree	113 (33.6)	81 (38.2)	1.1 (0.68–1.7)	0.69	32 (25.8)	0.81 (0.44–1.4)	0.5
As the exam date approaches, I tend to increase my study time and effort significantly.	Agree	302 (89.9)	190 (89.6)	0.88 (0.46–1.6)	0.71	112 (90.3)	1.27 (0.53- 3.0)	0.58
	Neutral	24 (7.1)	17 (8.0)	Ref-1		7 (5.6)	Ref-1	
	Disagree	10 (3.0)	5 (2.4)	0.70 (0.20–2.4)	0.58	5 (4.0)	1.7 (0.43–6.7)	0.43

*(Strongly agree + Agree) = Agree; Neutral; (Strongly disagree + Disagree) = Disagree

** High GPA >= 4.5/5; Low GPA < 4.5/5

Table 4 Association of Memorizing and Revising among the medical students with high and low GPAs

			GPA**					
Memorizing and Revising	**Categories***	***n*(%)**	**Low GPA *n* = 212 (63.1%)**	**95% CI**	***p*-value**	**High GPA *n* = 124 (36.9)**	**95% CI**	***p*-value**
I ensure that I study the lectures day by day.	Agree	160 (47.6)	87 (41.0)	0.78 (0.50–1.2)	0.29	73 (58.9)	1.4 (0.8–2.5)	0.16
	Neutral	74 (22.0)	51 (24.1)	Ref-1		23 (18.5)	Ref-1	
	Disagree	102 (30.4)	74 (34.9)	1.05 (0.6–1.6)	0.82	28 (22.6)	0.88 (0.4–1.6)	0.69
Before I start memorizing, I tend to skim the lecture beforehand.	Agree	166 (49.4)	89 (42.0)	0.71 (0.4–1.1)	0.17	77 (62.1)	1.8 (0.9–3.4)	0.06
	Neutral	55 (16.4)	41 (19.3)	Ref-1		14 (11.3)	Ref-1	
	Disagree	115 (34.2)	82 (38.7)	0.95 (0.58–1.5)	0.85	33 (26.6)	1.1 (0.5–2.2)	0.73
When studying, I try to recall what I have just memorized.	Agree	258 (76.8)	156 (73.6)	0.8 (0.5–1.4)	0.63	102 (82.3)	1.83 (0.6–2.3)	**0.05**
	Neutral	47 (14.0)	32 (15.1)	Ref-1		15 (12.1)	Ref-1	
	Disagree	31 (9.2)	24 (11.3)	1.1 (0.56–2.2)	0.71	7 (5.6)	0.7 (0.23–1.9)	0.51
Regarding my memorization, I prefer to write down/ speak out what I just memorized.	Agree	240 (71.4)	147 (69.3)	0.89 (0.5–1.4)	0.96	93 (75.0)	1.2 (0.6–2.3)	0.55
	Neutral	44 (13.1)	30 (14.2)	Ref-1		14 (11.3)	Ref-1	
	Disagree	52 (15.5)	35 (16.5)	0.98 (0.5–1.8)	0.96	17 (13.7)	1.0 (0.5–2.3)	0.94
Regarding my memorization, I prefer to read the content repetitively.	Agree	230 (68.5)	148 (69.8)	1.2 (0.7- 2.0)	0.45	82 (66.1)	0.75 (0.4–1.3)	0.31
	Neutral	51 (15.2)	27 (12.7)	Ref-1		24 (19.4)	Ref-1	
	Disagree	55 (16.4)	37 (17.5)	1.2 (0.6–2.3)	0.45	18 (14.5)	0.69 (0.3–1.4)	0.32
I try to integrate ideas in all courses for a better understanding.	Agree	238 (70.8)	140 (66.0)	0.81 (0.5–1.2)	0.33	98 (79.0)	1.4 (0.8–2.5)	0.15
	Neutral	72 (21.4)	52 (24.5)	Ref-1		20 (16.1)	Ref-1	
	Disagree	26 (7.7)	20 (9.4)	1.0 (0.5–2.1)	0.85	6 (4.8)	0.83 (0.3–2.2)	0.72
I make sure to revise the lectures regularly.	Agree	192 (57.1)	105 (49.5)	0.8 (0.5–1.2)	0.26	87 (70.2)	1.5 (0.9–2.5)	0.13
	Neutral	73 (21.7)	51 (24.1)	Ref-1		22 (17.7)	Ref-1	
	Disagree	71 (21.1)	56 (26.4)	1.0 (0.6–1.7)	0.83	15 (12.1)	0.7 (0.3–1.4)	0.34
When data/information is presented to me, I prefer it to be in a written form rather than a graphical one.	Agree	120 (35.7)	70 (33.0)	1.0 (0.6–1.6)	0.85	50 (40.3)	0.94 (0.6–1.5)	0.81
	Neutral	109 (32.4)	61 (28.8)	Ref-1		48 (38.7)	Ref-1	
	Disagree	107 (31.8)	81 (38.2)	1.3 (0.8- 2.0)	0.16	26 (21.0)	0.55 (0.3–0.9)	**0.03**

*(Strongly agree + Agree) = Agree; Neutral; (Strongly disagree + Disagree) = Disagree

** High GPA >= 4.5/5; Low GPA < 4.5/5

Table 5 Association of negative lifestyle factors among medical students with high and low GPA

			GPA					
Variables	**Categories**	***n*(%)**	**Low GPA *n* = 212 (63.1%)**	**95% CI**	***p*-value**	**High GPA *n* = 124 (36.9)**	**95% CI**	***p*-value**
Smoking	Cigarette	7 (2.1)	5 (2.4)	1.14 (0.35–3.63)	0.82	2 (1.6)	0.76 (0.15–3.75)	0.74
	Shisha	2 (0.6)	0 (0)	0.31 (0.015- 6.6)	0.46	2 (1.6)	1.02 (0.37–2.37)	0.32
	Vaping	37 (11.0)	25 (11.8)	1.07 (0.62–1.84)	0.78	12 (9.7)	0.87 (0.43–1.73)	0.69
	I don't smoke	290 (86.3)	182 (85.8)	Ref 1		108 (87.1)	Ref 1	
Chronic illness	Yes	29 (8.6)	22 (10.4)	1.22 (0.68–2.19)	0.49	7 (5.6)	0.63 (0.27–1.48)	0.29
	No	307 (91.4)	190 (89.6)	Ref 1		117 (94.4)	Ref 1	
Mental illness	Anxiety	30 (8.9)	17 (8.0)	0.88 (0.47–1.65)	0.7	13 (10.5)	1.2 (0.60–2.38)	0.6
	Depression	20 (6.0)	14 (6.6)	1.09 (0.54–2.22)	0.79	6 (4.8)	1.18 (0.44–3.16)	0.73
	others	7 (2.1)	3 (1.4)	0.67 (0.17–2.63)	0.56	4 (3.2)	1.57 (0.45–5.50)	0.73
	No	279 (83)	178 (84.0)	Ref 1		101 (81.5)	Ref 1	

Discussion

Learning is a multifaceted process that evolves throughout our lifetimes. The leading indicator that sets students apart is their academic achievement. Hence, it is crucial to investigate the factors that influence it. The present study examined the relationship between different study habits, personal characteristics, and academic achievement among medical students. In medical education, and more so in Saudi Arabia, there needs to be more understanding regarding such vital aspects.

Regarding motivational factors, the present study found some differences between high and low achievers. Students with high GPA scores were more motivated toward their future careers (OR = 1.67, $p = 0.09$). The study also indicated that students who had ambitions and sought self-fulfillment were more likely to have high GPA scores, which were statistically significant (OR = 1.93, $p = 0.04$). This was consistent with Bin Abdulrahman et al. [20], who indicated that the highest motivation was self-fulfillment and satisfying family dreams, followed by a high educational level, aspirations to join a high-quality residency program, and high income. Their study also found that few students were motivated by the desire to be regarded as unique students. We hypothesize that this probably goes back to human nature, where a highly rewarding incentive becomes the driving force of our work. Hence, schools should utilize this finding in exploring ways to enhance students' motivation toward learning.

The present study did not find a significant effect of previous exam results on academic performance (OR = 1.03, $p = 0.88$). However, some studies reported that more than half of the high-achieving students admitted that high scores acquired on previous assessments are an important motivational factor [15, 25, 26]. We hypothesize that as students score higher marks, they become pleased and feel confident with their study approach. This finding shows how positive measurable results influence the students' mentality.

The present study also explored the social environment surrounding medical students. The results indicated that those who were supported by their friends or family were slightly more likely to score higher GPAs (OR = 1.1, $p = 0.73$); however, the results did not reach a statistical significance. We hypothesize that a supportive and understanding environment would push the students to be patient and look for a brighter future. Our study results were consistent with previous published studies, which showed an association [3, 27–30]. We hypothesize that students who spend most of their time with their families had less time to study, which made their study time more valuable. The findings of this study will hopefully raise awareness concerning the precious time that students have each day.

The association of different study habits among medical students with high and low GPAs was also studied in our study. It was noted that the high-achieving students try to attend their lectures compared to the lower achievers. This was in line with the previous published studies, which showed that significant differences were observed between the two groups regarding the attendance of lectures, tutorials, practical sessions, and clinical teachings [31, 32]. The present study found that most students prefer to study alone, regardless of their level of academic

achievement (82.1%). This finding is consistent with the study by Khalid A Bin Abdulrahman et al., which also showed that most students, regardless of their GPA, favored studying alone [20].

The present study findings suggest that a small number of students (29.8%) prefer to walk or stand while studying rather than sit, with most being high achievers (OR=1.57, P=0.15). A study reported that 40.3% of students with high GPAs seemed to favor a certain posture or body position, such as sitting or lying on the floor [15]. These contradictory findings might indicate that which position to adopt while studying should come down to personal preference and what feels most comfortable to each student. The present study also found that high achievers are more likely to prefer studying early in the morning (OR=1.3, P=0.28). The authors did not find similar studies investigating this same association in the literature. However, mornings might allow for more focused studying with fewer distractions, which has been shown to be associated with higher achievement in medical students [3, 15, 33].

Our study also found that 39.5% of the academically successful students reviewed pre-work or went through the material before they were taught it (OR=1.08, p=0.75), and 25% were neutral. Similar findings were reported in other studies, showing that academically successful students prepared themselves by doing their pre-work, watching videos, and revising slides [3, 9, 34]. Our study showed that 75% of high-achieving students tend to listen attentively to the lecturer (OR=1.2, p=0.48). Al Shawa et al. found no significant differences between the high achievers and low achievers when talking about attending lectures [15]. This could be due to the quality of teachers and the environment of the college or university.

Regarding the relationship between memorizing and revising with high and low GPA students, the present study found that students who study lectures daily are more likely to score higher than those who do not (OR=1.4, p=0.16). This finding is consistent with other studies [3, 19, 35]. For skimming lectures beforehand, an appreciable agreement was noted by high GPA students (62.1%), while only (42%) of low GPA students agreed to it. Similarly, previous published studies also found that highlighting and reading the content before memorization were both common among high-achieving students [15, 36]. Furthermore, the present study has found recalling what has just been memorized to be statistically significantly associated with high GPA students (OR=1.83, p=0.05). Interestingly, we could not find any study that investigated this as an important factor, which could be justified by the high specificity of this question. Besides, when it comes to writing down/speaking out what has just been memorized, our study has found no recognizable differences between high-achieving students (75%) and low-achieving students (69%), as both categories had remarkably high percentages of reading and writing while studying.

The present study has found no statistical significance between regularly revising the lectures and high GPA (p>0.05), unlike the study conducted by Deborah A. Sleight et al. [37]. The difference in findings between our study and Deborah A. Sleight et al. might be due to a limitation of our study, namely the similar backgrounds of our participants. Another explanation could be related to curricular differences between the institutions where the two studies were conducted. Moreover, a statistically significant correlation between not preferring the data being presented in a written form instead of a graphical form and high GPA scores have been found in their study (p<0.05). However, a study conducted by Deborah A. Sleight et al. indicated that 66% of high achievers used notes prepared by other classmates compared to 84% of low achievers. Moreover, their study showed that only 59% of high achievers used tables and graphs prepared by others compared to 92% of low achievers. About 63% and 61% of the students in their study reported using self-made study aids for revision and memory aids, respectively [37].

The present study also examined the effects of smoking and chronic and mental illness, but found no statistical significance; the majority of both groups responded by denying these factors' presence in their life. A similar finding by Al Shawwa et al. showed no statistical significance of smoking and caffeine consumption between low GPA and high GPA students [15]. We hypothesize that our findings occurred due to the study's broad approach to examining such factors rather than delving deeper into them.

Conclusion

High-achieving students' habits and factors contributing to their academic achievement were explored in the present study. High-achieving students were found to be more motivated and socially supported than their peers. Moreover, students who attended lectures, concentrated during lectures, studied early in the morning, prepared their weekly schedule, and studied more when exams approached were more likely to have high GPA scores. Studying techniques, including skimming before memorizing, writing what was memorized, active recall, and consistent revision, were adopted by high-achievers. To gain deeper insight into students' strategies, it is recommended that qualitative semi-structured interviews be conducted to understand what distinguishes high-achieving students from their peers. Future studies should also explore differences between public and private university students. Additionally, further research is needed to confirm this study's findings and provide guidance to all

students. Future studies should collect a larger sample size from a variety of universities in order to increase generalizability.

Limitations and recommendations

The present study has some limitations. All the study's findings indicated possible associations rather than causation; hence, the reader should approach the results of this study with caution. We recommend in-depth longitudinal studies to provide more insight into the different study habits and their impact on academic performance. Another limitation is that the research team created a self-reported questionnaire to address the study objectives, which carries a potential risk of bias. Hence, we recommend conducting interviews and having personal encounters with the study's participants to reduce the risk of bias and better understand how different factors affect their academic achievement. A third limitation is that the research team only used the GPA scores as indicators of academic achievement. We recommend conducting other studies and investigating factors that cannot be solely reflected by the GPA, such as the student's clinical performance and skills. Lastly, all participants included in the study share one background and live in the same environment. Therefore, the study's findings do not necessarily apply to students who do not belong to such a geographic area and point in time. We recommend that future studies consider the sociodemographic and socioeconomic variations that exist among the universities in Saudi Arabia.

Abbreviations

GPA	Grade Point Average
OR	Odd ratio
KSU	King Saud University
IRB	Institutional review board
SPSS	Statistical package for the social sciences

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Author contributions

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Availability of data materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest

The Authors declare that they have no conflict of interest.

Consent for publication

Not applicable.

Competing interests

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Human ethics and consent to participate declarations

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