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Discussion Points:

- Medical students show a positive attitude towards conducting research in Saudi Arabia, it appears that the upcoming generation of physician is going to have many outstanding & enthusiastic research that will elevate the quality of healthcare using evidence-based method to tackle common health issues
- Many medical students conduct research for various reasons, exploring different specialties by conducting studies in that field and working with senior physician may be a good way of building research skills and discover specialties of interest during medical school.

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1 **ABSTRACT**

2

3 **Introduction:** Medical research has become an essential part of medical students' curricula at
4 several medical colleges in Saudi Arabia. This study aimed to assess medical students' attitudes and
5 identify factors influencing their willingness to conduct medical research.

6

7 **Methods:** This cross-sectional study was conducted between December 2021 and April 2022 using
8 the student attitude towards research and the students' perceived influential factors toward
9 participating in research activities questionnaires. A 5-Likert scale to calculate the average of the
10 students' responses where 5 indicated 'strongly agree' and 1 indicated 'strongly disagree' was used.
11 The survey was distributed to medical students at the College of Medicine, King Saud bin Abdulaziz
12 University for Health Sciences (KSAU-HS), Saudi Arabia.

13

14 **Results:** A total of 500 responses were collected from the students (67.2% male and 32.8% female).
15 Most students agreed with the following statement: 'Research is important for identifying and
16 investigating problems in a subject matter' (N=399, 79.8%). More than half of the students agreed to
17 the following statement: 'I am very interested in participating in research activities at the
18 undergraduate level' (N=318, 63.6%). The top three influential factors for conducting medical
19 research were 'to facilitate entry into competitive residency programs' followed by 'interest in
20 specific research fields or medical topics' and then to 'improve curriculum vitae (CV)'.

21

22 **Conclusion:** Majority of the surveyed students showed a positive attitude towards conducting
23 medical research in King Saud bin Abdulaziz University for Health Sciences, Saudi Arabia. Most
24 students conduct research to gain a competitive edge and explore specialties of interest.

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27 **Key Words:** Research, Medical students, Attitudes, Knowledge, Perception (Source: MeSH-NLM).

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1 INTRODUCTION

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3 Medical research has advanced medical practice because it helps physicians address the most pressing
4 challenges in the healthcare sector, thereby reducing global health disparities by offering affordable
5 treatments and rapid screening tools.^{1,2} It is crucial for researchers and medical students to understand
6 research principles in order to produce reliable and high-quality articles.³ Previous studies have shown that
7 early exposure to research can improve medical students understanding and conduction of medical research.
8 As a result, several medical colleges have incorporated research into their curricula.⁴⁻⁶ There are a few
9 methods to incorporate research training into medical school curricula, either by research-driven curricula,
10 research electives, or mandatory research projects for graduation.^{7,8} However, many medical students still do
11 not have sufficient knowledge to conduct research projects and publish them.^{6,9,10} Given the need to build a
12 research-facilitating curriculum, it is important to determine the attitude of medical undergraduates towards
13 research in Saudi Arabia.¹¹

14

15 In the Kingdom of Saudi Arabia, there has been an increase in the number of medical undergraduates who
16 have conducted research before graduation, though only a few have been the first authors.^{6,9} Low number of
17 graduates with research experience are commonly observed in colleges where research projects are not
18 mandatory for graduation.^{6,9} However, only seniors and students with a high-Grade Point Average (GPA) were
19 more likely to participate in research.^{6,9} A study conducted in Umm Al-Qura University in Saudi Arabia
20 revealed that only 10.8% of health colleges' students have an adequate background in research and only
21 6.6% had published a medical research paper.¹⁰ Despite the increasing number of medical students involved
22 in research for various reasons¹², studies had shown that students' research projects are often not of good
23 quality, nor are they particularly very impactful towards the scientific community.^{13,14}

24

25 Currently, conducting a research project is a prerequisite for graduation in several Saudi medical colleges.^{6,15}
26 In addition, the Saudi Commission for Health Specialties (SCFHS)—a regulatory commission that sets
27 requirements for students' enrollment into Saudi residency programs—recently announced that participation in
28 research activities and publications in specified journals are granted 6 points of the total 20 points available for
29 residency application as of 2022.¹⁶ There has been an increase in research summer schools to encourage
30 students to gain hands-on experience with well-known researchers and physicians.⁶ While this will improve
31 the students' knowledge about research principles, many global studies have shown that these changes
32 usually become controversial since they can influence the quality and quantity of students' future contributions
33 to the field by encouraging them to publish more articles with lower quality to increase their chance of getting
34 accepted into a competitive residency program.^{6,12,16-18}

35

36 However, there is no available multi-campus study conducted in Saudi Arabia to thoroughly explore the
37 attitudes of medical students toward conducting research, and which factors influence students to do so.
38 Multi-campus studies can provide better insights into students' attitudes and identify the influential factors in
39 conducting research. Influential factors affect students' decisions to conduct research projects. The primary
40 aim of this study was to assess medical students' attitudes towards conducting medical research and identify
41 the factors influencing their willingness to conduct research projects.

42

1 METHODS

2 3 **Study Design, Settings, and Participants**

4 This cross-sectional study was conducted at the College of Medicine of King Saud bin Abdulaziz University for
5 Health Sciences (KSAU-HS), Saudi Arabia, on the Jeddah and Riyadh campuses. The survey was distributed
6 to medical students. Foundational and pre-medical students were excluded because the research course
7 started during year three in the college curriculum. Interns were also excluded because they were more likely
8 to be familiar with the process of conducting medical research as per the requirements of residency program
9 application points that require at least one published research to give candidates an advantage over other
10 applicants.

11 12 **Questionnaires and Data Collection Process**

13 This study utilized two self-administered questionnaires acquired with permission from recent studies; the
14 Students' Attitude Towards Research (SAR) ⁴ and Students' Perceived Influential Factors Toward
15 Participating in Research Activities questionnaires, this is a pre-piloted survey with high internal reliability
16 (Cronbach's a coefficient = 0.88).¹² The survey included four sections. The first section investigates students'
17 attitudes towards research activities provided by the college. The second section identifies students' opinions
18 on faculty involvement in research projects. The third section examines the availability and quality of the
19 infrastructural facilities offered by their colleges. The last section identifies possible influential factors in
20 conducting medical research. A 5-Likert scale was used to assess the level of students' agreement from
21 'strongly disagree=1', 'disagree=2', 'neutral=3', 'agree=4', to 'strongly agree=5'. Demographic information
22 such as sex, year of study, and GPA, which was collected in ordinal values, and previously published
23 research was collected. An online survey was distributed between December 12, 2021, and April 10, 2022.
24 The estimated population was 1627 medical students from both campuses. Therefore, with a 5% margin of
25 error and 95% a confidence interval, the minimum recommended sample size is 311 students as suggested
26 by Raosoft Sample size calculator. Considering that the non-response rate is 20%, the final sample size is
27 373. This study was approved by the Institutional Review Board (IRB) of King Abdullah International Medical
28 Research Center (Study number: SP21J/458/11).

29 30 **Statistical Analysis:**

31 The participants were asked to complete the survey through a Google webpage, which was exported to Excel
32 and then to JMP software (version 10.0; SAS Institute Inc., Cary, NC, USA). Quantitative variables are
33 presented as means and standard deviations, and qualitative variables are presented as frequencies and
34 percentages. The chi-square test was used to compare categorical values and report any differences.
35 Disagreement responses (1: strongly disagree, and 2: disagree) were grouped as "disagree", and agreement
36 responses (4: agree, and 5: strongly agree) were grouped as "agree"; while neutral responses (3: neutral) was
37 simply presented as "neutral." All calculations of the mean and SD were based on the average of the 5-point
38 Likert scale that was used. A P-value less than 0.05 was considered statistically significant.

39
40 *(Insert Table 1 here)*
41

1 RESULTS

3 Students' Characteristics

4 A total of 500 students completed the survey on both campuses. The majority were male students (N=336,
5 67.2%) from the Riyadh campus (N=273, 54.6%). Most were fourth-year students (N=218, 43.6%). Most of the
6 students had a grade point average (GPA) that ranges between 4.5 and 5 (N=354, 70.8%) and were in the pre-
7 clinical phase (N=366, 73.2%). Only a few students had prior research publications (N=67, 13.4%). Further
8 characteristics are presented in Table 1.

10 Students' Attitudes

11 **Table 2** shows the respondents' attitudes towards research. The agreement responses 'strongly agree' and
12 'agree' were grouped as 'agree, the disagreement responses 'strongly disagree' and 'disagree' were grouped
13 as 'disagree, and neutral was recorded as 'neutral'. More than 60% of students (N=318) agreed to have an
14 interest in participating in medical research at the undergraduate level, and 282 (56.6%) agreed that they had
15 been exposed to the basic and advanced statistical tools needed to prepare a research report. Additionally,
16 most students (N=399, 79.8%) agreed that research is important for identifying and investigating problems in a
17 subjective manner. There was a significant difference among students in responses to following statement
18 'always getting the chance to discuss about the scientific/academic research in their class' ($P=0.022$). Only 265
19 (53%) of the students agreed that, overall, they were satisfied with the research training program offered at the
20 undergraduate level, which was close to significance ($P=0.056$).

22 (Insert Table 2 here)

24 Female students significantly agreed more than male students that faculty have adequate skills to handle
25 research methodology (3.93 ± 1.01 vs. 3.7 ± 1.06 , $P=0.014$). Less than half of the students (N=228, 45.6%) agreed
26 that faculty members do not have sufficient time to mentor undergraduate students in research, but this was not
27 significant ($P=0.836$). Only 108 (21.6%) students disagreed that faculty involvement in the research program
28 was good. The majority of students (N=210, 62%) agreed that faculty members place great emphasis on
29 research. Furthermore, a significant difference was found in the following statement: Faculty members use
30 research findings as a part of their teaching material ($P < .001$), but the difference among students' agreement
31 regarding whether faculty members discuss their own research interests in class was not significant ($P=0.484$).

33 More than half of the students (N=314, 62.8%) agreed that their college organizes and prioritizes including
34 undergraduates in research activities. The students agreed that their college had adequate infrastructure to
35 organize research programs (N=321, 64.2%, $P=0.005$). Moreover, there was a difference between the students
36 when they were asked if their college provided good infrastructural facilities (i.e., laboratories and libraries)
37 needed to conduct research at the undergraduate level ($P=0.547$). Only 230 (46%) agreed that the library
38 facilities available at their college were sufficient for them to conduct research activities. The majority of students
39 (N=344, 68.8%) either disagreed or were neutral when asked if the university offered sufficient funding to
40 conduct research at the undergraduate level.

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Influential Factors & Motives

The 5-Likert scale was used to calculate the average of the students' responses, where 5 indicated 'strongly agree' and 1 indicated 'strongly disagree'. The most influential factors chosen by the students were (1) facilitating entry into competitive residency programs, (2) interest in specific research fields or medical topics, (3) improve curriculum vitae (CV), and (4) necessary competency for future clinical careers. On the other hand, the least influential factors were (1) good method to fulfill leisure time, (2) motivation by faculty/senior student researchers, (3) encouragement from previous participation in research activities, and (4) communicate research findings in scientific meetings. All influential factors are presented in **Figure 1**.

(Insert Figure 1 here)

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1 DISCUSSION

2
3 This cross-sectional study aimed to assess medical students' attitudes and identify the influential factors in
4 conducting medical research. The study outcomes revealed that most of the students recognize how vital
5 research is in identifying clinical issues and trying to solve them in a subjective matter. Most of the students
6 showed an interest in participating in research activities at the undergraduate level. Moreover, statistical
7 analysis revealed that most of the students were exposed to basic and advanced statistical tools for the
8 preparation of a research report. These results are essential because medical students will eventually become
9 physicians who need to incorporate evidence-based medicine into their practice to ensure the best health
10 service outcomes, evaluate their practice in a critical but logical manner, and remain updated. The most
11 influential factors for participating in research were (1) facilitating entry into competitive residency programs,
12 (2) interest in specific research fields or medical topics, and (3) improving curriculum vitae (CV).

13
14 Similar to the outcomes of this study, several studies have demonstrated positive attitudes towards research
15 among medical students who have been exposed to research activities.^{5,6,14,15,19} Prior exposure to research
16 activities may help students understand the importance of research and how it can advance science and
17 medicine. This positive attitude may indicate that some students view research as a method to gain a more
18 comprehensive understanding of medicine, but our results showed that it was ranked as the fifth factor, which
19 may be because students prefer to understand medicine through textbooks and references recommended by
20 their faculty. These outcomes emphasize the importance of establishing strong research programs and
21 encouraging students to integrate research into their learning as this can increase the likelihood of students
22 becoming more knowledgeable physicians.² Interestingly, our results regarding the influential factors in
23 conducting medical research were very similar to another study conducted at Alfaisal University.¹² The top
24 influential factor in the latter study and this study was to facilitate entry into competitive residency programs.
25 This shows that medical students, regardless of their institution, conduct research to gain a competitive edge
26 to help them apply for residency. However, in our study, the second influential factor in conducting medical
27 research was the interest in a specific research field. This stems from the fact that King Saud bin Abdulaziz
28 University for Health Sciences students view research as a method to explore different specialties and build
29 connections with physicians from different fields to decide which specialty they will eventually apply.

30
31 Students agreed that their faculty members used research findings to teach, which may lead to research-
32 oriented students subjectively investigating information. There was a difference between the students
33 regarding their chances to discuss scientific research in class, which may be due to the lack of understanding
34 of research at their undergraduate level. Half of the students were satisfied with the research training
35 curriculum in their college, indicating that most students are equipped to conduct research projects and try to
36 integrate their research findings into the clinical materials they learn from.

37
38 The students reported several barriers to conducting research at their colleges. Almost half of the students
39 agreed that faculty members did not have sufficient time to mentor undergraduate students. Moreover, other
40 studies have shown similar outcomes.^{6,20-23} This may discourage interested students from participating in
41 research projects and delay the advancement of research. Almost half of the students disagreed with or were

1 neutral about their satisfaction with the research program offered by their college. This may be due to several
2 reasons: (1) Saudi medical colleges focus on the fundamentals of medicine rather than research, (2) the
3 research program is a part of a curriculum that does not explain in detail complex research methodologies, (3)
4 most faculty members are not involved in student projects because it takes time to mentor students and
5 faculty members have various professional and academic commitments, and (4) some of the students may
6 not be able to finalize their research projects due to busy schedule conflicts with their medical curriculum and
7 examinations.

8
9 In this study, facilitating entry into competitive residency programs was the most influential factor in
10 conducting medical research. A study from Pakistan conducted in 2013 reported the same reason as the
11 second most common influential factor.²⁴ It was the second most common influential factor in another study
12 conducted in Canada.²³ Facilitating entry into competitive residency programs is a common influential factor
13 among medical students who conduct research projects. While improving the curriculum vitae (CV) was the
14 third influential factor in our study, it was the most influential factor in several previous studies.²⁴⁻²⁶ Medical
15 students around the globe conducted research to advance their careers and nourish their resumes. This may
16 be because residency programs and academic institutions emphasize research activities without examining
17 the quality of the research conducted and/or published. This may pressure students to participate in research
18 activities without having any interest in a career in research, leading to many research articles that have been
19 published and remain unread and uncited for several years.

20
21 It has been reported that Saudi residency program directors in competitive specialties such as plastic surgery,
22 anesthesiology, and urology prefer candidates who have high-quality research publications.²⁷⁻²⁹ In contrast,
23 specialties that are relatively less competitive in Saudi Arabia, such as internal medicine, obstetrics and
24 gynecology, family medicine, and pediatrics have fewer publications.³⁰ This issue extends to the United States
25 as orthopedic residency program applicants research projects listed in their resumes as 'submitted' remain
26 frequently unpublished or published in low-impact journals.³¹ Furthermore, this issue extends beyond
27 residency applications, as the selection for fellowship programs requires more scholarly work.³²

28
29 Local and international residency programs and academic institutions should consider enhancing research
30 outcomes and improving evidence-based medicine. Many medical students conduct and publish research to
31 get accepted into competitive programs, but it is unknown how many pursue a career in research once they
32 are accepted into their desired specialty and program. Students' efforts should be directed toward
33 basic/translational and clinical research that attempts to experiment and investigate various ways to contribute
34 to medicine efficiently and productively.

35 36 **Limitations**

37 This study had several limitations. For example, this study utilized a self-administered, web-based survey.
38 Therefore, the response rate is low. This was because the survey was distributed during the students' final
39 examination. Additionally, this study was conducted at only one university, which means that the results may
40 not be generalizable to other universities. However, campuses in two different cities were included to ensure a
41 diverse and large sample of students. King Saud bin Abdulaziz University for Health Science is a research-

1 oriented university with the King Abdullah International Medical Research Center (KAIMRC) within its campus,
2 which may have impacted students' responses. This was a cross-sectional study, which means that it only
3 represented students' attitudes at one point in time.
4

5 **Conclusion**

6 In conclusion, medical students at King Saud bin Abdulaziz University for Health Sciences generally showed a
7 positive attitude towards conducting medical research. The most influential factor in conducting medical
8 research is facilitating entry into competitive residency programs. The second influential factor is the interest in
9 a specific research field or medical topic. The study outcomes revealed the importance of recruiting interested
10 medical students in basic and/or clinical studies so that they can contribute to the scientific field in the early
11 stages of their careers. This study is important for policymakers, residency program directors, and research
12 center directors to reconsider published research and research activities as prerequisites for acceptance into
13 competitive programs. Further studies should investigate whether medical students pursue research activities
14 after college, their attitudes, and influential factors, as well as their research skills and how they acquired them.
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1 **SUMMARY - ACCELERATING TRANSLATION**

2

3 Write a summary of your research in the language where the study was conducted and written for a non-
4 scientific audience. In this way, participants, researchers, practitioners, and decision-makers can have easier
5 access to your research/results and use them where they see adequate.

6

7 It must include, title, main problem to solve, aim of study, methodology, results, and conclusion (no references
8 are required). The summary should have a maximum of 1000 words.

9

Accepted, in-press

1 **FIGURES AND TABLES.**

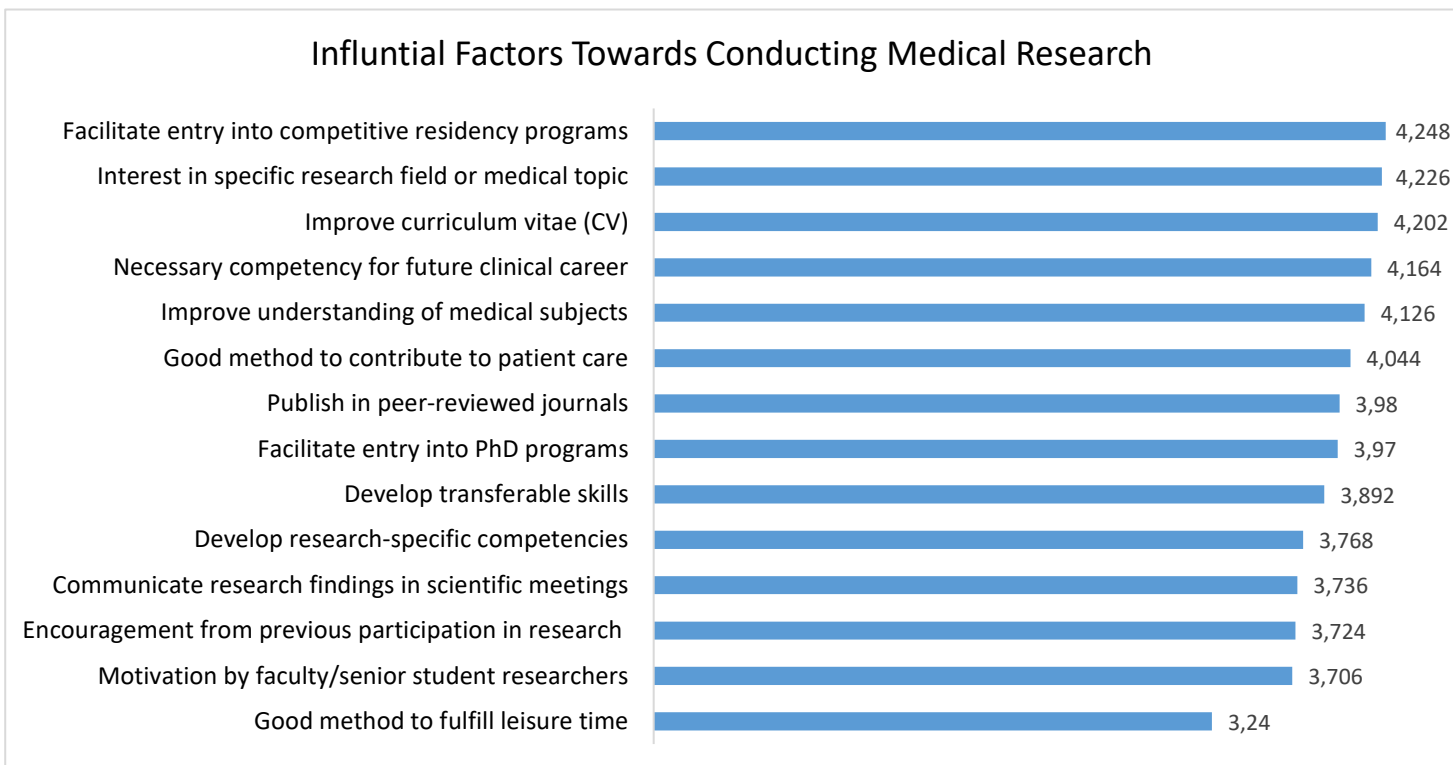
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4 **Figure 1.** The Influential Factors Toward Conducting Research among Medical Students.

5 Facilitating entry into competitive residency programs is the first influential factor then having an interest in
6 specific research field or medical topic is the second influential factor.

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1 **Table 1** Participants' Characteristics

2

Characteristic	Descriptive Statistics	3
Campus [N (%)]		
Riyadh	273 (54.6%)	
Jeddah	227 (45.4%)	
Sex [N (%)]		
Male	336 (67.2%)	
Female	164 (32.8%)	
GPA* [N (%)]		
3 – 3.49	4 (0.8%)	
3.5 – 3.99	34 (6.8%)	
4 – 4.49	108 (21.6%)	
4.5 – 5	354 (70.8%)	
Level [N (%)]		
Freshmen	154 (30.8%)	
Sophomores	218 (43.6%)	
Juniors	87 (17.4%)	
Seniors	41 (8.2%)	
Phase of Study [N (%)]		
Pre-clinical phase	366 (73.2%)	
Clinical phase	134 (26.8%)	
Prior research publication [N (%)]		
Yes	67 (13.4%)	
No	433 (86.6%)	

4 *Grade Point Average, it is out of 5

5

6

7 **Table 2.** Attitude of Medical Students Towards Research

8

Statement	Disagree N (%)	Neutral N (%)	Agree N (%)*	P-value**
Statement regarding Research Activities Offered in the College				
I am much interested in participating in research activities at the undergraduate level	91 (18.2)	91 (18.2)	318 (63.6)	0.331
My college organizes and gives priority to include undergraduates in	63 (12.6)	123 (24.6)	314 (62.8)	0.360

research activities

Faculty members have adequate skills to handle research methodology

59 (11.8)	113 (22.6)	328 (65.6)	0.014*
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Faculty do not have sufficient time to mentor undergraduate students in research

133 (26.6)	139 (27.8)	228 (45.6)	0.836
------------	------------	------------	-------

The degree of involvement of the faculty in the research program is good

108 (21.6)	148 (29.6)	244 (48.8)	0.338
------------	------------	------------	-------

Our college has adequate infrastructure to organize research programs

65 (13)	114 (22.8)	321 (64.2)	0.005*
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I had been exposed to basic and advanced statistical tools needed for the preparation of a research report

100 (20)	117 (23.4)	282 (56.6)	0.207
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Statement regarding Students Opinions of Faculty Involvement in Research

Faculty members place great emphasis on research

64 (12.8)	126 (25.2)	210 (62)	0.258
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Faculty members discuss their own research

182 (36.4)	162 (32.4)	156 (31.2)	0.484
------------	------------	------------	-------

interests in
class

Faculty members use research findings as a part of their teaching material	100 (20)	151 (30.2)	249 (49.8)	<.001*
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Research is important for identifying and investigating problems in a subject matter	23 (4.6)	78 (15.6)	399 (79.8)	0.060
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I am always getting the chance to discuss about the scientific/academic research in my class	168 (33.6)	166 (33.2)	166 (33.2)	0.022*
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Statement regarding Infrastructural Facilities Offered by College for Research

Our college provides good infrastructural facilities (i.e. laboratory) needed to conduct research at the undergraduate level	130 (26)	166 (33.2)	204 (40.8)	0.547
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The library facilities available in my college are sufficient for us to conduct research activities	99 (19.8)	171 (34.2)	230 (46)	0.758
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Sufficient funding is offered by the university for	125 (25)	219 (43.8)	156 (31.2)	0.674
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conducting
research at
the
undergraduat
e level

Overall, I am satisfied with the research training program offered at the undergraduat e level	95 (19)	140 (28)	265 (53)	0.056
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- 1 *Disagreement responses (1: strongly disagree, and 2: disagree) were grouped as “disagree”, and agreement
 2 responses (4: agree, and 5: strongly agree) were grouped as “agree”; while neutral responses (3: neutral) was
 3 simply presented as “neutral.”
 4 **A p-value of <0.05 was considered statistical significant
 5

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