ORIGINAL ARTICLE

Nursing Students' Views on Numeracy: An Exploratory Cross-Sectional Study in Riyadh, Saudi Arabia

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Abstract

Background: Medication administration in healthcare settings demands strong mathematical skills from healthcare practitioners. This study investigated nursing students' perceptions of mathematical calculations in Nursing at a Saudi university in Riyadh, Saudi Arabia. **Materials and Methods:** A cross-sectional study was conducted at the College of Nursing in a Saudi University, Riyadh, Kingdom of Saudi Arabia, between June and July 2025. The data were collected using a self-administered paper-based questionnaire of 16 items and analyzed using the statistical package for the social science (SPSS) version 26. **Results:** Among the students, majority were male, 74% (n = 182) belonged to the baccalaureate nursing program as compared to 20.3% (n = 50) in the Masters' nursing program. Nearly 58% of participants claimed that they studied mathematics during their nursing course (n = 141). While 56.9% (n = 140) perceived that their ability to perform mathematical calculations related to drug dosing would be important to them as future practicing nurses. One-third of the students were perceived (n = 83) to have good skills, while only 23.6% (n = 58) had excellent mathematical skills. A significant association was found between participant characteristics, such as age ($P < 0.0001$), educational level ($P < 0.0001$), degree ($P < 0.0001$), and the rating of self-reported perceptions of mathematical ability ($P < 0.0001$). **Conclusion:** This study reveals that nursing students perceive mathematical skills positively and advocate for increased emphasis on medical calculations in their degree course. Furthermore, our findings underscore the importance of enhancing nursing students' understanding of mathematical skills and their critical role in healthcare

Key words: Healthcare, mathematical skills, midwives, nursing students, perception

INTRODUCTION

Mathematical skills are crucial in healthcare, particularly in medication delivery and dosing.[1,2] As a result, healthcare practitioners, including nurses, must possess strong mathematical abilities to ensure accurate drug administration.[1,2] Undergraduates' mathematical learning goal is to be able to study and consolidate mathematical principles and abilities to solve problems in class and subsequently in their professional careers, as they are responsible for safely administering various types of medications to their patients.[1-3] As part of their undergraduate course, healthcare students, such as nurses, receive a variety of educational opportunities and rotations to update their knowledge and skills. Furthermore, at work, ratios, fractions, and algebraic equations are used to prepare and deliver medications to their patients,[1,2] and poor mathematical computation would result in medication errors as well as poor health outcomes such as an increased hospitalization rate.[1-3]

As a result, adequate mathematical competence in drug calculations is required among health care undergraduates, including Nurses. Notably, mathematical skills should be included in the curriculum of healthcare students to improve health outcomes.[2,3] Keeping in mind that over the past few decades, nursing students have demonstrated a lack of basic and advanced numeracy skills, despite receiving training and

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support in mathematical skills during their study course. As a result, it has been stated that nurses and nursing students have lower numeracy skills and both performed poorly, relying almost entirely on the use of digital machines and an inability to solve numerical problems.[4,5] Furthermore, research has revealed that nurses have complexity accurately analyzing and interpreting data.[5] Over half of all nursing students worldwide fail to pass a medication drug calculation exam.[5] For example, in a previous study of 124 nurses, only 4% received a perfect score on a medication calculation test given during orientation to a new position.[6]

Similarly, a recent study of 44 nurses in the United Kingdom discovered that the average nursing student score on a medication calculation exam was only 40.8%.[7] Given the importance of patient safety, international organizations such as the Institute of Medicine, the Joint Commission, and the World Health Organization (WHO) agreed that numeracy is critical to nursing care quality in medication management, patient monitoring, patient education, and quality improvement.[5] Furthermore, previous findings revealed that nursing students' knowledge and calculation skills were of poor quality.[8-10] A previous study, for example, found that students struggle with mathematical calculations such as rates, proportions, and percentages.[8] It suggests that even after several years of study, nursing students with relatively weak math skills who enroll in undergraduate programs frequently lack the mathematical competency and confidence required for practice.[10,11] A student being trained to be a future healthcare practitioner should be able to calculate drug dosage accurately; however, insufficient mathematics skills are frequently overlooked, potentially leading to further negative effects. Despite the fact that studies evaluating mathematical ability among other students exist both locally and internationally, research assessing mathematical skills among undergraduate nurses in Saudi Arabia is lacking in the current era.[9-12] As part of the assessment, students' attitudes toward mathematics and their level of confidence were measured, which will influence their perception of their mathematical ability. Therefore, this study aimed to assess undergraduate nursing students' perceptions of mathematical skills.

MATERIALS AND METHODS

Study design, sample, and data collection

This paper-based cross-sectional study was conducted from June to July 2025. The searched sampling frame included all nursing students from a Saudi University in the Department of Nursing in Riyadh, Kingdom of Saudi Arabia. All nursing students admitted to their courses, over the age of 18 years, registered at the college, and willing to complete the written informed consent form were included in the study, whereas students who did not meet the inclusion criteria or were unable to complete the questionnaire due to personal reasons were excluded. Before filling out the questionnaire, the trained researcher explained the purpose and content of the study to the students, as well as the principles of voluntariness, anonymity, and confidentiality. Before the study, an informed consent form was obtained. The ethics committee of King Saud University's College of Medicine approved the study. The sample size for the current study was calculated by assuming approximately 400 populations enrolled at the time of study in the Nursing course at the Saudi university. Similar to the previous studies,[13-19] we calculated the required sample size using the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html.) with a 99% confidence interval and a pre-determined margin of error of 5%. Because we were unaware of the potential results for each question, we assumed that the response distribution for each question would equal 50%.[20] Although the sample size was projected to be 250, we opted to poll at least 350 students to ensure greater reliability.

Questionnaire design and data collection

The questionnaire used for this study was adopted based on previous studies published in a similar context.[11,12] It consisted of 16-item questions. The used questionnaire consisted of two sections. The first section included five questions dedicated to obtaining information about the student's demographics and personal information such as year of study, gender, and nationality, and the second section comprises 11 questions about asking for the rating of students' perceptions toward their mathematical skills and students' perceptions of numeracy. Initially, it was designed in the English language and then was translated into Arabic with the assistance of Arabic language specialists; therefore, it was formulated clearly and conceptually. The questionnaire was later validated in two steps. First, the initial draft was evaluated by a research expert in the related field to check the accuracy of the content and flow of the questionnaire. Second, a pilot study was conducted among a randomly selected sample of (n = 20) students to give their opinions. Reliability was determined using Cronbach's alpha, which was found to be 0.72. The data from the pilot study were not included in the final analysis.

The final questionnaire was printed and then distributed to potential participants during break time at nursing colleges, with the assistance of a data collector. For data collection, research was appointed. The data were collected using a convenience sampling technique, and data collection was followed until the required sample. Students who did not respond or were absentees were given time to respond to the study, and reminders were sent to the class leader to fill out the questionnaires. All information was collected simultaneously, and incorrect or missing data were not included in the analysis. The students were assured that the data would be used only for research and would be kept confidential throughout the study.

Statistical analysis

The collected data were checked for completeness, accuracy, and consistency before being fed for analysis. All data were analyzed using a statistical package for the social science (SPSS for Windows version 26). The descriptive statistics were calculated, including frequencies (*n*) and percentages (%)of the relevant factors. Chi-square and Fisher's exact test were used to derive an association between the rating of mathematical knowledge perception and frequency of usage of the calculator with the sociodemographic parameters of study subjects. $P < 0.05$ were used as a cut-point for statistical significance.

RESULTS

Socio-demographic characteristics of participants

Two hundred and forty-six (n = 246) nursing students participated in the survey. Out of which 191 (77.6%) were male and 55 (22.4%) were female. More than half (54.8%) were aged between 19 and 25 years old, and the number of students from the 1st year to the 4th year was 60 (24.4%), 73 (29.7%), 56 (22.8%), and 57 (23.3%), respectively. Among the participants, majority of the students, 182 (74%), were from BSC nursing, while most enrolled subjects were Saudi nationals, 174 (70.7%). Table 1 presents the detailed demographic characteristics of the participants.

Table 1: Demographic characteristics and basic information of the study sample (n=246)

Characteristics	Frequency (n)	Percentage
Gender		
Male	191	77.6
Female	55	22.4
Age		
18	26	10.6
19–25	135	54.9
26–30	52	21.1
31–35	20	8.1
>36	13	5.3
Education		
1st-year	60	24.4
2nd year	73	29.7
3rd year	56	22.8
4th-year	57	23.2
Degree		
Bachelors in Nursing	182	74.0
Masters in Nursing	50	20.3
Diploma in Nursing	14	5.7
Nationality		
Saudi	174	70.7
Non-Saudi	72	29.3

Perceptions of nursing students toward numeracy

Table 2 describes the nursing students' perceptions of numeracy. Nearly (57.3%) of students claimed that they studied or were studying mathematics during their nursing course (n = 141). While 56.9% show agreement with the statement that their ability to perform mathematical calculations related to drug dosing would be important to them as future practicing nurses. In this study, we observed that 43.9% of the participants always used a calculator when carrying out calculations, while two-fifths of the participants used a calculator sometimes [Figure 1]. Regarding teaching numeracy skills in college, almost 40.7% agreed that adequate teaching provided by the school of nursing concerning numeracy skills needed to complete the nursing degree in particular, when asked participants, about sufficient support within the school of nursing with problems encountered by students with calculations 42.7% believed in the statement. More than one-third of the students claimed that they would benefit from extra classes in basic mathematics. Almost 32% of participants agreed that there would be a support network available for those who have difficulties with mathematics. When asked about the rating of mathematical ability, more than one-third claimed good, 23.6% excellent, and 20.7% fair, respectively. In addition, 56.5% agreed that nursing students should be taught basic mathematics at university.

Table 3 shows the association between calculator usage during their nursing course at university and study subject characteristics such as gender, age, education, degree, and studying math courses in nursing. The findings found no significant association between students' characteristics (age, gender, degree, and education) and the frequency of use of calculators ($P > 0.005$). Likewise, studying a mathematics course at university was also not significantly associated with calculator usage ($P > 0.005$).

Table 4 illustrates the relationship between perceptions of Nursing students toward mathematical ability and their characteristics. A significant association was found between participant characteristics, such as age, ($P < 0.0001$) educational level ($P < 0.0001$), degree ($P < 0.0001$), and the rating of self-reported perceptions of mathematical ability ($P < 0.0001$). Whereas self-reported perceptions of mathematical skills are also significantly associated with studying a mathematics course ($P < 0.0001$).

DISCUSSION

To the best of our knowledge, there were limited studies that evaluated the knowledge of mathematical skills among undergraduate nursing students in Saudi Arabia. Not much

Table 2: Perceptions of nursing students toward numeracy (*n*=246)

Question	Frequencies (*n*)	Percentage
Did you study or studying any math courses in nursing?		
Yes	141	57.3
No	87	35.4
Not applicable	18	7.3
Do you feel that the ability to perform mathematical calculations related to drug dosing will be important to you as a future practicing nurse?		
Yes	140	56.9
No	80	32.5
Not applicable	26	10.6
How often do you use a calculator when carrying out calculations?		
Always	108	43.9
Some Times	66	26.8
Rarely	40	16.3
Never	18	7.3
Don't Have Math Subject	14	5.7
Do you feel that there is adequate teaching provided by the School of nursing concerning numeracy skills needed to complete the Nursing degree?		
Yes	100	40.7
No	61	24.8
I don't know	85	34.6
Do you think there is sufficient support within the school of nursing concerning problems encountered by students with calculations?		
Yes	105	42.7
No	0	32.5
I don't know	61	24.8
Do you think there should be more of an emphasis placed on medical calculations (drug dosing) within the nursing degree course?		
Yes	104	42.3
No	76	30.9
I don't know	66	26.8
Do you feel that you would benefit from extra classes in basic mathematics?		
Yes	84	34.1
No	98	39.8
I don't know	64	26.0
Is there a support network available for those who have difficulties with mathematics?		
Yes	78	31.7
No	96	39.0
I don't know	72	29.3
How would you rate your mathematical ability?		
Excellent	58	23.6
Good	83	33.7
Fair	51	20.7
Poor	38	15.4
I Did Not Study	16	6.5
Since starting your nursing degree do you feel more or less able to perform mathematical calculations?		
More Able	111	45.1
No Change	62	25.2
Less Able	44	17.9
I Did Not Study	29	11.8
Nursing students should be taught basic mathematics at university.		
Agree	139	56.5
Neither Agree nor Disagree	69	28.0
Disagree	38	15.4

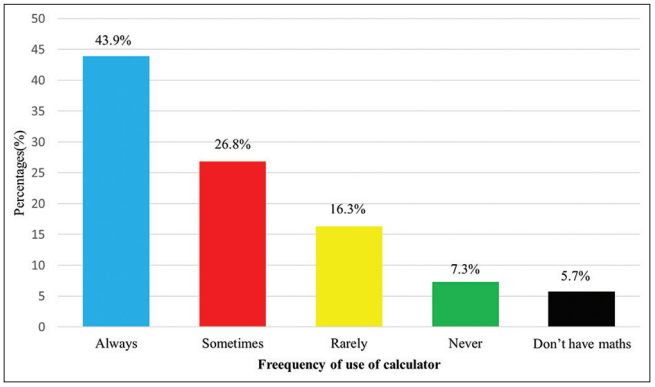

Figure 1: Use of calculator when carrying out calculations

literature was identified nationally and internationally about perceptions and views of undergraduate nursing students towards Mathematics and its impact on health care. Additionally, this study examines the sociodemographic factors that influence their mathematical skills. The findings of the current study would add a significant contribution to the efficacy and safety of drug use and administration among patients because a lack of calculating skills causes Medication Errors not only in Saudi Arabia but also in other countries, and this would serve as a reference for the much-needed upcoming studies.[23-25] The findings could also be used by educational and healthcare institutions to develop appropriate training initiatives to improve nursing and other healthcare professionals' knowledge and attitude toward mathematics and learning goals and outcomes.

This study found the overall understanding of the student's concept of rating their mathematical ability. However, in

Table 3: Association between the demographics of the nursing undergraduates and frequency of use of calculator when carrying out calculations

Demographics	Frequency of use of calculator when carrying out calculations					*P*-value
	Always *n* (%)	Some times *n* (%)	Rarely *n* (%)	Never *n* (%)	Don't have Math's subject *n* (%)	
Gender						
Male	83 (43.5)	54 (28.3)	34 (17.8)	12 (6.3)	8 (4.2)	0.159
Female	25 (45.5)	12 (21.8)	6 (10.9)	6 (10.9)	6 (10.9)	
Age						
<18	16 (61.5)	10 (38.5)	0 (0)	0 (0)	0 (0)	0.151
18–25	59 (43.7)	34 (25.2)	22 (16.3)	12 (8.9)	8 (5.9)	
26–30	20 (38.5)	14 (26.9)	8 (15.4)	6 (11.5)	4 (7.7)	
31–35	8 (40)	4 (20)	6 (30)	0 (0)	2 (10)	
>36	5 (38.5)	4 (30.8)	4 (30.8)	0 (0)	0 (0)	
Education						
1st-year	27 (45)	19 (31.7)	6 (10)	6 (10)	2 (3.3)	0.164
2nd year	31 (42.5)	20 (27.4)	15 (20.5)	4 (5.5)	3 (4.1)	
3rd year	32 (57.1)	12 (21.4)	8 (14.3)	2 (3.6)	2 (3.6)	
4th-year	18 (31.6)	15 (26.3)	11 (19.3)	6 (10.5)	7 (12.3)	
Degree						
Baccalaureate in Nursing	80 (44)	46 (25.3)	32 (17.6)	16 (8.8)	8 (4.4)	0.396
Masters in Nursing	24 (48)	14 (28)	6 (12)	2 (4.0)	4 (8.0)	
Diploma in Nursing	4 (28.6)	6 (42.9)	2 (14.3)	0 (0)	2 (14.3)	
Did you study any math courses in nursing?						
Yes	69 (48.9)	46 (32.6)	18 (12.8)	6 (4.3)	2 (1.4)	0.058
No	31 (35.6)	16 (18.4)	18 (20.7)	10 (11.5)	12 (13.8)	
I don't have the course	8 (44.4)	4 (22.2)	4 (22.2)	2 (11.1)	0 (0)	

our study, only a small percentage (33.7%) of students were good (n = 246), in mathematical ability, while the previous study reported the majority of the (51.14%) students were found to have the good mathematical ability.26Similarly another study among pharmacy students by Alrabiah *et al*. reported majority of (90.0%)the students had excellent and/or good mathematical ability.[12] According to these results, when participants believe they are good at mathematics, they also feel confident about their math skills in clinical practice. Prior studies reported that nursing students had sufficient mathematical skills (78.9%).[26] For example, nursing students understand the concept of mathematics more than they possess their ability to perform mathematical calculations related to drug dosing.[26] In a previous study, it was reported that students who were excellent in mathematics, took the long syllabus, and were satisfied with the amount of medication calculation instruction, were favorably inclined towards mathematics and dosage calculation, and rated their self-rated basic level and Higher-level skills as adequate.[25,26]

Furthermore, Grandell *et al*. reported that nursing students found it difficult to learn medication calculations, and their skills were insufficient.[24] Nursing students ought to have a solid knowledge base of mathematical skills during the undergraduate nursing program as this impact their practice post-qualification. Although the overall number of nursing students who studied Math during their course period was 57.3%, this study shows that nursing students have a moderate understanding of mathematical skills, suggesting that the nursing curriculum in Saudi Arabia could adequately address the concept. In our study, 45.1% of students were able to perform calculations since starting their course, while a study conducted on undergraduate entrants of nursing, midwifery, and pharmacy reported that nursing, and to a lesser extent midwifery, students showed poor performance.[26] There is an urgent need to review the nature of education received by nursing students on performing computations. A significant association was found between participant characteristics, such as age, educational level, degree, and studying a mathematics course, with the rating of the perceptions

Table 4: Association between the demographics of the nursing undergraduates and self-reported perceptions toward the mathematical ability

Demographic	Self-reported perceptions toward mathematical ability					*P*-value
	Excellent *n* (%)	Good *n* (%)	Fair *n* (%)	Poor *n* (%)	I don't have the course *n* (%)	
Gender						
Male	48 (25.1%)	61 (31.9%)	38 (19.9%)	30 (15.7%)	14 (7.3%)	0.572
Female	10 (18.2%)	22 (40%)	13 (23.6%)	8 (14.5%)	2 (3.6%)	
Age						
<18	10 (38.5%)	4 (15.4%)	8 (30.8%)	0	4 (15.4%)	0.0001
18-25	38 (28.1%)	55 (40.7%)	24 (17.8%)	10 (7.4%)	8 (5.9%)	
26-30	6 (11.5%)	9 (17.3%)	13 (25%)	22 (42.3%)	2 (3.8%)	
31-35	2 (10%)	10 (50%)	4 (20%)	4 (20%)	0 (0)	
>36	2 (15.4%)	5 (38.5%)	2 (15.4)	2 (15.4%)	2 (15.4%)	
Education						
1st-year	29 (48.3%)	9 (15%)	13 (21.7%)	5 (8.3%)	4 (6.7%)	0.0001
2nd year	12 (16.4%)	25 (34.2%)	23 (31.5%)	9 (12.3%)	4 (5.5%)	
3rd year	6 (10.7%)	27 (48.2%)	7 (12.5%)	8 (14.3%)	8 (14.3%)	
4th-year	11 (19.3%)	22 (38.6%)	8 (14%)	16 (28.1%)	0 (0%)	
Degree						
Baccalaureate in Nursing	44 (24.2%)	65 (35.7%)	33 (18.1%)	26 (14.3%)	14 (7.7%)	0.0001
Masters in Nursing	10 (20%)	18 (36%)	16 (32%)	4 (8%)	2 (4%)	
Diploma in Nursing	4 (28.6%)	0 (0%)	2 (14.3%)	8 (57.1%)	0 (0%)	
Did you study any math courses in nursing?						
Yes	44 (31.2%)	45 (31.9%)	24 (17%)	14 (9.9%)	14 (9.9%)	0.0001
No	8 (9.2%)	34 (39.1%)	21 (24.1%)	22 (25.3%)	2 (2.3%)	
I don't have the course	6 (33.3%)	4 (22.2%)	6 (33.3%)	2 (11.1%)	0 (0%)	

of mathematical knowledge (P = 0.0001). No significant associations were found between participant characteristics, such as gender, age, educational level, degree, and studying a mathematics course, with the frequency of use of a calculator.

Our study claims that 45.9% of Students always use a calculator while doing calculations. These findings were comparable to previous findings by Alrabiah *et al*. and Barry *et al*. among pharmacy students.[12,18] For instance, Alrabiah *et al*. revealed that 59.1% of students used a calculator, while Barry *et al*. reported 50% of students sometimes used calculators.[12,27] Use of calculators among students and practicing nurses, even for the simplest calculations in daily life and clinical practice, is a common factor, and it may be considered as the reason for the failure of the mathematical skill test.[28] The most common justification offered by students for using calculators is that they frequently find it impossible to do so.[12,27] It is advantageous to know how to perform some calculations on their own, whether or not they utilize calculators in their nursing careers. Anybody can make math mistakes, whether they are done by hand or using a calculator. Such errors may have detrimental effects on the health and safety of patients.[12,27]

Studies examining the variation between knowledge or perceptions of mathematical ability and the frequency of use of calculators among undergraduate nursing students were currently lacking. Although some studies exist among pharmacy students[12] and reported no significant association was reported between the rating of student perceptions toward their mathematical skills and characteristics of participant (age, gender, year of study). On the other hand, the previous study reported a significant association between the frequency of use of a calculator for calculations and self-reported perceptions.[12] In this study, there was a statistically significant association between participant characteristics such as age, educational level, year of study, and self-reported mathematical perception. While studying mathematical subjects during their nursing course, gender was not significantly associated with it. However, regarding the association between socio-demographic factors and the frequency of use of the calculator, the findings reported no significant association.

It is alarming that only 34.1% of students agree, and 39.8% are undecided about whether extra classes in basic mathematics would benefit them or not. Therefore, a test of students' mathematics skills at the beginning of clinical practice, and periodically during nursing programs, would reveal those who need extra support. Those students who consider their skills inadequate may require remedial instruction. In addition, it is useful for students to analyze the errors they have made in their drug calculation exams. Generally speaking, better curriculum planning can result in

better instruction and help students become more competent at calculating medications. The present study sheds light on the relationship between attitude towards mathematics and learning goals and outcomes. However, studies on mathematical skills assessment among students were lacking or limited; therefore, this study would add beneficial knowledge in the research area and would serve as a future reference for upcoming studies.

The fact that our study is the first of its kind to examine mathematical abilities from the standpoint of Arabic features nurses as their distinguishing characteristics, especially among nursing students. The perceptions of the nursing students were ascertained through a variety of questionnaires, and it was discovered that the majority of them stated that they had studied or were studying mathematics and believed that a basic mathematics course would be included in the nursing curriculum. In addition, it was discovered that the majority of them were capable of performing calculations after enrolling in the nursing program, and it was well-known that mathematics plays a beneficial role in efficient clinical practice and patient care. The results, in particular, demonstrate that participants' comfort levels with their conceptions of the term "mathematics" and its use in individualized medicine. The first drawback of this study is that it was self-exploratory with a limited sample size. Furthermore, because just one Saudi university and one region of the kingdom were included in the study, it was impossible to generalize because the participants were not representative of other academic institutions on a national and worldwide scale. Despite these drawbacks, our research suggests that greater focus be given to educating students on the value of the mathematical abilities needed by healthcare professionals to enhance the health of the entire community. It is also suggested to carry out a thorough survey that welcomes participation from nursing students from all parts of Saudi Arabia and all levels of expertise. Future studies should strive to use a bigger sample size to thoroughly confirm the results.

CONCLUSION

The present study attempted to portray the profiles of nursing students of Saudi University in the Riyadh region of Saudi Arabia, according to their background characteristics and perceptions of mathematics skills. The current findings reported that one-third of nursing students reported good mathematical ability, and nearly half of them used a calculator. Furthermore, a significant association was found between age, educational level, and degree concerning self-reported perceptions of mathematical ability. Students should be aware of the importance and relevance of learning and studying mathematics. Lecturers should offer academic support, inclusive teaching practices, and encouragement to weaker students and students with learning disabilities. A unified approach between mathematics courses is crucial if we like to influence how nursing students see the use of mathematics in their degrees and future career should be identified as a distinct competency in nursing curricula, continuing education programs, and administrating a math proficiency entrance exam at the university level serve as examples of such strategies.

INFORMED CONSENT STATEMENT

Informed consent was obtained from students, which confirmed that their data would be kept confidential and used exclusively for research purposes.

CONSENT FOR PUBLICATION

All the authors have given their final approval of the manuscript and agreed to publication.

DATA AVAILABILITY STATEMENT

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

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