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# Association between procrastination and learning strategies in medical students in a hybrid problem-based and lecture-based learning curriculum

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## Abstract

**Background** Procrastination is characterized by the deliberate postponement of assigned educational tasks and is correlated with low academic achievement and depression. Concern about procrastination is particularly high among medical students, as it has a strong association with aspects such as low self-efficacy, lack of organization, low intrinsic motivation, inefficient effort regulation and time management problems. On the other hand, it was found that students' use of study strategies is significantly related to better academic results. The relationship between students' tendency to procrastinate and the adoption of effective study strategies remains little explored, leaving a critical space for investigation. This study aims to fill this gap by exploring how procrastination affects the selection and effectiveness of study strategies adopted by students.

**Methods** This cross-sectional study was conducted in Brazil and included medical students from the first to the seventh semester of the Unichrsitus Medical School. The validated procrastination scale and the Learning and Study Strategies Inventory were used. Generalized linear regression multivariate models with robust errors were used to verify the association between the study variables.

**Results** 447 students participated, 70.2% of whom were female, with an average age of 23 years. The domain of "study aids" scored higher among younger students, who self-referred as black and who studied in private schools prior to the Medical School. Higher procrastination scores were statistically associated with higher main idea selection, concentration, time organization and anxiety scores and with lower study aids and study preoccupation scores ( $p$  values < 0.05). In addition, active methodology was associated with higher scores in the domains of study aids and time organization.

**Conclusions** Procrastination is associated with the study strategies used by medical students, which can be modified through training and ultimately improve their performance. Students in traditional models, who are older, white and from public schools may especially benefit from this training.

**Keywords** Problem-based learning, Medicine, Procrastination, Learning strategies

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## Introduction

Procrastination is a phenomenon that is being studied more and more these days, especially because of its serious implications for performance in different areas of life. In the academic context, it is characterized by the deliberate postponement of assigned educational tasks [1], often due to illogical justifications, such as the perception that the task is excessively complex, leading to a reluctance or inability to complete it. Research indicates a correlation between procrastination and low academic performance [2–5] and depression [6]. Concern about procrastination is particularly high among medical students, as it has a strong association with aspects such as low self-efficacy, lack of organization, low intrinsic motivation, inefficient effort regulation and time management problems. [7–10]

The prevalence of procrastination for the realization of academic tasks among students is high, with some studies suggesting rates of 46% to 52% [11, 12]. A study of medical students showed that approximately 29.25% of them procrastinate almost always or always, while 47.9% reported that procrastination at a moderate level caused them numerous problems [13]. In addition, procrastination can affect more boys than girls. [10] Investigating and detecting early the preventive factors of low academic performance in the various medical curricula, including student procrastination as well as the deficiency and knowledge of the use of study strategies in medical courses, is important [14]. It is known that the use of active methodologies can prevent academic procrastination by triggering students' active involvement and innovation in learning. [15] In addition, the additional cognitive overload of innovative medical curricula that simultaneously use traditional teaching and problem-based learning (PBL—hPBL hybrid) may be a key factor leading to student procrastination. [16, 17]

Study and learning strategies can be defined as thoughts, behaviors, beliefs or emotions that facilitate the acquisition, understanding or subsequent transfer of new knowledge and skills [18]. Such strategies cover a range of functions, from organizing the way information is processed, making plans for learning tasks, setting and monitoring goals, to critically analyzing one's own learning. The use of study strategies by students has been found to be significantly related to better academic results [19]. Diagnosing, measuring and studying these strategies is one of the fundamental aspects of improving the learning process. The results of a study conducted with medical students suggested that among their sample two specific study skills, time management and self-assessment, were more effective predictors of academic performance in the first semester than the students' own aptitude [20].

Although the existing literature offers a comprehensive understanding of both procrastination and study strategies in isolation, there is a scarcity of evidence regarding the association of these two domains in medical students, especially in different learning methodologies. More recent studies have focused on factors associated with procrastination, such as internet use, and their effect on academic performance, and most studies on study strategies focus on describing the strategies used by students and their association with other psychological factors [21–24]. The relationship between students' tendency to procrastinate and the adoption of multiple different study strategies characteristics remains little explored, leaving space for investigation. This study aims to contribute to the understanding on how procrastination affects the selection and effectiveness of study strategies adopted by students.

## Methods

### Study design

A cross-sectional, quantitative, analytical study was carried out in the city of Fortaleza—CE on the premises of Unichristus Campus Parque Ecológico. The study period was from June 2023 to October 2023.

### Study population and sample

All students over the age of 18, of both sexes, who are linked to the medical course of Unichristus, in semesters 1, 2, 3, 5 and 7, were included.

Students under the age of 18 were excluded, as were those who did not wish to take part in the study, who were unable to answer the questions on the collection instrument, who were not linked to a higher education institution in the health field or who did not use virtual platforms during the pandemic.

The sample calculation with a 95% confidence level took into account the number of students with a power of 80 and a significance level of 5%. Considering an average on the procrastination scale of 61 in one group and 55 in the other, with standard deviations of 13 and 14 respectively, a minimum *n* of 178 was calculated.

### Data collection

The scale was applied in person to university students from the health area at Unichristus at times agreed in advance by trained interviewers.

### Variables

The Procrastination Scale (PS), developed and validated by Lay (1986), was used to collect data for the study. The scale is a 20-item Likert-type self-report instrument. It is made up of items designed to find out how much subjects procrastinate on issues covering various aspects

of life. The original author of the instrument found it to have high internal consistency and convincing construct validity. A high score on the scale indicates a high level of procrastination, while a low score indicates a low level of procrastination [25]. This scale was validated for Brazilian Portuguese with university students [26]. Validation studies showed that internal consistency, estimated by Cronbach's alpha, was 0.83 for the total scale [27], and the Cronbach's alpha calculated for our study was 0.81, value considered adequate for the questionnaire.

Learning strategies were assessed using the Learning and Study Strategies Inventory (LASSI), third edition. It is a 10-scale, 60-item assessment of students' awareness of the use of learning strategies related to Ability (Information Processing, Main Idea Selection and Test-taking Strategies), Will (Anxiety, Attitude and Motivation) and Self-Awareness. Regulation (Concentration, Self-testing, Time Management and Use of Academic Resources). It uses a five-point Likert scale (1=Not at all like me to 5=Very like me). The LASSI provides standardized scores (equivalent to percentage scores) based on normative samples for the 10 scales included in the instrument [28].

The LASSI was chosen because it is a diagnostic tool that identifies students' strengths and weaknesses and a prescriptive tool that provides feedback to improve academic performance in high school and university, which in turn can be beneficial for guidance students. This scale has been validated for Brazilian Portuguese with university students [29]. The reliability of LASSI subscales as measured by Cronbach's alpha is 0.73–0.89 [30].

A self-reported questionnaire on sociodemographic data and life habits was also applied. The questionnaire used is available in full as a supplementary file (supplementary file 1).

### Statistical analysis

Initially, the descriptive measures of the collected variables were presented, using frequencies and percentages for categorical variables and means and standard deviations for the numerical ones. The chi-square tests were used to verify the statistical association between the measured variables and learning strategies. Specifically for the variable semester in which the student is, we use the test Goodman and Kruskal's lambda coefficient. Minimally adjusted general linear regression models were also used to verify the association of learning strategies and procrastination, adjusted for students sex and age. Values of  $p < 0.05$  were considered statistically significant. Data were tabulated and statistical calculations were performed using the Statistical Package for Social Sciences (SPSS) software, version 23.0 (SPSS Inc., Chicago, United States)<sup>®</sup>.

### Ethical aspects

In the online application, the Free and Informed Consent form was applied through the electronic platform and made available to all participants. All necessary procedures were adopted to keep the collected data confidential. The project was submitted to the Research Ethics Committee (REC) of Unichristus University under the opinion number 67715223.2.0000.5049.

### Results

A summary of the baseline characteristics of the study participants, which included 447 medical students, is shown in Table 1. The median age was 23 years, and 70.2% of the participants were female. Most participants were attending the first semester. The majority of the students declared themselves white (73%) and 94.6% had studied in private schools. More than three quarters reported living with their parents (75.4%) and only 12.3% reported working. The sample's average score on the procrastination scale was 3.05, with a standard deviation of 0.45. Finally, 42.5% of the sample was in a traditional teaching model, with the remainder in a hybrid active model. All the characteristics can be seen in Table 1.

The scores for the different study strategies presented by the medical students can be seen in Table 2. The highest scores were obtained in the domain of preoccupation when studying (average of 3.73), and the lowest in the domain of motivation (2.72). The other domains oscillated between these two values, with the second highest being the study aids domain (2.44) and the second lowest being the selection of main ideas domain (2.89). All the domains are described in Table 2.

When studying the factors associated with the domains of study strategies of medical students, we observed that the domain of study aids obtained a higher score in younger students, who self-referred as black and who studied in private schools, as seen in Table 3. Also, the scores of the domain of time organization also improved as students progressed through the course. Finally, the active methodology was associated with higher scores in the domains of study aids and time organization.

Figure 1 shows the correlation matrix between students' procrastination scores and the various domains of learning strategies, in a multivariate analysis minimally adjusted for students' age and gender. It can be seen that higher procrastination scores were statistically associated with higher scores for main idea selection, concentration, time organization and anxiety, and with lower scores for study aids and worry when studying (Fig. 1).

**Table 1** Description of the sample of evaluated medical students

	N (%) or $\bar{x}$ (SD)
Sex	
Female	314(70.2)
Male	133(29.8)
Age, in years	23(6.0)
Age in tertiles	
First tertile	181(40.7)
Second tertile	117(26.3)
Third tertile	147(33.0)
Ethnicity	
White	327(73.0)
Black	7(1.6)
Brown	114(25.4)
Semester	
S1	109(24.4)
S2	81(18.1)
S3	53(11.9)
S5	116(26.0)
S7	88(19.7)
Secondary school type	
Private school	420(94.6)
Public schools	24(5.4)
Paid activity during graduation	
No	393(87.7)
Yes	55(12.3)
Lives with	
With friends	4(0.9)
With your spouse	56(12.5)
With your parents	337(75.4)
Alone	33(7.4)
Other	17(3.8)
Has an appropriate place to study at home	
No	27(6.0)
Yes	420(94.0)
Procastination score mean, SD	3.05(0.45)
Traditional teaching or PBL	
Traditional	190(42.5)
Hybrid PBL	257(57.5)

Considering that the teaching method was associated with the learning strategies selection of main ideas and organization of time, we carried out multivariate analysis to verify the independent association of this factor in relation to procrastination. It was found that active methodology students have a statistically independent association with teaching strategies, and that procrastination is more associated with the two learning techniques in active methodology students, as can be seen in Fig. 2.

**Table 2** Scores for each domain of study strategies for medical students

	$\bar{x}$ (SD)
Selection of main ideas	2.89(0.52)
Study aids	3.44(0.41)
Worry when studying	3.73(0.62)
Concentration	2.98(0.52)
Motivation	2.72(0.41)
Organizing time	2.91(0.52)
Anxiety	2.99(0.57)

## Discussion

In this study it was observed that procrastination is closely associated with the learning strategies used by students. In addition, it was found that the active teaching methodology contributes to the learning domains selection of main ideas and organization of time even after adjusting for procrastination, and that the variables age, ethnicity and type of secondary education are associated with the use of study aids.

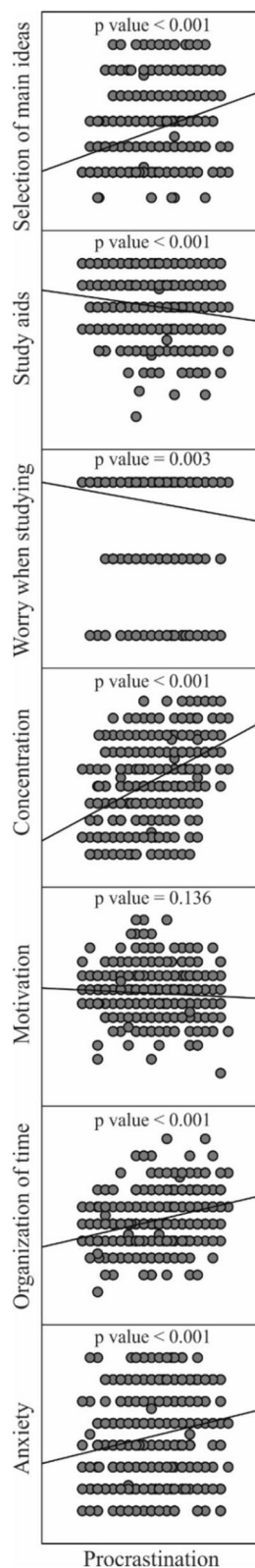
Academic procrastination is a common behavior among university students and has been associated with a number of factors, including self-regulation of learning and the study strategies employed. Studies highlight the detrimental nature of procrastination and its relationship with self-regulation of learning, pointing to differences in study strategies between procrastinating and non-procrastinating students [31]. Procrastination may be a way of dealing with low self-efficacy beliefs in the face of possible negative results, indicating a failure in the process of self-regulation of learning [32]. To deal with academic procrastination, the development of time organization strategies has been pointed out as an effective way of minimizing it, which is corroborated by the results of this study [33].

San, Roslan and Sabouripour, in a 2016 study [34], showed that high levels of academic procrastination are related to low levels of motivation, in contrast to what we identified, that procrastination is not associated with motivation. In the same study, it was shown that students who are in a situation of shorter deadlines are more likely to develop anxiety about exams and other tasks, increasing levels of procrastination, this time in a way that is congruent with the findings of the present study. The findings of the study by San, Roslan and Sabouripour also show that there is a negative association between academic procrastination and other study strategies (selection of main ideas, study aids, preoccupation when studying, concentration, time organization). In general, students with high levels of academic procrastination are

**Table 3** Factors associated with learning strategies in the students evaluated

	Selection of main ideals		Study aids		Worrying about studying		Concentration		Motivation		Time organization		Anxiety	
	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value	$\bar{x}$ (SD)	p-value
Sex		0.117		0.12		0.76		0.721		0.645		0.297		0.083
Female	2.91(0.51)		3.46(0.39)		3.72(0.63)		2.97(0.50)		2.71(0.40)		2.90(0.48)		3.02(0.55)	
Male	2.83(0.55)		3.40(0.44)		3.76(0.59)		3.00(0.56)		2.75(0.44)		2.95(0.58)		2.90(0.61)	
Age (Categorical)		0.605		<b>0.017</b>		0.324		0.211		0.778		0.163		0.762
First tertile	2.91(0.53)		3.5(0.40)		3.71(0.64)		3.03(0.51)		2.73(0.42)		2.87(0.52)		3.00(0.56)	
Second tertile	2.86(0.53)		3.41(0.42)		3.7(0.65)		2.93(0.51)		2.75(0.40)		2.93(0.50)		2.96(0.58)	
Third tertile	2.89(0.51)		3.38(0.42)		3.8(0.55)		2.96(0.51)		2.71(0.41)		2.97(0.52)		3.00(0.57)	
Ethnicity		0.629		<b>0.011</b>		0.632		0.179		0.56		0.859		0.756
White	2.90(0.52)		3.41(0.42)		3.71(0.65)		3.00(0.52)		2.73(0.42)		2.91(0.51)		3.00(0.57)	
Black	2.90(0.53)		3.81(0.15)		3.83(0.41)		3.15(0.55)		2.91(0.50)		3.00(0.54)		3.05(0.69)	
Brown	2.85(0.53)		3.49(0.39)		3.80(0.52)		2.90(0.51)		2.71(0.41)		2.92(0.54)		2.95(0.57)	
Semester		0.492		<b>0.001</b>		0.083		0.406		0.626		<b>0.002</b>		0.534
S1	2.95(0.56)		3.49(0.39)		3.64(0.70)		3.01(0.51)		2.70(0.43)		2.76(0.48)		3.00(0.56)	
S2	2.83(0.48)		3.55(0.33)		3.86(0.44)		2.92(0.53)		2.68(0.36)		2.87(0.47)		2.92(0.55)	
S3	2.85(0.48)		3.38(0.40)		3.71(0.67)		2.9(0.52)		2.77(0.47)		2.93(0.57)		2.96(0.52)	
S5	2.92(0.54)		3.45(0.44)		3.68(0.64)		3.02(0.54)		2.74(0.40)		2.99(0.50)		3.05(0.57)	
S7	2.85(0.52)		3.29(0.43)		3.81(0.56)		2.98(0.5)		2.75(0.44)		3.04(0.54)		2.97(0.62)	
Secondary education		0.131		<b>0.006</b>		0.766		0.161		0.348		0.514		0.668
Private school	2.90(0.52)		3.45(0.41)		3.73(0.62)		2.99(0.52)		2.72(0.41)		2.92(0.51)		2.99(0.57)	
Public schools	2.75(0.52)		3.19(0.45)		3.75(0.62)		2.83(0.56)		2.80(0.41)		2.99(0.52)		2.94(0.57)	
Any paid work during your degree		0.433		0.071		0.694		0.204		0.314		0.056		0.475
No	2.89(0.52)		3.45(0.41)		3.74(0.6)		2.99(0.52)		2.73(0.41)		2.93(0.51)		2.99(0.56)	
Yes	2.84(0.52)		3.36(0.38)		3.67(0.73)		2.90(0.55)		2.66(0.42)		2.80(0.56)		2.93(0.61)	
Mora		0.396		0.705		0.419		0.325		0.411		0.595		0.786
With friends	2.83(0.33)		3.5(0.49)		3.75(0.50)		3.00(0.59)		2.95(0.37)		2.72(0.38)		3.07(0.27)	
With your spouse	2.88(0.52)		3.35(0.42)		3.71(0.65)		2.87(0.49)		2.66(0.40)		2.94(0.51)		2.96(0.57)	
With your parents	2.87(0.51)		3.45(0.40)		3.75(0.60)		2.98(0.51)		2.72(0.41)		2.91(0.52)		2.98(0.56)	
Other	3.00(0.51)		3.45(0.41)		3.41(0.87)		3.05(0.49)		2.82(0.44)		2.97(0.53)		3.01(0.69)	
Alone	3.06(0.66)		3.40(0.48)		3.79(0.60)		3.10(0.62)		2.80(0.43)		2.92(0.54)		3.05(0.57)	
Has an appropriate place to study		0.359		0.227		0.522		0.693		0.44		0.391		0.36
No	2.98(0.47)		3.37(0.44)		3.89(0.32)		3.00(0.57)		2.83(0.42)		3.02(0.49)		3.11(0.64)	
Yes	2.88(0.53)		3.44(0.41)		3.72(0.63)		2.98(0.52)		2.72(0.41)		2.91(0.52)		2.98(0.56)	
Type of teaching		0.723		<b>0.001</b>		0.927		0.882		0.224		<b>&lt;0.001</b>		0.547
Traditional	2.90(0.53)		3.51(0.37)		3.74(0.61)		2.97(0.52)		2.69(0.4)		2.81(0.48)		2.97(0.55)	
PBL	2.88(0.52)		3.38(0.43)		3.73(0.62)		2.98(0.52)		2.75(0.43)		2.99(0.53)		3.00(0.58)	





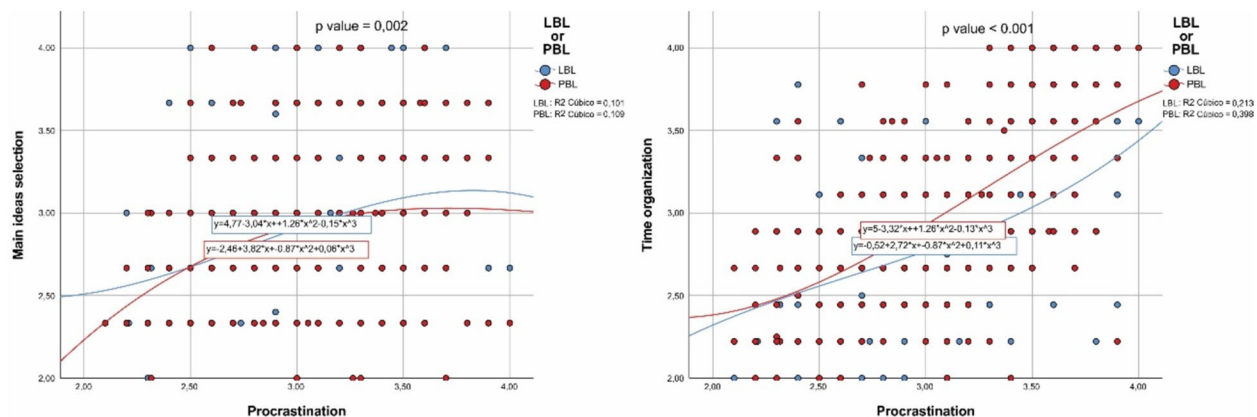
**Fig. 1** Correlation matrix of procrastination and learning strategy domains

unable to allocate enough time to effectively apply their study strategies, thus compromising their performance and generating higher levels of anxiety, as the postponement of tasks and work results in the obligation to meet shorter and more restrictive deadlines. Other studies have also shown that there is a negative relationship between academic procrastination and motivation [3], and that students who apply time organization and learning strategies tend to have lower levels of academic procrastination and higher levels of academic performance [35]. The results of these studies corroborate previous literature on the subject, as well as the results of this study.

The study aids domain, which includes the use of complementary teaching resources and learning support tools, showed higher scores among younger students and those from private schools, in contrast to other studies that showed higher scores among older students [36]. This result may reflect greater training received in high school at private institutions to make better use of study aids, considering that access to the medical course is extremely competitive in Brazil. This training is lost over time during the course, as can also be seen by the drop in scores for this domain as the semesters go by. It was observed that scores in the time organization domain tended to increase as students progressed through university. This increase may indicate a refinement of study skills as students become more familiar with academic demands and available resources. Furthermore, it suggests that the experience gained during college may help students develop better time management practices, an important skill for success in academic and professional life [36].

This study also sought to explore the association between the teaching method (hybrid or traditional) and the different learning strategies. A statistical association was found in the domains of study aids and time organization, and the active methodology was related to higher scores in these domains, even when adjusted for procrastination. This link reinforces the literature that proposes significant benefits of active learning approaches, which can encourage students to become more engaged and autonomous in their education [37].

This study had some limitations. First, as this is a cross-sectional study, the associated factors we found cannot be defined as causal, especially considering that the temporality of the association was not evaluated and there may be reverse causality. Furthermore, although we used a validated self-efficacy scale, it is not exhaustive of the occurrence of procrastination in each individual, even though it has shown good accuracy in the studies that tested it. Finally, as the study was carried out in a single center, the results found here may not be generalizable to all medical schools.



**Fig. 2** Scatter plot of procrastination and teaching strategies according to learning methodology

This study results suggest some implications. It is known that success in the learning process, despite being considered a “highly complex and multi-determined phenomenon”, depends on several variables, including study strategy, procrastination, and teaching methodology. Thus, the pedagogical evaluation of these variables can reduce students’ personal difficulties, maximize learning, and better control environmental factors that interfere with satisfactory academic performance. In addition to detecting procrastinating students, the results of this study also imply that developing training for the use of better study techniques that lead to less procrastination can benefit students.

## Conclusion

This study is one of the first to assess the association between study strategies and procrastination in medical students from different curricula. Procrastination is associated with the study strategies used by medical students. Students in traditional models, who are older, more advanced in their course, white and from public schools may especially benefit from this training.

## Abbreviations

PBL	Problem-Based Learning
LBL	Lecture-Based Learning
SD	Standard deviation
IQR	Interquartile range

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12909-024-06306-0>.

Supplementary Material 1.

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NA.

## Authors’ contributions

Author’s contributions were as follows: MMP, MK, ABTMS, MNO, LOC, and HALR have made substantial contributions to conception and design. HALR and MK revised the manuscript critically for relevant intellectual content. All authors approved the submission.

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None.

## Data availability

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

## Declarations

### Ethics approval and consent to participate

Written informed consent was obtained from participants. The survey was approved by the Research Ethics Committee of Unichristus in Brazil under the opinion number 67715223.2.0000.5049. All methods were carried out in accordance with relevant guidelines and regulations.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

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