

Original Article

Understanding the value, perceptions, and challenges of research among pharmacy undergraduates in Jamshoro, Sindh

Unzila Faheem *, Laveesha Kewlani, Noor Bibi

Faculty of Pharmacy, University of Sindh, Jamshoro, Pakistan

* Correspondence: unzila faheem1105@gmail.com



Citation: Faheem U, Kewlani L, Bibi N. Understanding the value, perceptions, and challenges of research among pharmacy undergraduates in Jamshoro, Sindh. Bull Pharm Med Res. 2023;2:1-8.

Received: 08 August 2023

Revised: 16 October 2023

Accepted: 21 October 2023

Published: 18 November 2023

Publisher's Note: Logixs Journals remains neutral concerning jurisdictional claims in its published subject matter, including maps and institutional affiliations.



Copyright: © 2023 The Author(s). This is an open access article distributed under the terms of the [Creative Commons Attribution \(CC BY\) License](https://creativecommons.org/licenses/by/4.0/). The use, distribution, or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Abstract

Pharmacy education is evolving worldwide to meet the changing role of pharmacists in providing pharmaceutical care services. Engagement in undergraduate research helps students develop analytical and critical thinking skills that are crucial for their future careers. It is essential to equip pharmacy students with the necessary knowledge, skills, and motivation to engage in research and apply innovative findings to clinical practice. Therefore, this study was conducted to determine the value of research among undergraduate pharmacy students and to understand their perceptions of its importance and challenges. The study was conducted over three months and involved 384 students from two different public sector universities in Jamshoro, Sindh. A convenient sampling technique was used, and data were collected from fourth- and final-year students at the targeted universities. The results of the study revealed that 53.39% of the participants were male and 46.61% were female. A total of 78.65% were between the ages of 21 and 23 years, with 54.69% from urban areas and 39.06% from rural areas. Of the 384 students, 96% considered research valuable, while 85% disagreed with the notion that research is theoretical and has no benefit for the common person. Moreover, 67% of the students considered publishing in a peer-reviewed journal to be a good source of recognition. Regarding the benefits of research, 41% of students strongly agreed that it boosts their professional profile, while 37% strongly agreed that it helps in a pharmacy career. This study revealed that undergraduate students generally possess a good level of knowledge and understanding of research and recognize its future advantages. Moreover, many students expressed a strong interest in participating in undergraduate research projects, although they also identified challenges such as the need for supervision and resources. These findings suggest that there is potential for increased research engagement among students if the research environment is enhanced. Therefore, there is a need for academicians and policymakers to consider ways to support and improve the research opportunities and infrastructure for undergraduate students in universities.

Keywords

Pharmacy education; Student perceptions, Research importance; Undergraduate research

1. Introduction

COVID-19 has proven to be a revolution worldwide and has resulted in the origination of much research focused not only on microbes but also on multiple related social issues. It has also changed human thinking patterns. This surge in research has generated new knowledge, enhancing overall patient care and advancing healthcare sciences. The Doctor of Pharmacy (Pharm.D.) are professional doctorates that traditionally prepare pharmacists for dispensing and compounding [1,2]. However, the role of pharmacists has shifted to providing pharmaceutical care services over the years [3]. Similarly,

to meet advancements in the role trajectory of pharmacists, pharmacy education is evolving worldwide [4].

Research is a vital indicator of the scientific development and growth of a country [5,6]. Undergraduate research (UR) involves research conducted by undergraduate students, resulting in an original contribution to their discipline [7]. The benefits of research extend beyond building a successful career; gaining research experience also equips students with analytical and critical thinking skills, which are beneficial life skills [8,9]. Research experience has also been shown to improve decision-making skills among alumni [10]. Considering the benefits of undergraduate research, it is imperative to adequately equip pharmacy students and graduates with the necessary knowledge, skills, and motivation to engage in research and effectively apply the obtained results to clinical practice [7,11,12].

In Australia, fourth-year pharmacy students at The University of Sydney have the option to pursue honor research as part of their Bachelor of Pharmacy degree [13]. An Indian study conducted in 2022 revealed that the concept of 'students as partners' is an emerging trend in the Indian pharmacy system, encouraging undergraduate pharmacy students to participate in research projects as part of their curriculum, collaborating with faculty members as coresearchers [14]. A Pakistani study conducted in 2020 emphasized the importance of research for healthcare students [6]. However, another Pakistani study conducted in Karachi on pharmacy, medical, and dental students highlighted the lack of interest in research among students for reasons such as curriculum overload, difficulty finding a mentor, and lack of exposure [9].

Despite research courses and projects being integrated into pharmacy schools worldwide, there is a shortage of research opportunities for undergraduate pharmacy students in Jamshoro [15,16]. Research is a crucial component of undergraduate healthcare education because it helps develop a scientific mindset and promotes evidence-based practice. It equips students with the skills to analyze medical literature critically and make informed clinical decisions, adapting to the ever-changing landscape of healthcare. Moreover, undergraduate research fosters innovation and drives advancements in medical knowledge and technology, ultimately leading to better patient care outcomes. By engaging in research, undergraduates gain a deeper understanding of the complexities of healthcare, ethical considerations, and societal impacts, preparing them to tackle real-world health challenges with competence and compassion.

The primary objectives of this research study are to provide an overview of undergraduate pharmacy students' perceptions and understanding of research in Jamshoro, Sindh, Pakistan, and to assess the importance these students place on undergraduate research. Moreover, this study aimed to identify the perceived challenges and benefits of engaging in research among these students. The findings will help inform academicians and policymakers on how to enhance the research environment for undergraduate students in universities.

2. Material and methods

2.1. Study design

This descriptive cross-sectional study was conducted over a period of three months, from July to September 2023.

2.2. Ethical approval

This study adhered to international ethical guidelines for research involving humans and obtained ethical clearance from the Institutional Bioethics Committee (IBC) of the University of Sindh, Jamshoro, Pakistan (No. ORIC/SU/1645) [17].

2.3. Study setting

This research was conducted at two major public universities in Jamshoro, the University of Sindh and Liaquat University of Medical and Health Sciences (LUMHS). The University of Sindh is the oldest university in the country, with seven campuses, 60 teaching departments offering degrees in 121 disciplines, and 74 affiliated colleges, while LUMHS is the first public-sector medical university in Pakistan [18,19,20,21,22].

2.4. Participant recruitment

The study recruited fourth- and final-year undergraduate pharmacy students, excluding those in foreign quota seats or those unwilling to participate.

2.5. Sampling method

A convenient sampling technique was used to collect the data.

2.6. Sample size

The sample size was determined using the sample size calculator provided by the World Health Organization (WHO), considering a 5% margin of error and a 95% confidence interval. Based on the student populations at the two institutions, the initial sample size was calculated to be 354, which was further increased to 384 to ensure a safe margin.

2.7. Study measures

The questionnaire, validated by experts, consisted of three sections: sociodemographics, students' perceptions of research, and students' understanding of the importance of research. The perception and understanding sections were adapted from a previous study with some modifications [11]. A pretest was conducted on six students to assess the questionnaire's difficulty level and comprehension.

In the sociodemographic section, information was gathered on gender, university name, age, professional year (4th year, 5th year), and area of residence (urban, rural, semiurban, or semirural). Students' opinions about research were collected using a 25-item questionnaire with responses on a three-point scale ('yes', 'no', 'maybe'). Students' understanding of the importance of research was assessed using a 15-item Likert scale questionnaire with responses ranging from 'strongly agree' to 'strongly disagree.'

2.8. Data collection

The sample size was determined using the sample size calculator provided by the World Health Organization (WHO), considering a 5% margin of error and a 95% confidence interval. Based on the student populations at the two institutions, the initial sample size was calculated to be 354, which was further increased to 384 to ensure a safe margin.

2.9. Statistical analysis

The data were analyzed using SPSS v25.00 (IBM Corp., Armonk, NY, USA) to calculate frequencies and percentages.

3. Results

Table 1 shows that the University of Sindh accounted for the major proportion of respondents (82.29%), with the remaining (17.71%) representing students from LUMHS. More than half of the respondents were male (53.39%), while 46.61% were female. The majority of students were within the 21–23 years age bracket (78.65%). A greater propor-

tion of students resided in urban areas (54.69%) and rural areas (39.06%), while a smaller proportion lived in semiurban (4.69%) and semirural (1.56%) areas.

Table 1. Demographic and academic attributes of undergraduate pharmacy students (N = 384).

Characteristics	Frequency (%)
Age	18 – 20 years
	25 (6.51)
	21 – 23 years
Gender	302 (78.65)
	24 – 26 years
	57 (14.84)
Institution	Male
	205 (53.39)
Professional year	Female
	179 (46.61)
Residential area	University of Sindh
	316 (82.29)
Residential area	LUMHS
	68 (17.71)
Residential area	4 th year
	273 (71.09)
Residential area	5 th year
	111 (28.91)
Residential area	Urban
	210 (54.69)
Residential area	Rural
	150 (39.06)
Residential area	Semiurban
	18 (4.69)
Residential area	Semirural
	6 (1.56)

Table 2 delineates the perceptions of undergraduate pharmacy students regarding research. Most students (96.09%) perceived research as valuable, while a significant proportion (71.35%) believed that research could only be conducted in a laboratory. Moreover, 61.98% of the students did not perceive undergraduate research as a burden, with 11.72% viewing it negatively and 26.30% expressing uncertainty. Most respondents stated that research contributes to existing knowledge and information (85.16%) and helps in policy development (74.74%). However, 83.07% disagreed that research is useless due to the advancement of artificial intelligence. Furthermore, 84.90% disagreed that the research is only theoretical and has no practical benefit.

Table 2. Undergraduate research: overall perceptions of pharmacy students (N = 384).

Variables	Yes (%)	No (%)	Maybe (%)
Research is valuable in the field of pharmacy	369 (96.09)	10 (2.60)	5 (1.30)
Undergraduate research is a burden on students	45 (11.72)	238 (61.98)	101 (26.30)
Research is only conducted by postgraduate students	83 (21.61)	239 (62.24)	62 (16.15)
Conducting research requires a lot of money	150 (39.06)	106 (27.60)	128 (33.33)
Conducting research requires a laboratory	274 (71.35)	39 (10.16)	71 (18.49)
Conducting research requires a supervisor	299 (77.86)	23 (5.99)	62 (16.15)
Research cannot be conducted without a university	147 (38.28)	140 (36.46)	97 (25.26)
Research is useless due to advancements in Artificial Intelligence	38 (9.90)	319 (83.07)	27 (7.03)
No need for research because Google has all the information	44 (11.46)	303 (78.91)	37 (9.64)
Public organizations usually conduct research	105 (27.34)	177 (46.09)	102 (26.56)
Research in pharmacy is saturated	152 (39.58)	150 (39.06)	82 (21.35)
Research was completed ages ago by well-known scientists	129 (33.59)	204 (53.13)	51 (13.28)
Research can only be performed by males	8 (2.08)	370 (96.35)	6 (1.56)
Research is useless because it is only theoretical and has no practical benefit	26 (6.77)	326 (84.90)	32 (8.33)
Research cannot be performed in rural/semirural areas	67 (17.45)	252 (65.63)	65 (16.93)
Research contributes to existing knowledge and information	327 (85.16)	39 (10.16)	18 (4.69)
Research contributes to policymaking	287 (74.74)	37 (9.64)	60 (15.63)
Research papers can only be published by postgraduate students	118 (30.73)	199 (51.82)	67 (17.45)
Publishing undergraduate research in a journal is a good source of recognition	261 (67.97)	38 (9.90)	85 (22.14)

Table 2 further shows that the majority considered publishing in a peer-reviewed journal to be a good source of recognition (67.97%) and disagreed that research can only be conducted by postgraduate students (62.24%) or that research cannot be performed in rural settings (65.63%). Approximately one-quarter of the students were uncertain about whether undergraduate research is a burden (26.30%), whether research cannot be conducted without a university (25.26%), and whether only public sector organizations conduct research (26.56%).

Table 3 illustrates the students' understanding of the importance of research. Most participants strongly agreed that research boosts their professional profile (40.89%), helps in their pharmacy career (36.98%), aids in job promotions (33.85%), increases their personal impact factor (30.99%), assists in securing international scholarships (33.07%), and helps in obtaining admissions for higher studies (31.25%). Additionally, a majority of participants agreed that they precisely understood the meaning of research (65.89%) and were well aware of research operations (48.18%). Research was perceived as beneficial for their pharmacy career (55.73%), securing admissions for higher studies (55.47%), obtaining international scholarships (53.65%), job promotions (52.86%), and boosting their professional profile (51.04%). However, fewer than half of the participants disagreed with having participated in any research project without university support (44.79%). A significant portion of students had not taken part in research projects with university support (30.73%) or had received assignments related to research (27.34%).

Table 3. Students' understanding of the importance of research (N = 384).

Variables	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Agree (%)
I understand precisely what research means	83 (21.61)	253 (65.89)	44 (11.46)	3 (0.78)	1 (0.26)
I am well aware of research operations	50 (13.02)	185 (48.18)	110 (28.65)	38 (9.9)	1 (0.26)
I know the types of research	34 (8.85)	165 (42.97)	115 (29.95)	63 (16.41)	7 (1.82)
I have participated in research without university support	19 (4.95)	83 (21.61)	75 (19.53)	172 (44.79)	35 (9.11)
My faculty has discussed the importance of research	58 (15.1)	167 (43.49)	60 (15.63)	68 (17.71)	31 (8.07)
I have received assignments related to research	42 (10.94)	135 (35.16)	74 (19.27)	105 (27.34)	28 (7.29)
I have participated in research with university support	33 (8.59)	129 (33.59)	61 (15.89)	118 (30.73)	43 (11.2)
I am confident in my scientific writing skills	32 (8.33)	163 (42.45)	126 (32.81)	48 (12.5)	15 (3.91)
Research can help in my pharmacy career	142 (36.98)	214 (55.73)	22 (5.73)	3 (0.78)	3 (0.78)
Research helps increase my personal impact factor	119 (30.99)	230 (59.9)	30 (7.81)	3 (0.78)	2 (0.52)
Research helps me get admission to higher studies	120 (31.25)	213 (55.47)	41 (10.68)	8 (2.08)	2 (0.52)
Research helps me achieve an international scholarship	127 (33.07)	206 (53.65)	38 (9.9)	11 (2.86)	2 (0.52)
Research will help me obtain a local scholarship	82 (21.35)	192 (50)	81 (21.09)	23 (5.99)	6 (1.56)
Research experience will boost my professional profile	157 (40.89)	196 (51.04)	20 (5.21)	8 (2.08)	3 (0.78)
Research helps me get job promotions	130 (33.85)	203 (52.86)	39 (10.16)	10 (2.6)	2 (0.52)

4. Discussion

This study revealed several key findings regarding the perceptions and understanding of research among undergraduate pharmacy students in Sindh. The majority of students considered research valuable and believed it contributes significantly to existing knowledge and policy development. A considerable number of students also recognized the professional benefits of research, such as enhancing their career prospects, aiding in job promotions, and securing scholarships.

The results of the current study align with findings from a randomized controlled trial on undergraduate students, which indicated that students involved in research courses had a better understanding of research and performed well in such courses [23].

Similarly, a study in China revealed that research training helped students develop multiple research competencies and perform better in research-based courses than in theoretical courses [24]. Additional studies have shown that teaching research-based courses significantly impacts students' understanding, skill development, and performance [25,26,27].

In contrast, some studies have reported different outcomes. For instance, a study on undergraduate medical students in Jordan revealed that while students had positive attitudes toward research, their knowledge and understanding were limited, although they increased with increasing professional years [28]. A study on undergraduate engineering students suggested that while research programs are effective teaching tools, they may not be compelling enough to influence students' career choices or pursuit of higher education [29]. Another study in the United States assessing the impact of undergraduate research programs on diverse groups showed that students gained research-related knowledge and skills, but the impact varied significantly across different groups, including gender differences [30].

Challenges in undergraduate research programs include a lack of student knowledge, preparedness, and faculty resources, as well as the need for tailored mentoring approaches for underrepresented students [31]. Despite these challenges, undergraduate research holds great potential for teaching valuable skills beyond the academic environment. Effective research programs should complement university education throughout the entire course of study, emphasizing rigor, academic integrity, and responsible research conduct [32]. Addressing the gaps in research models used across various disciplines is essential for improving student comprehension and research capabilities [33].

This study provides baseline information on undergraduate students' research orientation by targeting two major public sector universities in Sindh, opening the horizon for further exploration in regional contexts. The findings serve as a basis for policymakers, educators, and academicians to consider integrating research courses at the undergraduate level. The strengths of this study include its focus on senior undergraduate students and its potential implications for educational policy. However, limitations include the exclusion of comparisons among different student groups and the lack of qualitative analysis.

5. Conclusions

This study revealed that undergraduate pharmacy students generally possess a good level of knowledge and understanding of research and are well aware of its future benefits. Moreover, many students expressed a strong interest in participating in undergraduate research projects, although they also identified challenges such as the need for supervision and resources. These findings suggest a significant potential for increased research engagement among students if the research environment is enhanced. Therefore, there is a crucial need for academicians and policymakers to consider ways to support and improve research opportunities and infrastructure for undergraduate students in universities. By doing so, they can ensure that students are better equipped with the necessary skills and motivation to engage in research and apply innovative findings to clinical practice, ultimately contributing to the advancement of pharmacy education and healthcare services.

Author contributions: Conceptualization, UF; methodology, UF, LK, and NB; software, UF, LK, and NB; validation, UF, LK, and NB; formal analysis, LK; investigation, UF, LK, and NB; resources, UF, LK, and NB; data curation, UF, LK, and NB; writing—original draft preparation, LK, and NB; writing—review and editing, UF; visualization, UF, LK, and NB; supervision, UF; project admin-

istration, UF, LK, and NB. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no specific grant from the public, commercial, or not-for-profit funding agencies.

Ethics statement: This study obtained ethical clearance from the Institutional Bioethics Committee (IBC) of the University of Sindh, Jamshoro, Pakistan (No. ORIC/SU/1645).

Consent to participate: Written informed consent was obtained from all participants prior to data collection.

Data availability: The data supporting this study's findings are available from the corresponding author, Unzila, upon reasonable request.

Acknowledgments: None.

Conflicts of interest: The authors declare no conflicts of interest.

References

- [1] Mohammed SI, Hussain AH, Hussain HA. The PharmD students' beliefs, perceptions, and challenges regarding their first year in the PharmD program: a qualitative study. *Al-Rafidain J Med Sci.* 2023;4:102-08. <http://doi.org/10.54133/ajms.v4i.124>
- [2] Sule A. European perspectives of hospital pharmacy - changing roles and workforce challenges. *Arch Pharm.* 2022;72(Suppl 4):S155.
- [3] Azhar S, Hassali MA, Ibrahim MIM, Ahmad M, Masood I, Shafie AA. The role of pharmacists in developing countries: the current scenario in Pakistan. *Hum Resour Health.* 2009;7:54. <http://doi.org/10.1186/1478-4491-7-54>
- [4] Law M, Bader L, Uzman N, Williams A, Bates I. The FIP Nanjing statements: shaping global pharmacy and pharmaceutical sciences education. *Res Social Adm Pharm.* 2019;15(12):1472-75. <https://doi.org/10.1016/j.sapharm.2019.03.013>
- [5] Vujaklija A, Hren D, Sambunjak D, Vodopivec I, Ivaniš A, Marušić A, et al. Can teaching research methodology influence students' attitude toward science? cohort study and nonrandomized trial in a single medical school. *J Investig Med.* 2010;58(2):282-6. <https://doi.org/10.2310/JIM.0b013e3181cb42d9>
- [6] Liaquat A, Tayyab TF, Saeed T, Azeem M, Naheed A, Riaz N, et al. Interest in research among the undergraduate students of medical and dental colleges of Pakistan. *Professional Medical J.* 2020;27(9):1942-46. <http://doi.org/10.29309/tpmj/2020.27.09.4530>
- [7] Huang Q, Yue Z, Lin J, Zhang Y, Yuan S, Zhuang Q, et al. The effect and influence of undergraduate research on medical undergraduates in China. *Biochem Mol Biol Educ.* 2019;47(1):41-50. <http://doi.org/10.1002/bmb.21194>
- [8] Lee MW, Clay PG, Kennedy WK, Kennedy MJ, Sifontis NM, Simonson D, et al. The essential research curriculum for doctor of pharmacy degree programs. *Pharmacotherapy.* 2010;30(9):966. <http://doi.org/10.1592/phco.30.9.966>
- [9] Bilal M, Haseeb A, Mari A, Ahmed S, Sher Khan MA, Saad M. Knowledge, attitudes, and barriers toward research among medical students of Karachi. *Cureus.* 2019;11(9):e5599. <http://doi.org/10.7759/cureus.5599>
- [10] Ascione FJ. Research requirement for pharmD students. *Am J Pharm Educ.* 2007;71(6):115. <http://doi.org/10.5688/aj7106115>
- [11] Mukhalalati B, Elshami S, Adlan O, Elshazly M, Awaisu A, Stewart D, et al. Perceptions and experiences of undergraduate pharmacy students and alumni toward research after exposure to undergraduate research courses. *Front Med (Lausanne).* 2022;9:988908. <http://doi.org/10.3389/fmed.2022.988908>
- [12] Nouri AI, Hassali MA, Hashmi FK. Contribution of pharmacy education to pharmaceutical research and development: critical insights from educators. *Perspect Public Health.* 2020;140(1):62-6. <https://doi.org/10.1177/1757913919832927>
- [13] Gnjdjic D, da Costa N, Wheate NJ. Potential factors that can affect the performance of undergraduate pharmacy research students: a descriptive study. *BMC Med Educ.* 2023;23:32. <http://doi.org/10.1186/s12909-023-04018-5>
- [14] Rajiah K, Maharajan MK, Maricar FMAB. Students as partners: how the student-centred active learning concept may help Indian pharmacy education. *Indian J Pharm Educ Res.* 2022;56(Suppl 4):620-26. <https://doi.org/10.5530/ijper.56.4s.209>
- [15] Surratt CK, Drennen JK, Douglas BJ. The "research track" concentration, a new pharmD elective option. *Am J Pharm Educ.* 2005;69(5):90. <http://doi.org/10.5688/aj690590>
- [16] Cailor SM, Chen AMH, Kiersma ME, Keib CN. The impact of a research course on pharmacy students' perceptions of research and evidence-based practice. *Curr Pharm Teach Learn.* 2017;9(1):28-36. <http://doi.org/10.1016/j.cptl.2016.08.031>
- [17] World Health Organization. International ethical guidelines for health-related research involving humans. 2023 [cited 09 June 2023]. Available from: <https://cioms.ch/wp-content/uploads/2017/01/WEB-CIOMS-EthicalGuidelines.pdf>.
- [18] University of Sindh. Prospectus. 2023 [cited 09 June 2023]. [https://admission.usindh.edu.pk/admission/assets/Prospectus_2023_\(13-01-2023\).pdf](https://admission.usindh.edu.pk/admission/assets/Prospectus_2023_(13-01-2023).pdf).
- [19] University of Sindh. 2023. [cited 09 June 2023]. Available from: <https://usindh.edu.pk/page/59>
- [20] Liaquat University of Medical & Health Sciences. 2023 [cited 09 June 2023]. Available from: <https://www.lumhs.edu.pk/admissions/ug/Prospectus2022-23.pdf>.
- [21] Health Department. Government of Sindh. 2023 [cited 09 June 2023]. Available from: https://www.lumhs.edu.pk/admissions/mbbs-bds/Prospectus%20MBBS%20&%20BDS%202022-23_11222.pdf.

-
- [22] Liaquat University of Medical & Health Sciences. 2023 [cited 09 June 2023]. Available from: <https://www.lumhs.edu.pk/home/>.
- [23] Ing M, Burnette III JM, Azzam T, Wessler SR. Participation in a course-based undergraduate research experience results in higher grades in the companion lecture course. *Educ Res*. 2021;50(4):205-14. <https://doi.org/10.3102/0013189X20968097>
- [24] Gao L, Guo M. A course-based undergraduate research experience for bioinformatics education in undergraduate students. *Biochem Mol Educ*. 2023;51(2):189-99. <https://doi.org/10.1002/bmb.21710>
- [25] Bopegedera AMRP. Student-driven, curriculum-embedded undergraduate research experiences (SD-CUREs) in the senior chemistry curriculum and its impact on students. *J Chem Educ*. 2021;98(8):2549-58. <https://doi.org/10.1021/acs.jchemed.0c01140>
- [26] Medley-Rath S, Morgan R. Gaining confidence, experience, and knowledge as researchers among undergraduate sociology students. *Teach Sociol*. 2022;50(1):28-38. <https://doi.org/10.1177/0092055X211033638>
- [27] Arshad S, Huda NU, Nadeem N, Ali S, Ahmad N, Anwar S, et al. Perceptions of medical students about research at undergraduate level. *J Ayub Med Coll Abbottabad*. 2021;33(1):129-33
- [28] Abusamak M, AlQato S, Alrfooh HH, Altheeb R, Bazbaz L, Suleiman R, et al. Knowledge, attitudes, practices and barriers of medical research among undergraduate medical students in Jordan: a cross-sectional survey. *BMC Med Educ*. 2024;24:23. <https://doi.org/10.1186/s12909-023-05002-9>
- [29] Seifan M, Lal N, Berenjian A. Effect of undergraduate research on students' learning and engagement. *Int J Mech Eng Educ*. 2022;50(2):326-48. <https://doi.org/10.1177/0306419021988962>
- [30] Bruthers CB, Hedman EL, Matyas ML. Undergraduate research programs build skills for diverse students. *Adv Physiol Educ*. 2021;45(2):399-408. <https://doi.org/10.1152/advan.00165.2020>
- [31] Miller CT, Drewery M, Waliczek TM, Contreras RN, Kubota C. Engaging undergraduate students in research. *HortTechnology*. 2023;33(1):1-7. <https://doi.org/10.21273/HORTTECH05130-22>
- [32] Adebisi YA. Undergraduate students' involvement in research: values, benefits, barriers and recommendations. *Ann Med Surg*. 2022;81:104384. <https://doi.org/10.1016/j.amsu.2022.104384>
- [33] Ahmad Z, Al-Thani NJ. Undergraduate research experience models: a systematic review of the literature from 2011 to 2021. *Int J Educ Res*. 2022;114:101996. <https://doi.org/10.1016/j.ijer.2022.101996>