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Effect of Integrating Research Skills in the Medical Curriculum: A Comparative Cross Sectional Study on Students' Research Practices and Their Perception at King Abdulaziz University, Jeddah

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ABSTRACT

Background: Health research plays a vital role in promoting medical students' interest in academic medical careers, and increases their postgraduate research productivity. Scientific research skills were integrated into the developed medical curriculum implemented at King Abdulaziz University (KAU) in 2006–2007 and its impact on students' research practices was not assessed till now. Objectives: This study aimed to assess the effect of integrating scientific research skills into the medical curriculum on research practices and perception among senior medical students at KAU. **Subjects and methods:** This comparative cross-sectional study was conducted at the KAU in the academic year 2014–2015. A validated questionnaire was distributed to all the sixth year medical students (n = 307) and 60% (n = 184) of them responded. Data was analysis by using the Statistical Package of Social Science. **Results:** About 51% of the students have started their own research projects and 17% have completed and published their articles, 14.7% of them got accepted manuscript for publication. Career progression (75%) was the main students' motive to conduct research and the lack of dedicated time for research was the most reported obstacle to participate in research (73.4%). Students reported that inclusion of one-month rotation dedicated for research in the internship will enhance their research activity (68.5%) and agreed that research publication will greatly improve their postgraduate acceptance chances (95.1%). **Conclusion:** A large percent of KAU senior medical students have started their research project but only small percent succeed to complete it. Providing dedicated time for conduction research, more research opportunities and devoted supervisors are recommended to further boost students' involvement in research.

Keywords: *Research skills, Medical curriculum, Publication, Perception, Integration, King Abdulaziz University*

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Introduction

Improving attitudes of undergraduate medical students towards health research will nurture greater participation, development of a more robust research infrastructure and promotion of evidence-based medicine (1). A previous study revealed that those students who engaged in research (while at the medical school) showed positive responses toward their research experiences, toward medical science, and self-reported changes in their practices (2). They added that students also contributed to the publication output of their university, reflecting better image at the organisational level which gives us an idea on the great impact that undergraduate research experience will have on medical students (2).

In addition, experience of research at medical school has been shown to promote medical student interest in academic medical careers, and increases postgraduate research productivity (3). Furthermore, early involvement in research may enhance students' critical thinking and their appreciation of the strong link between research, clinical practice and evidence-based medicine (4). Lastly a study on senior medical students of King Saud University in Saudi Arabia showed that (82.3%) of them believed that conducting research reinforces a teamwork spirit. In addition, understanding the perceptions and attitudes of students toward research can lead to improvement of research practices among future physicians (5). This means that efforts, finance and time should be appropriately invested to promote and encourage early student involvement in research (6).

A previous study was conducted at Faculty of Medicine (FOM), King Abdulaziz University (KAU) to assess the research practice and obstacles among interns graduated from the traditional medical curriculum implemented in the FOM till 2006–2007 (7). In 2007–2008, a developed integrated system-based curriculum had been implemented. Training on research skills had been spirally integrated in the first three years the developed curriculum. Adding to that, the students were encouraged to be involved in health researches supervised by the faculty members of different specialty. A research support unit has been established in the FOM to help and guide students to be involved in conducting researches. Therefore this study was conducted to assess the impact of integrating scientific research skills on students' research practices and perception.

Methods

The study was approved by the biomedical research ethics committee at the FOM, KAU. This comparative cross-sectional study was conducted using a validated, self-administered, anonymous questionnaire that has been used in a previous study (7). The questionnaire included some questions about demographic data of the participants, in addition to some questions about the participants research activity (if they ever started a research, complete it, publish it, or not, and the reason if not, what is the main motivation for them). It included also some questions about the obstacles that preventing the participants from completing their research projects or publishing research articles. Students' response was classified according to five Likert scale and was rated from strongly disagree [1] to strongly agree [5]. The reliability of the questionnaire was calculated by Cronbach's alpha and it was 0.80.

The questionnaire was distributed to all medical students at the sixth year (n = 307) at the end of the academic year 2014–2015 by the authors who were explaining the purpose of the study to the participants. The response rate was 64.89% among male students (85 out of 131) and 56.25% among female students (99 out of 176), and the overall response rate was 60% (184 out of 307). After data collection, it was analysed by using the statistical package of social

science (SPSS) program version 16 Inc. The data were examined for normality in distribution using the Kolmogrov–Smirnov test. The quantitative data was expressed as mean and standard deviation (SD). The student t-test was used to test significance for quantitative data. The qualitative data were expressed as number and percentage. The x^2-test was used to test significance for qualitative data. The x^2-test with linear trend was used for ordinal data. Significance was considered at p value less than 0.05.

Table 1: Students activity in conducting and publishing research

Students activity in conducting and publishing research	n (%)
Students who have not started a research project yet	89 (48.4)[#]
Students who have started a research project	95 (51.6)[#]
Students who had started a research project but stopped	51 (53.7)
Students who have completed a research project	44 (46.3)
Students who have submitted their research papers for publication	60 (63.2)
Students who have published a research paper:	16 (16.8)
Original paper	13
Review	1
Case report	2
Students whose research papers have been accepted for publication:	14 (14.7)
Original paper	7
Review	5
Case report	2
Students whose submitted research papers are under revision:	25 (26.3)
Original paper	16
Review	4
Case report	5
Students whose research papers have been rejected:	5 (5.3)
Original paper	3
Review	1
Case report	1

Note: Data is presented in the form of number and percentage. $p < 0.05$ is considered significant. [#]the percentage was calculated from the total number of the participants (n = 184).

Results

On studying the research activity of the participants it was found that about half of them have started their own research projects and unfortunately, about half of those who started (53.7%) stopped their projects. About 17% of the participants have completed and published their articles; about 15% of them got accepted for publication while about 26% of them still under revision at the journals (Table 1). It was observed that a large percent (about 43%) of the students who were engaged in a past research project have participated mainly in data collection while fewer percentages of them have participated in other research stages (Table 2).

Table 2: Participation of students in past and future research projects

Level of research activities	Students who started a research (n = 95)	Students who did not start a research (n = 89)	Total n = 184	*p*- value
Participation in past research projects				
Hypothesis	16 (16%)	16 (18%)	32 (17.4%)	0.49
Data collection	42 (44.2%)	38 (42.7%)	80 (43.5%)	0.48
Data analysis	21 (22.3%)	12 (13.5%)	33 (18%)	0.09
Manuscript writing/ editing	19 (20%)	12 (13.5%)	31 (16.8%)	0.16
Participation in future research projects				
Hypothesis	15 (15.79%)	18 (20.22%)	33 (17.93%)	0.265
Data collection	4 (4.21%)	13 (14.61%)	17 (9.24%)	0.01
Data analysis	12 (12.63%)	22 (24.72%)	34 (18.48%)	0.03
Manuscript writing/ editing	17 (17.89%)	23 (25.84%)	40 (21.74%)	0.12

Note: Data is presented in the form of number and percentage. The x^2-test was used to test significance. $p < 0.05$ is considered significant.

It was observed that the number of female students who started research was double that of the male students with a statistical significance ($p < 0.001$). It was also observed that only students who have GPA higher than 3 were engaged in research activities (Figures 1, 2). As for the reasons why some of the participants have stopped their researches, lack of support in manuscript writing was the most common cause, followed by unavailability of enough data. About 40% of the students did not choose any of the proposed causes (Figure 3). A large percent (about 75%) of participants who started or who did not started a research project, agreed that the most motivating factor for medical students to be engaged in research activity was career progression. A significantly higher ($p = 0.01$) percentage of the students group that had participated in research noted supervisor encouragement as a motivated factor compared to the other who did not started a research (Figure 4). On being asked on the factors that prevented the students from actively participating in research, lack of dedicated research time and lack of research methodology training were the most two common reason noted by both students who started or who did not started a research yet (Table 3).

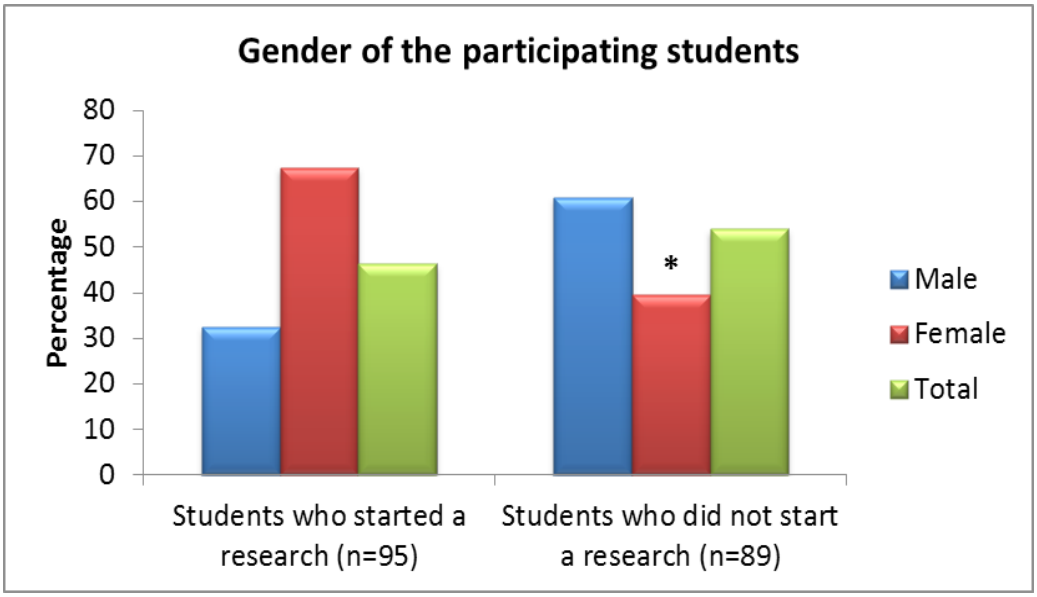

Figure 1: Gender of the participating students.

Note: The x^2-test was used to test significance. $^*p < 0.05$ is considered significant.

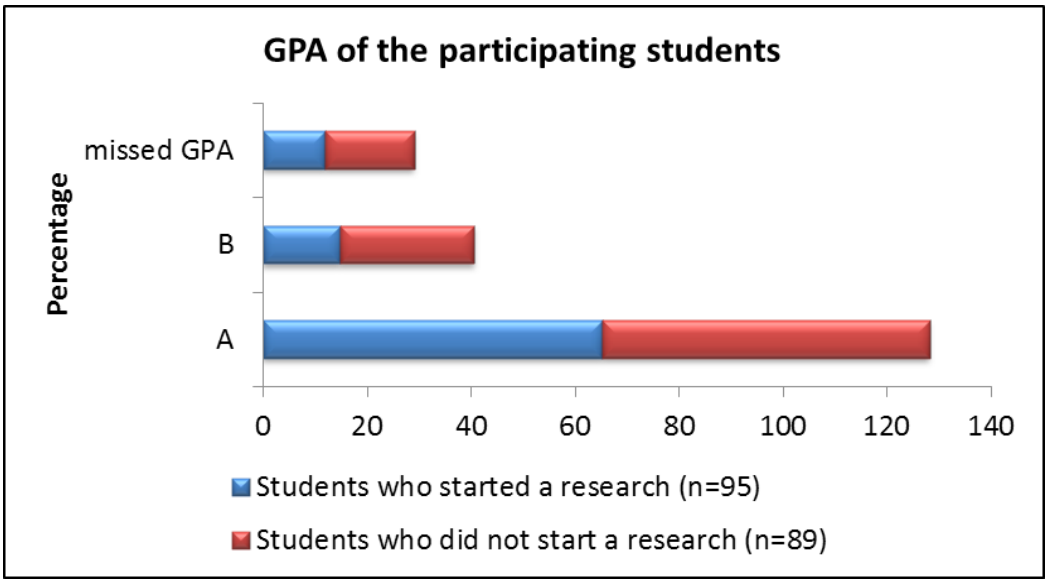

Figure 2: GPA of the participating students.

Note: The x^2-test was used to test significance. $^*p < 0.05$ is considered significant.

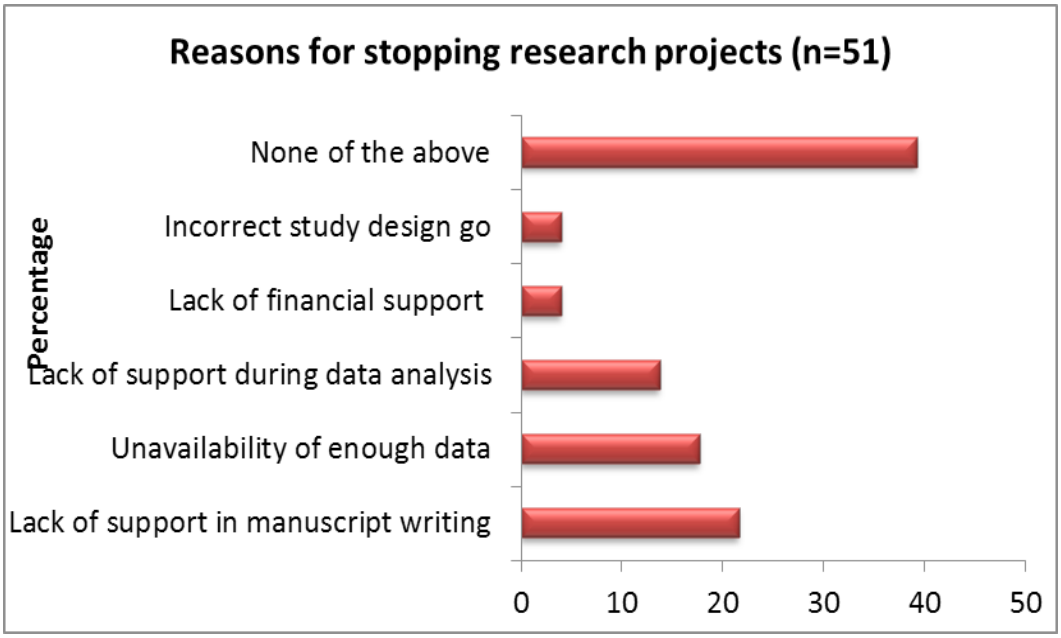

Figure 3: Reasons for stopping research projects.

Note: The x^2-test was used to test significance. $^*p < 0.05$ is considered significant.

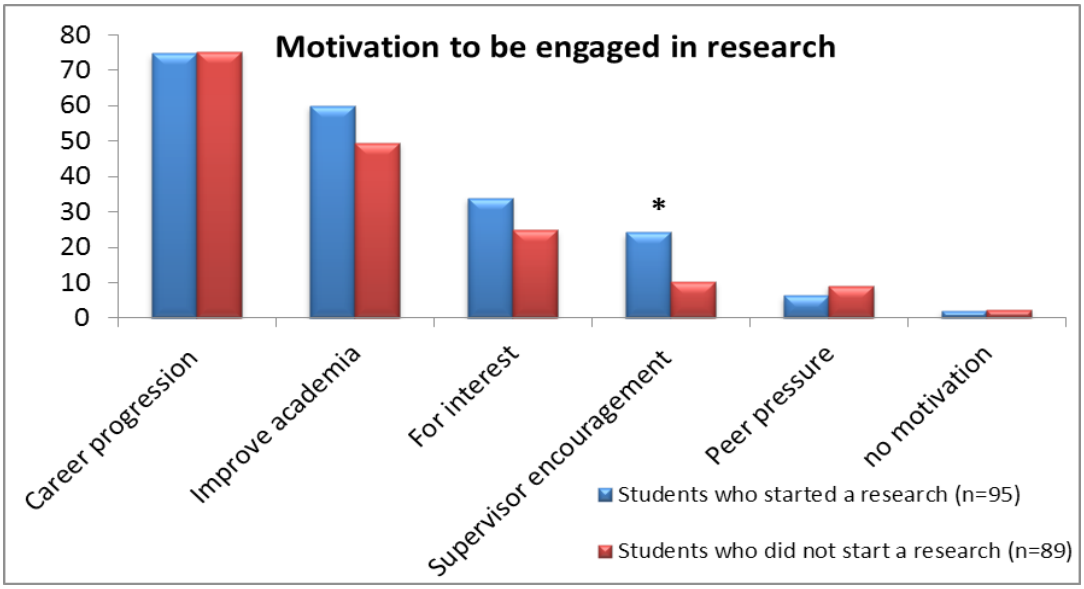

Figure 4: Motivation to be engaged in research.

Note: The x^2-test was used to test significance. $^*p < 0.05$ is considered significant.

Table 3: Students perceptions of research obstacles

Obstacles	Students who started a research (n = 95) Mean±SD	Students who did not start a research (n = 89) Mean±SD	*p*-value
Lack of research methodology training	3.77±1.05	3.79±1.02	0.39
Difficulty in writing in English	2.92±1.02	2.78±1.14	0.42
Lack of available projects to join	3.55±.99	3.73±1.01	0.24
Lack of dedicated research time	3.86±.96	3.97±0.89	0.22
Lack of financial rewards	3.03±1.08	2.97±1.05	0.63
Lack of workshops on scientific publication	3.66±1.004	3.51±1.01	0.73
KAUH does not value student participation in research versus patient care	2.96±1.15	3.43±1.12	0.01
KAUH does not allow many opportunities for creative research	3.12±1.14	3.34±1.07	0.04
Faculty members are not providing assistance	3.14±1.11	3.26±1.07	0.19
Consultants are not providing assistance	3.15±1.11	3.29±1.05	0.83
Lack of convenient data base system	3.45±1.15	3.4±.81	0.37

Note: Data is presented in the form of mean±standard deviation. The Student t-test was used to compare the quantitative data between the two groups. $p < 0.05$ is considered significant. KAUH: King Abdulaziz University Hospital

When it came to students research-related practices, it was found that the majority (about 85%) of students who did not start a research don't regularly read and appraise peer reviewed journals and the percent of this practice was significantly higher ($p = 0.02$) among students who started a research. The commonest cause behind deficiency of this practice was that the students were not encouraged to do it (Table 4). As for the impact on this survey, more than two thirds of the participants believed that this survey would make them start looking for opportunities to perform more researches (Table 4).

When asked on the students satisfaction regarding their research practices, it was observed that the satisfaction was significantly higher ($p = 0.001$) among the students who started a research and they feel more confident (with significance $p = 0.03$) to start their own research than those who did not start a research yet (Figure 5). Despite of that, about 65% and 75% of them thought that these opportunities can be motivating for them to start in research activity (Table 5). Lastly, when asked on the measures to enhance the research activity of students in the future, more than two third of all participating students agreed that including rotation devoted to high-quality research and methodology into the internship program as well as course or module devoted to research during the undergraduate medical school years would be very effective to enhance the scientific research practice among the students. About 60% of them considered including publication as prerequisite for graduation if assistance is provided as a motivating factor to enhance students research activity (Table 6).

Table 4: Students perception of research-related practices

Practice	Response and reason	Students who started a research (n = 95)	Students who did not start a research (n = 89)	Total n = 184	*p*-value
Do you regularly read and appraise articles in peer reviewed journals?	Yes	28 (29.47%)	14 (15.73%)	42 (22.83%)	0.02
	Interest	15 (15.79%)	10 (11.24%)	25 (13.59%)	
	Improve knowledge	13 (13.68%)	4 (4.49%)	17 (9.24%)	
	To critique article	1 (1.05%)	2 (2.25%)	3 (1.63%)	
	No	67 (70.53%)	75 (84.27%)	142 (77.17%)	
	Too difficult to understand	9 (9.47%)	8 (8.99%)	17 (9.24%)	
	Not interested	19 (20%)	19 (21.35%)	38 (20.65%)	
	Wasn't encouraged to do so	31 (32.63%)	37 (41.57%)	68(36.9%)	
	Not a good place to gain knowledge	4 (4.21%)	3 (3.37%)	7 (3.8%)	
Do you have a valid research question appropriate for study conduction? Yes		67 (63.2%)	70 (57.3%)	137(74.46%)	0.254
Would you feel confident to submit an article without supervision? Yes		8 (8.42%)	17 (19.10%)	25 (13.59%)	0.03
Did you attend any research workshop during your study years? Yes		53 (55.79%)	32 (35.96%)	85 (64.2%)	0.01
Are you pursuing a postgraduate residency/study abroad? Yes		57 (60%)	58 (65.17%)	115 (62.5%)	0.284
Do you believe that publication will improve your acceptance chances? Yes		92 (96.84%)	83 (93.26%)	175 (95.11%)	0.217
Are you pursuing a career in research? Yes		40 (42.11%)	39 (43.82%)	79 (42.93%)	0.126
Has this survey made you think you should start seeking out opportunities to perform research? Yes		67 (70.53%)	70 (78.65%)	137 (74.46%)	0.137

Note: Data is presented in the form of number and percentage. The x^2-test was used to test significance. $p < 0.05$ is considered significant.

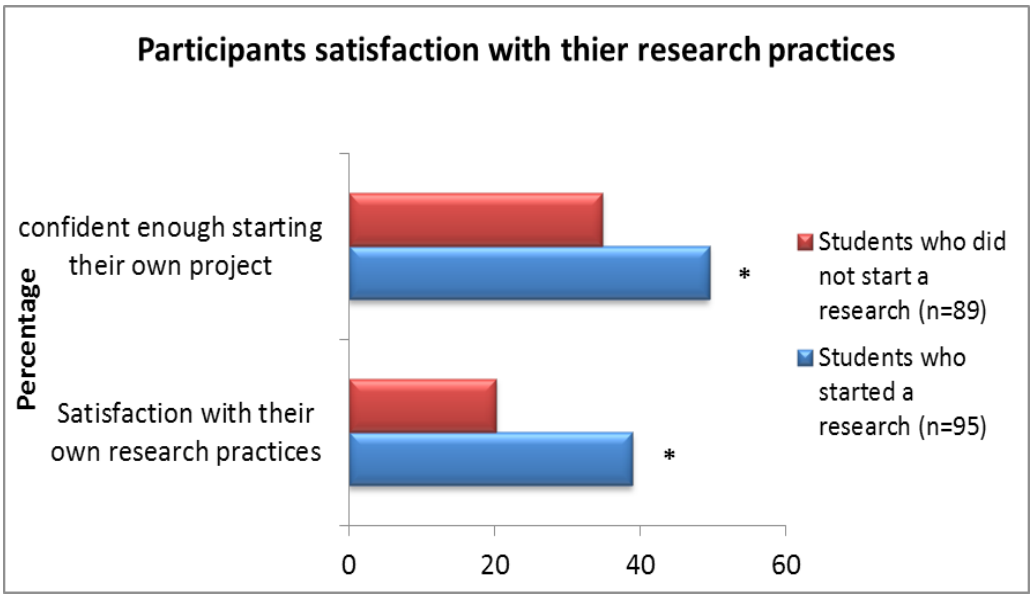

Figure 5: Participants satisfaction with their research practices.

Note: The x^2-test was used to test significance. $^*p < 0.05$ is considered significant.

Table 5: Students perception of research opportunities provided by the institute

	Students who started a research (n = 95)	Students who did not start a research (n = 89)	Total n = 184	*p*-value
Do you know about research groups? Yes	13 (13.68%)	3 (3.37%)	16 (8.7%)	0.01
Do you know that research centers and scientific chairs provide research opportunities for the students? Yes	30 (31.58%)	15 (16.85%)	45 (24.46%)	
Do you think the research centers and research groups can be motivating to your research activity? Yes	61 (64.21%)	66 (74.16%)	127 (69.02%)	0.09
Have you ever participated with research centers and research groups? Yes	26 (27.37%)	19 (21.35%)	45 (24.46%)	0.22
In what stage? Data collection	20 (21.05%)	13 (14.61%)	33 (17.93%)	0.84
Data analysis	2 (2.11%)	3 (3.37%)	5 (2.72%)	0.12
Manuscript writing	4 (4.22%)	5 (5.62%)	9 (4.89%)	0.21

Note: Data is presented in the form of number and percentage. The x^2-test was used to test significance. $p < 0.05$ is considered significant.

Table 6: Students perception of measures to enhance research activities

	Students who started a research (n = 95)	Students who did not start a research (n = 89)	*p*-value
Include 1 month rotation devoted to high-quality research and methodology into the internship program	3.48±1.31	3.51±1.10	0.85
Include 2–3 months course devoted to research, methodology and publication training during the undergraduate medical school years	3.86±1.9	3.81±1.07	0.74
Include publication as prerequisite for graduation if assistance is provided	3.78±1.19	3.61±1.14	0.31
Complete a research rotation abroad	3.53±1.06	3.49±0.91	0.73
Teaching how to write a paper	3.53±1.06	3.49±0.91	0.36
Teaching how to write abstract	3.86±0.82	3.67±.97	0.55
Teaching publishing practices	3.61±0.92	3.60±.97	0.97
Pursuing a postgraduate residency/ study abroad	3.05±1.14	3.31±0.97	0.09

Note: Data is presented in the form of mean±standard deviation. The Student t-test was used to compare the quantitative data between the two groups. $p < 0.05$ is considered significant.

Discussion

This study aimed to assess the impact of integrating research skills into the medical curriculum on research practices and publication obstacles of the six year medical student. These research practices were compared to those of the interns graduated from the traditional curriculum and was reported in 2011–2012 in order to highlight the effect of curricular changes as well as the other extracurricular activities encouraging the scientific research conduction.

One of the main finding in this study was the marked increase in the research practice among the six year medical students as about half of them have started their own researches and about 17% of them successfully published their researches versus 31% of interns started their researches in 2011–2012 and only 3.2% of them had their research papers published (7). This increased research practice could be attributed to curricular changes included integration of scientific research teaching and training through the first three years of the medical curriculum. Increased participation of students in research-related workshops that was observed in this study (64% in 2015–2016 versus 35.7% in 2011–2012) could be also a reason for increasing students' participation in research activities. These research practices were considered high when compared with other international medical schools as only 14% of medical students at British medical school had submitted an article for publication (8). Only 16% of medical students in Kasturba Medical College from Coastal South India had made an attempt to publish and only four students had succeeded to publish in indexed peer reviewed journals (9). In Auckland, New Zealand, 25% of the medical students have been involved in research activities with no significant difference between male and female students (10). This was different from our study where the number of female students who had started their own researches was significantly higher than the male students. However this was consistent with the study conduct on students of Taibah college of Medicine in Saudi Arabia and showed a

higher research practice among female students (11).

Although the percent of students who completed their research increased in 2015–2016 compared to 2011–2012 (about 46.3% versus 24% respectively), unfortunately the percent of students who started their own researches and did not complete them also increased in 2015–2016 (about 53.7% versus 12%) (7). The main reasons behind this finding as reported by the participants in this study were the lack of dedicated time for research conduction, lack of workshops of scientific publishing process and lack of convenient data base system with no significant difference between the students who started or those who did not start their research projects. Lack of dedicated research time was a main barrier to conduct research not only at the KAU but it was also of great significance at Nottingham Medical School, University College Cork and University Sains Malaysia and Kasturba Medical College (1, 9, 12). On the other hand, students who did not started their research reported another two research obstacles; the King Abdulaziz University Hospital (KAUH) does not value students participation in research and does not allow sufficient opportunities for creative research and rated them significantly higher than those who started their research. This means further intervention is still needed to deal with these research obstacles like providing slots in the curriculum for conduction research, conducting workshops on principals' of scientific writing and scientific publication for students, valuing and rewarding students participating in creative research. In this the students' perceptions regarding the measures to enhance their research activities were not significantly different between the students who started in a research project or those who did not start yet. Large percentage of students in this study as well as that of 2011–2012 considered including publication as prerequisite for graduation as a motivating factor to enhance students research activity (about 63% in 2011–2012 and 60% in 2015–2016). In Pennsylvania State University College of medicine, as well as in other countries, a greater percentage of graduates had participated in research during the medical school as the research projects is curriculum requirement for students who did not do medical research prior to entering medical school (13–15).

Considering for the motivating factors for conducting research revealed in this study, career progression (75%) and academic improvement (53%) were the two most common driving forces for research practice among the participants. This is congruent with what was previously reported in FOM, KAU at 2011–2012 as well as at British medical school where 51% of the students got involved with research for career progression and the study conducted in both University College Cork and University Sains Malaysia (7, 8, 12). On interesting finding is that students who started their research project rated supervisor encouragement as motivating factor for research conduction significantly higher than those who did not started research project and this highlights the important role of supervisors in fostering the undergraduate research. Surprisingly, the students who did not start in a research project were feeling confident to submit an article without supervision than those who started in a research project. This is because they did not go through the process of conducting a research under supervision.

It was observed that the percent of students had participated mainly in data collection and data analysis of a past research project has been reduced in this study compared to that of 2011–2012 (7). The reason behind this might be increased students interest to participate in the entire process of a research and not just in data collection as they were exposed to the stages of research conduction and the principals of scientific research writing during their study. Although the practice of reading and appraising articles in peer reviewed journals has been increased among students in this study (18.5% in 2011–2012 versus 22.83% in 2015–2016), both percentage still small and more effort

must be done to encouraging this practice among the students (7). Worldwide, reading and appraising journal articles by medical students were encouraged. In the British medical school, 87% of the students read journal articles for interest or to improve their knowledge (8). As expected, in this study, the students who started in a research project were regularly reading and appraise articles in peer reviewed journals attending research workshop during their study years than those who did not start yet.

Surprisingly the level of students satisfaction with their research practices were similar in 2011–2012 and 2015–2016 but the confidence of students to start their own research has been markedly increase in this study (27% in 2011–2012 versus 42.93% in 2015–2016), this might be attributed to increased students research skills after integrating them in the developed curriculum. In this study and as it was expected the students who started a research project were significantly more satisfied about their research practices and more confident to start their own research project than those who did not start yet in a research project.

Conclusion

This study highlights that large number of FOM students have research activity and publications in addition to their positive attitude towards research practice and their willingness to participate in future projects. More opportunities to students participation by research centres and an increased number of faculty members who are dedicated to help and guide students is needed, alongside with incorporation of the principles of scientific writing and designing of data collection tools into the curriculum. Inclusion of one month rotation devoted to high quality research into internship program and inclusion of research project as prerequisite for graduation will greatly enhance the students' research activity.

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