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Teaching scientific research in medical graduation: is there interest and involvement of the students?

Ensino da pesquisa científica na graduação médica: há interesse e envolvimento dos estudantes?

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ABSTRACT

Introduction: Knowledge and understanding of scientific research are skills that must be developed by all health professionals. Specifically in Medicine, these skills make up an important part of undergraduate and continuing medical education. Considering that medical training is closely related to the understanding of scientific evidence, it becomes relevant to analyze the involvement of medical students with scientific activities during the course.

Objective: This study aimed to investigate the interest and involvement in scientific research among medical students, analyzing the academic profile and the extracurricular activities carried out, in addition to evaluating the scientific production and identifying the motivations and difficulties faced.

Method: A cross-sectional study carried out with medical students from Salvador/Bahia, over 18 years of age. A virtual, structured, anonymous questionnaire was applied through Microsoft Forms, containing 21 questions about the academic profile and extracurricular activities carried out, in addition to data on scientific production and the motivations and difficulties faced by students.

Result: Of the 460 participating students, there was a predominance of women (63.3%), aged 24.1±6.1 years, attending the basic (45.4%) and clinical (46.7%) cycles, who have no previous desire to work with research (54.8%). Among the participants, 54.6% were part of academic leagues, 31.1% were involved in research groups and 29.1% participated in monitoring. It was found that only 33.9% of students have abstracts published in congresses, 12.2% are co-authors of scientific articles and 7.4% are main authors. Interest in working with research increases during graduation ($p = 0.010$), with students motivated to produce scientifically (66.1%). Research experience (27.4%) and genuine interest in scientific discovery (20.9%) were the main motivating factors. However, 81.1% of students identify difficulties in producing scientific content, with inadequate guidance (16.0%) and lack of time (15.5%) being the main obstacles. No relationship was observed between motivation and difficulty to produce scientifically and the current academic cycle.

Conclusion: Medical students show interest and participation in scientific research, however those who are actually involved in scientific activities represent the minority.

Keywords: Scientific Research; Medical Education; Medical Students; Health Education; Motivation.

RESUMO

Introdução: *O conhecimento sobre pesquisa científica e a compreensão dela são habilidades que devem ser desenvolvidas por todos os profissionais de saúde. Especificamente na Medicina, essas habilidades compõem uma parcela importante da graduação e da educação médica continuada. Considerando que a formação médica possui estreita relação com a compreensão sobre evidências científicas, torna-se relevante analisar o envolvimento dos estudantes de Medicina com as atividades científicas durante o curso.*

Objetivo: *Este estudo teve como objetivos verificar o interesse e o envolvimento em pesquisas científicas entre os estudantes de Medicina por meio da análise do perfil acadêmico e das atividades extracurriculares realizadas, avaliar a produção científica e identificar as motivações e dificuldades enfrentadas.*

Método: *Trata-se de um estudo transversal, realizado com estudantes de Medicina de Salvador, na Bahia, maiores de 18 anos. Aplicou-se, por meio do Microsoft Forms, um questionário virtual, estruturado e anônimo contendo 21 perguntas acerca do perfil acadêmico e das atividades extracurriculares realizadas, além de dados sobre a produção científica e as motivações e dificuldades enfrentadas pelos estudantes.*

Resultado: *Dos 460 estudantes participantes, houve predominância de mulheres (63,3%), com idade de 24,1±6,1 anos, cursando os ciclos básico (45,4%) e clínico (46,7%), que não possuem desejo prévio de trabalhar com pesquisa (54,8%). Dentre os participantes, 54,6% integraram ligas acadêmicas, 31,1% possuem envolvimento com grupos de pesquisa e 29,1% participaram de monitoria. Verificou-se que apenas 33,9% dos estudantes possuem resumos publicados em congressos, 12,2% são coautores de artigos científicos e 7,4% são autores principais. O interesse em trabalhar com pesquisa aumenta durante a graduação ($p = 0,010$), estando os estudantes motivados para produzir cientificamente (66,1%). A experiência em pesquisa (27,4%) e o interesse genuíno na descoberta científica (20,9%) foram os principais fatores motivadores. Entretanto, 81,1% dos discentes identificaram dificuldades para produzir conteúdo científico e apontaram como empecilhos a orientação inadequada (16,0%) e a falta de tempo (15,5%). Não foi observada relação entre a motivação e a dificuldade para produzir cientificamente e o ciclo acadêmico em curso.*

Conclusão: *Os estudantes de Medicina demonstram interesse e participação em pesquisa científica, entretanto aqueles que, de fato, estão envolvidos com atividades científicas representam a minoria.*

Palavras-chave: *Pesquisa Científica; Educação Médica; Estudantes de Medicina; Educação em Saúde; Motivação.*

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INTRODUCTION

Knowledge and understanding of scientific research are skills that should be developed by all health professionals. These professionals must understand scientific methodology even if they are not directly engaged in carrying out scientific research[1]. Adding clinical experience and the ability to critically analyze scientific information contributes to improving the quality of health care, an element that is promoted by Evidence-Based Medicine[2].

It is undeniable that the development of these skills and competences in research positively contributes to the formation of future physicians, stimulating the ability to evaluate the literature, the experience of teamwork, the ability to use data and to write scientific articles, as well as the development of critical thinking[3,4]. This last factor is crucial for physicians to be able to carefully analyze the literature, aiming to integrate new knowledge and scientific information into their daily clinical practice[1,5].

Despite the importance of the research methodology component in medical training, studies indicate that many developing countries do not satisfactorily include it in the curricula of medical undergraduate school[6,7]. This scenario, in turn, contributes to pushing the research topic to the background, to the detriment of an overload of basic and clinical disciplines. In addition, other factors can make it difficult for undergraduate students to engage in research, such as, for instance, the lack of funding and institutional stimulus, lack of time due to academic demands and lack of material for research [5,8–10].

Considering the above, this study aims to verify medical students' interest and involvement in scientific research, analyzing the academic profile and the extracurricular activities carried out by these students, in addition to evaluating the production of scientific material, while identifying their motivations and difficulties.

METHODS

This is a cross-sectional, descriptive and exploratory study with a quantitative approach.

The target population consisted of medical students from higher education institutions located in the city of Salvador, state of Bahia, Brazil. The inclusion criteria comprised being over 18 years old and being regularly enrolled in the medical course. It is important to point out that all institutions involved in this study offer the methodology component of scientific research in their medical education curriculum.

To calculate the sample size, the total population of medical students in the city of Salvador, Bahia, in 2020 was considered, which was estimated through the number of vacancies offered by the Ministry of Education at the time of the course implementation and the time of existence of each course. Therefore, the sample size was calculated considering a heterogeneous population of 7,500 medical students[11], for a 95% confidence interval and 5% sample error. After adding 10% due to sample losses, the participation of at least 366 students was estimated.

Sociodemographic data (age, gender, family income) and academic data (current year in medical school; administrative nature of the teaching institution; previous graduation; participation in academic leagues, monitoring and research groups; scientific publications) were recorded.

Moreover, data were was collected on factors that could influence student interest and involvement with scientific research, such as the presence of family members with academic titles (parents or siblings), the intention to work with scientific research before starting medical school and the perception of the most important curricular element for the construction of medical knowledge (practice, theory or research). Finally, the interest and motivation to produce scientific content and the motivational and hindering factors to carry out scientific research were assessed.

To assess interest, motivation and difficulties in producing scientific content, a Likert scale with five levels of responses was used, which were later grouped into three strata for the analysis: for interest - agreement (total or partial), indifference and disagreement (total or partial); for motivation - motivated (totally or partially), indifferent and unmotivated (totally or partially); for difficulty - concordant (totally or partially), indifferent and discordant (totally or partially).

Medical students were invited to participate in the research using the snowball method[12], a non-probabilistic sampling technique that allows study subjects to recruit other eligible subjects for the study itself.

For the data collection, a structured, anonymous, self-completion questionnaire was applied, prepared by the researchers themselves, specifically for this study, which comprised 21 multiple-choice questions. The form was created using the Microsoft Forms platform, whose link was sent electronically through the main communication platforms, such as social networks and WhatsApp groups.

Before starting the data collection, the questionnaire created by the researchers underwent a validation process, seeking to improve the understanding of the statements, eliminate any inaccuracies and guarantee the achievement of the proposed objectives. For that purpose, a pilot study was carried out with 10 students eligible for this research, which ensured the reliability and clarity of the data collection instrument. The responses obtained in the pilot study were not used in the final study sample.

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The data were analyzed using the statistical program IBM SPSS Statistics, version 28.0. Categorical variables were presented as absolute and relative numbers and continuous variables as mean and standard deviation values, because they showed a symmetrical distribution. To verify the existence of an association between the academic cycles and interest in research, the medical course years were grouped into basic (1st and 2nd years), clinical (3rd and 4th years) and internship (5th and 6th years) cycles and the Likert scale was grouped into three strata: agreement (total or partial), indifference and disagreement (total or partial). The comparison between the groups was performed using the chi-square test, with $p<0.05$ being considered statistically significant.

This study is in line with Resolutions number 466/12 and 510/16 of the National Health Council (CNS, *Conselho Nacional de Saúde*), having been approved by the Research Ethics Committee of the Higher Education Maintaining Institute of the state of Bahia (CAAE number 47770721.4.0000.5032, Opinion n. 4,812,636).

RESULTS

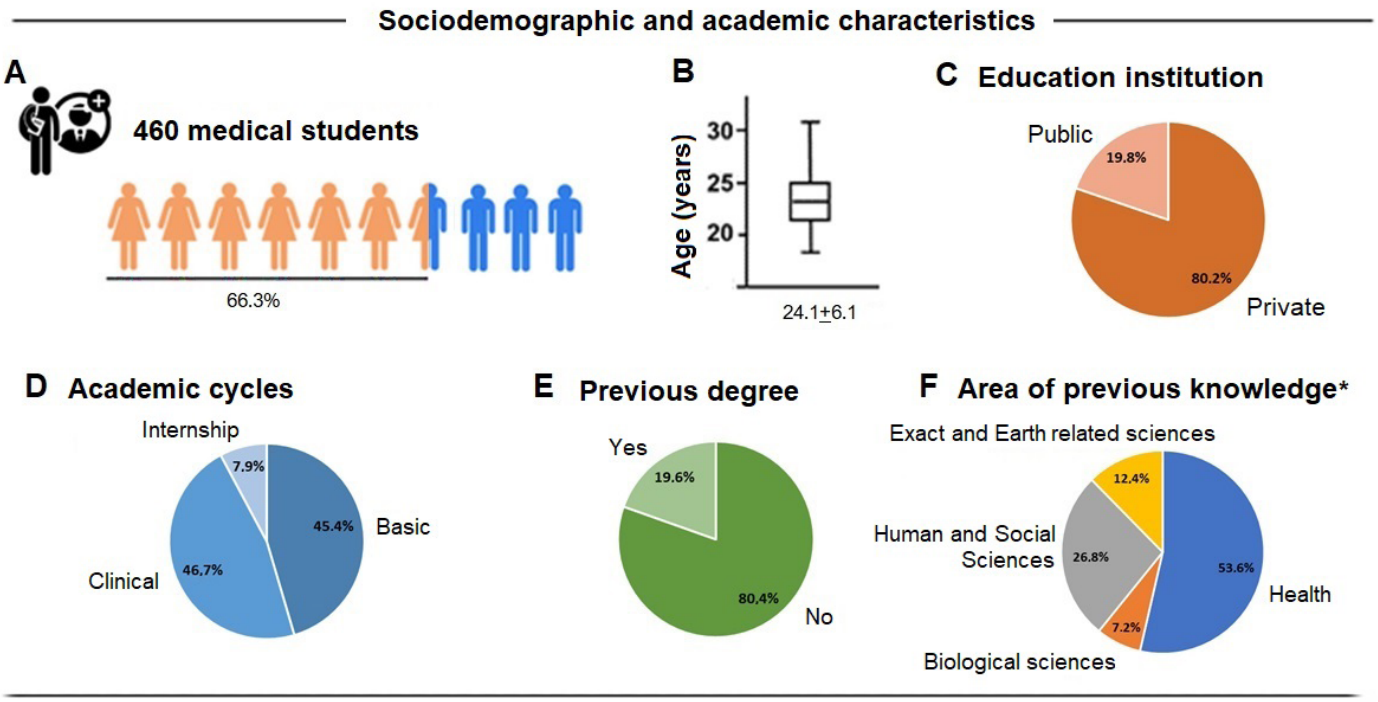
The study obtained 467 responses to the forms, of which seven were excluded for not meeting the eligibility criteria. Thus, the final sample consisted of 460 participants, corresponding to an amount that was 25.7% higher than the calculated minimum sample size.

Among the participating students, the age was 24.1+6.1 years, being mostly female (66.3%), from private institutions (80.2%), who were attending the Basic (45.4%) and Clinical (46.7%) cycles of the medical course, who had not previously obtained another Higher Education degree (80.4%) and, among those who had previous training, the previous graduation was in the health area (53.6%) [Figure 1].

When analyzing extracurricular activities, it was possible to observe differences regarding participation in academic leagues, tutoring and research groups. Participation in academic leagues was observed in most students (54.6%), whereas involvement was less significant in tutoring activities and research groups (29.1% and 31.1%, respectively) [Figure 2].

Regarding scientific production, it was observed that 33.9% of the students had abstracts accepted in congresses, 12.2% had articles published as co-authors and only 7.4% have had articles published as the main authors. Among the students who have scientific production, most published 1 to 2 abstracts (50.0%) and 1 to 2 articles as the main author or co-author (94.1% and 85.8%, respectively) [Figure 2] .

Figure 1. Sociodemographic and academic characteristics of medical students participating in the study (n=460).



A: Gender; B: Age; C: Administrative nature of the Higher Education Institution; D: Academic cycles in progress; E: Previously completed graduation; F: Area of knowledge of the previously completed graduation; *Relative frequency calculated considering a total of 97 previously completed undergraduate courses (some students finished more than one previous course).

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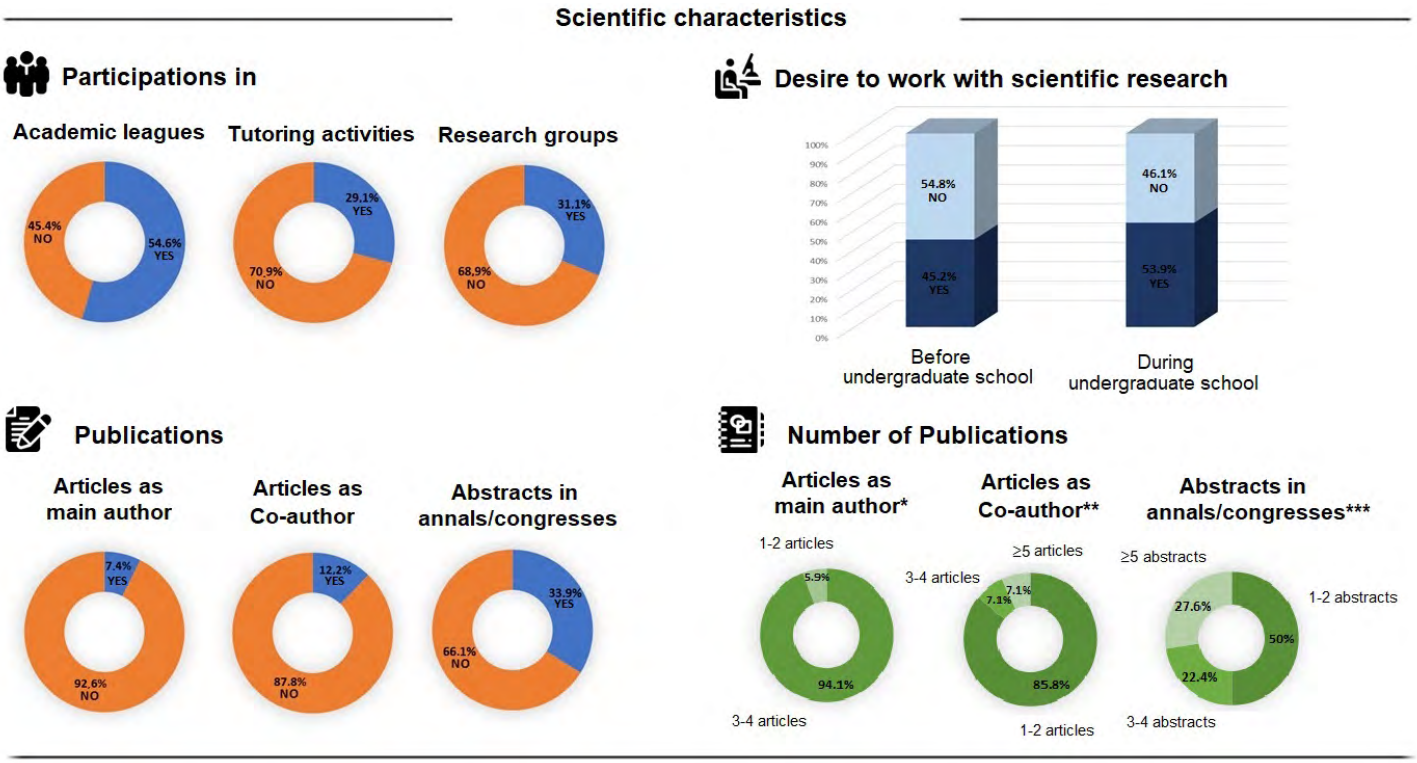
Figure 2. Scientific characteristics of medical students participating in the study (n=460).



*Relative frequency was calculated considering a total of 34 students who have articles published as the main author; **Relative frequency was calculated considering a total of 56 students who have articles published as co-authors; ***Relative frequency was calculated considering a total of 156 students who have abstracts published in Annals of Congresses; ¥Chi-square test.

When analyzing the desire to work with research, it was observed that only 45.2% of the students stated they had a previous interest, prior to the undergraduate school, while 53.9% have a current desire to work with research during undergraduate school, with this increase being statistically significant (p=0.010) [Figure 2].

Regarding the elements that comprise medical training, it was evident that 83.1% of the students identify practice as a crucial element, which is followed by research (8.9%) and, subsequently, by theory (8.0%).

Regarding the motivational aspect, it is observed that 66.1% of the students feel motivated to produce scientific content [Table 1]. Among the motivational factors listed by these students, the most frequently reported were: having experience in research (27.4%), genuine interest in scientific discovery (20.9%), directing the medical practice (15.9%) and curriculum enhancement (15.9%) [Figure 3]. Furthermore, 80.9% of the students consider there are difficulties and impediments to producing scientific contents [Table 1]. Among these, the most representative were: inadequate guidance or lack of guidance (16.0%), lack of knowledge about the scientific process (15.7%), lack of time due to the undergraduate course demands (15.5%) and lack of institutional stimulus or lack of funding (15.0%) [Figure 3].

Table 1. Motivations, difficulties and impediments identified by medical students related to scientific production (n=460).

MOTIVATION	
Do you feel motivated to produce scientific contents?	*n (%)*
Agree	304 (66.1)
Indifferent	89 (19.3)
Disagree	67 (14.6)
DIFFICULTIES AND IMPEDIMENTS	
Is it difficult to produce scientific contents?	*n (%)*
Agree	372 (80.9)
Indifferent	72 (15.7)
Disagree	16 (3.4)

n: absolute number; %: percentage.

There was no association between the current academic cycle and the motivation or difficulty to produce scientific contents (Table 2), suggesting that there is no variation in motivation and difficulty as medical training progresses.

No statistically significant differences were observed when analyzing the motivation and difficulty to produce

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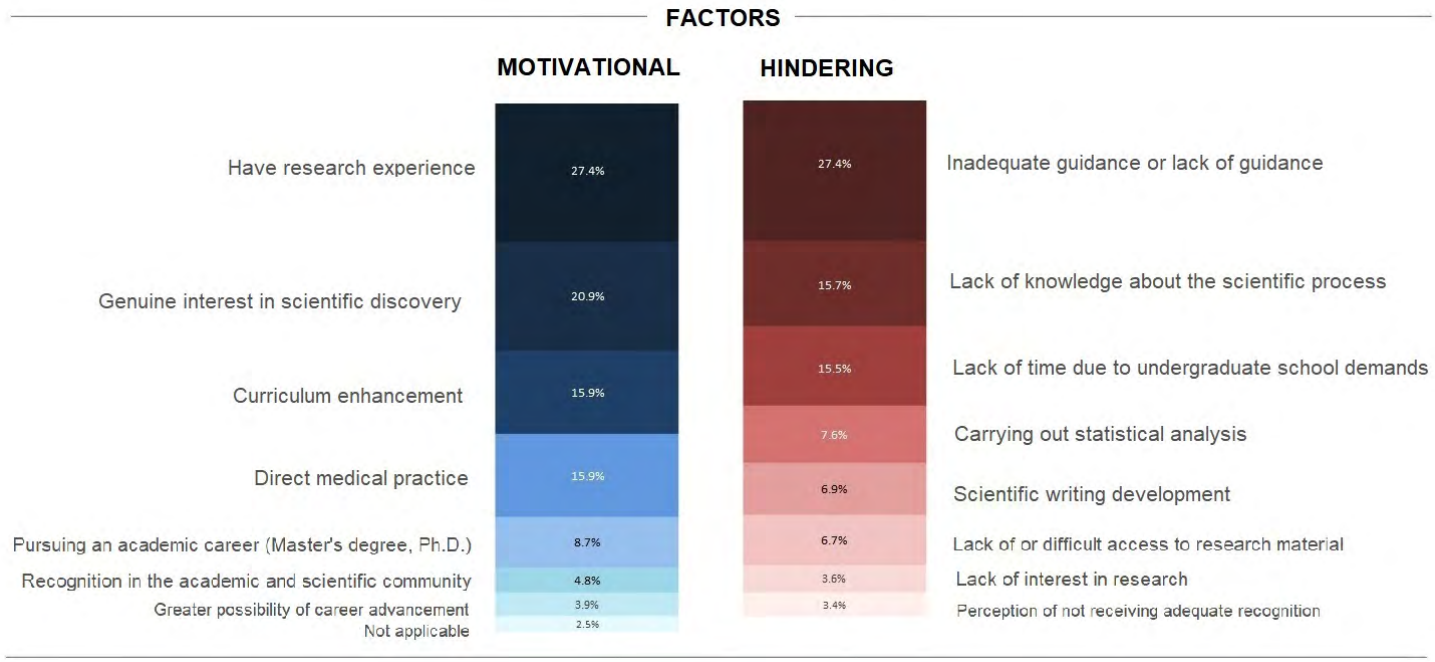
Figure 3. Motivational and hindering factors identified by medical students to produce scientific contents.



* Relative frequency calculated considering a total of 581 responses, since each student could mark more than one alternative.

Table 2. Analysis of motivation and difficulties to produce scientific contents, considering the academic cycles in progress by medical students participating in the study (n=460).

Variables	Academic cycles			*p**
	Basic	Clinical	Internship	
Motivation, n (%)				
Motivated	145 (47.7)	133 (43.8)	26 (8.6)	
Indifferent	42 (47.2)	41 (46.1)	6 (6.7)	0.138
Non-motivated	22 (32.8)	41 (61.2)	4 (6.0)	
Difficulty, n (%)				
Agree	159 (42.7)	182 (48.9)	31 (8.3)	
Indifferent	41 (56.9)	27 (37.5)	4 (5.6)	0.219
Disagree	9 (56.3)	6 (37.5)	1 (6.3)	

n: absolute number; %: percentage; *Chi-square test

scientific contents between students from public and private HEIs (Table 3).

DISCUSSION

The present study demonstrated that the interest of medical students in scientific research is high. However, only a small part of these students is involved in these activities, mostly those developed with academic leagues.

It is important to emphasize that medical training is closely related to understanding scientific evidence. The National Curriculum Guidelines for Medical Courses (DCN)[13] explicitly mention the need to scientifically train critical and reflective physicians. Thus, the present study brings light to considerations on the involvement of medical students with scientific research throughout their academic training.

Scientific research is intrinsically present in medical knowledge and, over the centuries, has shown to be of great importance for the development of medical practice and its technologies[14,15]. Therefore, during the undergraduate course, it is expected that the scientific methodology and the activities related to it be well structured, allowing the early improvement of attitudes towards science[1], generating encouragement for some of these students to continue to produce knowledge and technology through their own scientific research after

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Table 3. Analysis of the motivation and difficulty to produce scientific contents, considering the administrative nature of the higher education institution of the medical students participating in the study (n=460).

Variables	HEI		*p**
	Public (n=91)	Private (n=369)	
Motivation, n (%)			
Motivated	58 (63.7)	246 (66.7)	
Indifferent	17 (18.7)	72 (19.5)	0.660
Non-motivated	16 (17.6)	51 (13.8)	
Difficulty, n (%)			
Agree	79 (86.8)	239 (79.4)	
Indifferent	10 (11.0)	62 (16.8)	0.272
Disagree	2 (2.2)	14 (3.8)	

HEI: higher education institution; n: absolute number; %: percentage; *Chi-square test.

the end of the course[16]. In the context of medical training, scientific research can be introduced in several ways, such as, for instance, through undergraduate research and scientific mentoring[17]. By carrying out these activities, the student is able to more intensely absorb ethical qualities cultivated in clinical practice than in conventional classes, in addition to receiving stimuli to become future researchers[16]. It is believed that students understand the importance of this scientific activity for their training, a fact demonstrated by Oliveira et al.[5] who, when analyzing the practice of undergraduate research in six medical courses in four Brazilian states, pointed out that it was defended as mandatory by 84% of the students. Furthermore, some studies consider that the curricularization of scientific research activities can increase the medical students' interest and involvement [17,18]. In addition to undergraduate research, academic leagues have a relevant influence on students' scientific involvement, especially by offering opportunities for applied research and engagement in research groups[19]. This could be attested in the present study, where a majority of the students participated in academic leagues when compared to participation in monitoring activities and research groups. In agreement with this, it is known that academic leagues allow an improved training in health, anticipating the insertion of its participants in the fields of action, filling the knowledge gaps, mainly through student protagonism and autonomy, which favors the participation of students in academic extension activities[20,21].

Corroborating previous studies[22–25], we identified a low percentage of students who have articles published in scientific journals or abstracts in congresses and events throughout undergraduate school. The high mandatory curricular demand of medical courses[14,26,27], added to the fact that the role of graduation is not to train researchers, can contribute to this context. Therefore, in order to reverse this scenario, several educational institutions have implemented academic strategies to improve students' scientific engagement[28,29] through the implementation of innovative curricula[30]. One of the successful practices that has been implemented is scientific mentoring[17]. This activity encourages research by monitoring students in a serial manner throughout their scientific training, with incentives and the establishment of goals until the effective publication of the scientific work[17].

Regarding the most important elements for their medical training, an overvaluation of practical activities was perceived to the detriment of research and theory. This finding can be explained by the process of knowledge construction, where practice has been recognized as an axis. Based on it, the emerging problems in the daily training are identified, questioned, theorized and investigated, not as a mere example of theoretical application, but as the core of the production and dissemination of scientific theories[31].

However, the relationship between these elements is fundamental, since research improves the theoretical knowledge and deep knowledge of theory fosters questions for conducting good research, moving towards the progress of science and its applications. Hence, several educational institutions have been implementing mandatory research programs throughout the undergraduate course[5,6].

It was also observed that most participating students feel motivated to produce scientific content, with the main motivations being the opportunity to have experience with research and genuine interest in scientific discovery. These results are in line with the study by Stone et. al.[7], in which the medical students' interest and positive attitude in relation to scientific research is also evidenced, with variable motivational aspects. However, the students' interest in this area of activity is not reflected in the training of physician-scientists in the same proportion, which, in turn, may be closely related to the hindering factors.

The difficulty in producing scientific contents was demonstrated in the present study, being associated with hindering factors such as inadequate guidance, or the lack thereof, together with the lack of knowledge of the scientific process that prevents students from recognizing research opportunities[1,7]. It is believed that these difficulties and impediments can widen the gap between students and scientific research.

Furthermore, the complicating factors demonstrated in this study showed a similar proportion to that found in

other studies available in the literature[5,7,9]. When making a comparative analysis with another Brazilian study carried out over 10 years ago, the lack of institutional stimulus continues to be the biggest and most important difficulty. This finding is noteworthy because, even after more than a decade, one sees the persistence of a deficient educational system in this regard. Moreover, it is worth mentioning that, in both studies compared herein, there is no lack of interest on the part of the student, which reinforces extrinsic issues to the individual as more relevant to the lack of involvement in research.

On the other hand, Oliveira et al.[5] point to the lack of material conditions as an important impediment. However, this element was not pointed out as a relevant problem by the vast majority of students. This difference probably derives from the predominance of participation of students from private institutions in the present study, in contrast to those from public institutions in the previous study. In addition, one must consider the advances regarding the means of information and communication that occurred in more than a decade between these studies.

Furthermore, the fact that no variation in motivation and difficulty was observed as medical training progresses points to a possible deficit in the robustness of the curricular matrix within the scope of research. In contrast, course advancement could be a crucial tool for the maturation of students in relation to research. However, some studies have not shown a change in the inclination towards a scientific career[4,10], a fact that differs from the findings shown herein.

Regarding the distribution of students between public and private schools, at the time the study was carried out, there were six medical courses in operation in the city of Salvador, Bahia, of which 67% were offered by private Higher Education Institutions (HEIs), which are responsible for 85% of the available vacancies[11]. In the present study, the distribution of students from public and private HEIs corroborate this proportion. It is important to point out that some of these HEIs have been implemented for a longer time when compared to the others, which makes the distribution of students between them quite diversified. However, the study had the participation of students from all these HEIs, and this distribution was representative of the target population.

The data presented here reinforce the need to implement academic strategies that allow changing this scenario, favoring the medical students' interest and scientific engagement. This is currently one of the greatest academic challenges. Therefore, to modify the current scenario, a critical reflection on the part of the institutions involved in the training process of medical students is necessary, aiming at the implementation of strategies with the objective of reducing the hindering elements, as well as the enhancement of the motivational factors. Only then can scientific research be understood in practice as a fundamental pillar of Brazilian academic education.

Among these academic strategies, offering undergraduate research scholarships can encourage participation in research and institutional projects. This support occurs in a different manner in public and private institutions in the country and may have a motivating effect. In this context, analyzing these possible differences between public and private institutions can be considered an interesting topic for future research.

Finally, as a potential limitation of the study, is the use of a sample obtained through the snowball method, consisting of individuals who volunteered to answer the questionnaire and, possibly, already predisposed to participate in research, which may raise the possibility of a selection bias. However, this condition does not invalidate the findings presented herein, since a larger sample than the one established by the sample calculation was used in the study, representing a significant number of participating students.

CONCLUSION

Medical students show interest and participation in scientific research; however, those who are actually involved represent the minority. This behavior may be associated with the difficulties listed by students for scientific production, mainly those associated with inadequate guidance, lack of knowledge about the scientific process, lack of time due to undergraduate school demands and lack of institutional stimulus or funding. Moreover, it was shown that there is no variation in motivation and difficulty related to research activities as medical training progresses.

AUTHORS' CONTRIBUTION

Felipe da Silva Mota Santos, Sarah Fernandez Coutinho de Carvalho, Luiz Ricardo Cerqueira Freitas Junior, Isadora Abreu Oliveira, Claudio Lucas Silva Cunha and Katia de Miranda Avena contributed to the study design; data collection; and in the writing of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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