

Effectiveness of Structured Teaching Program on Knowledge Regarding Arterial Blood Gas Analysis among Nursing Students

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Received: 11th August, 2023

Accepted: 4th September, 2023

Published: 31th December, 2023

ABSTRACT

Background: Arterial blood gas (ABG) analysis measures blood pH, oxygen (O₂), and carbon dioxide (CO₂) levels. Normal pH is 7.35-7.45, PaO₂ ranges from 70-100 mm Hg, PaCO₂ is 35-45 mm Hg, and SaO₂ is 93-98%. HCO₃ normal value is 22-26 meq/l. This study assesses the effectiveness of a structured teaching program on arterial blood gas analysis knowledge among nursing students.

Methods: A pre-experimental study with a one-group pretest-posttest design evaluated the effectiveness of a structured teaching program on Arterial Blood Gas analysis knowledge among nursing students from two Purbanchal University-affiliated colleges. Narayani Samudayik Nursing College was chosen using a probability-based simple random sampling lottery method. Enumerative sampling was employed to select respondents for the study.

Results: The study found that 87% of respondents initially had an average knowledge level of arterial blood gas analysis, with 13% having adequate knowledge. After intervention, 82.6% demonstrated adequate knowledge, and 17.4% maintained an average level. Mean knowledge scores significantly increased from 67.15 to 87.7 in pretest and posttest, respectively ($p < 0.001$). The results affirm the intervention's effectiveness in improving participants' understanding of arterial blood gas analysis.

Conclusion: Most respondents had average knowledge of ABG analysis. Following the structured teaching program, the majority achieved adequate knowledge, demonstrating its significant positive impact in enhancing nursing students' understanding of ABG analysis.

Keywords: knowledge; arterial blood gas; structured teaching programme; nursing students.

INTRODUCTION

Arterial blood gas (ABG) analysis measures blood pH, oxygen, and carbon dioxide levels, crucial for diagnosing respiratory conditions. Normal values guide acid-base balance and lung function assessment, while acidosis and alkalosis, arising from metabolic or respiratory issues, have four subtypes.¹ ABG analysis aids in determining the imbalance type and assessing kidney compensation.² Its accurate interpretation is vital for timely responses to acid-base balance disturbances.³ In the ICU, ABG values provide objective information about a patient's acid-base status, aiding in identifying disorders and assessing the body's compensation mechanisms.⁴ Studies in India and Nepal reveal limited ABG knowledge among nursing students, underscoring the need for structured teaching programs.⁵⁻⁶ Proposed research in Nepal aims to address this gap by evaluating the effectiveness of such a program in enhancing ABG analysis knowledge

among nursing students, especially crucial in the context of respiratory problems faced by people in Nepal.

METHODS

A pre-experimental study utilized a one-group pretest-posttest design to evaluate the impact of a structured teaching program on Arterial Blood Gas (ABG) analysis knowledge among students in two Purbanchal University-affiliated nursing colleges. Ethical approval was taken from institutional review committee of Shree Medical and Technical College, Bharatpur, Chitwan. Data was collected using non probability (enumerative) sampling technique. Information was collected from Nursing students from different years (second year=20, third year=20, fourth year=29). Data was collected using a semi-structured self-administered questionnaire. Data was collected from students (pretest) followed by a posttest after a week of structured teaching on ABG analysis. Data

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was entered and analysis by using SPSS-17. Data was analyzed using descriptive and inferential statistical tools. In the descriptive statistics for categorical variables frequency and percentage were calculated while for continuous variables mean, standard deviation. In the inferential statistics Chi-square test were used to compare pretest and post test score. P-value <0.05 was considered as statistically significant.

RESULTS

Majority (56.5%) were 20-22 years of age group whereas, 43.5% were above 22 years. Mean age of the respondents was 22.1 years with 1.23 years of standard deviation, minimum of 20 and maximum of 24 years. Regarding academic level, 42% of the respondents were

Table 1. Socio-demographic Characteristics of the Respondents. (n=69)	
Variables	Frequency (%)
Age (years)	
<22	39(56.5)
>22	30(43.5)
Mean \pm SD = 22.08 \pm 1.23	
Academic level	
B.Sc. Nursing 2nd year	20(29)
B.Sc. Nursing 3rd year	20(29)
B.Sc. Nursing 4th year	29(42)
Clinical exposure at critical care	
Yes	61(88.4)
No	8(11.6)
Ever observed Arterial Blood Gas analysis procedure	
Yes	60(87)
No	9(13)
Ever performed Arterial Blood Gas analysis in Clinical Posting	
Yes	8(11.6)
No	61(88.4)
Attended Arterial Blood Gas analysis class/presentation Before	
Yes	54(78.3)
No	15(21.7)

from fourth year of B.Sc. nursing whereas, 29% of each were from second year and third year respectively. It is found that most (88.4%) of the respondents were clinically exposed at critical care. Concerning ever observed arterial blood gas analysis procedure in patient during clinical posting, most (87%) of the respondents respond yes. With respect to ever performed arterial blood gas analysis in clinical posting, most (88.4%) of the respondents did not performed the analysis in their clinical posting. Regarding attended arterial blood gas analysis class/presentation before, above three-fourth (78.3%) of the respondents attended the analysis class/presentation (Table 1). Most (87%) of the respondents had average level of knowledge on arterial blood gas analysis and 13% of them had adequate level of knowledge in the pretest whereas, most (82.6%) of the respondents had adequate and 17.4% had average level of knowledge in the posttest. Mean knowledge score in pretest was 67.15 with 9.7 standard deviation whereas, in the posttest, mean knowledge score was 87.7 with 8 standard deviation (Table 2).

Table 2. Respondent's Level of Knowledge regarding Arterial Blood Gas Analysis. (n=69)	
Level of Knowledge	Frequency (%)
Pretest	
Average	60(87)
Adequate	9(13)
Mean \pm SD= 67.15 \pm 9.7	
Posttest	
Average	12(17.4)
Adequate	57(82.6)
Mean \pm SD=86.7 \pm 8.0	

The association of pretest and posttest level of knowledge was found to be statistically significant ($\chi^2=66.91$, $p<0.001$) (Table 3).

The pretest and posttest mean knowledge score was found to be statistically significant i.e., $t(df=68)=-13.89$, $p<0.001$. Hence, alternative hypothesis (H1) was accepted (Table 4).

The respondent's pretest level of knowledge is statistically not significant with their age group ($\chi^2= 0.433$, $p= 0.722$), academic level ($\chi^2= 3.711$, $p= 0.156$), clinical exposure at critical care ($\chi^2= 1.141$, $p= 0.278$),

Level of Knowledge	Average	Adequate	c2 value	p Value
Pretest	60 (87.0%)	9 (13.0%)	66.91	<0.001
Posttest	12 (17.4%)	57 (82.6%)		

Test	Mean Score \pm SD	Min. Score	Max. Score	t Value	p-Value
Pretest	20.14 \pm 2.91	16	28	-13.89	<0.001
Posttest	26.01 \pm 2.40	18	30		

ever observed ABG analysis procedure in clinical posting ($\chi^2= 0.769$, $p= 0.333$), ever performed ABG analysis in clinical posting ($\chi^2= 1.141$, $p= 0.279$) and sure at critical care ($\chi^2= 3.517$, $p= 0.095$) and ever performed ABG analysis in clinical posting ($\chi^2= 0.171$, $p= 0.543$) (Table 6).

Variables	Pretest level of knowledge		Chi-square value	p-value
	Average	Adequate		
Age (years)				
20-22	33(84.62)	6(15.38)	0.433	0.722*
> 22	27(90)	3(10)		
Academic level				
B.Sc. Nursing 2nd year	15(75)	5(25)	3.711	0.156**
B.Sc. Nursing 3rd year	19(95)	1(5)		
B.Sc. Nursing 4th year	26(89.66)	3(10.34)		
Clinical exposure at critical care				
Yes	54(88.52)	7(11.48)	1.141	0.278*
No	6(75)	2(25)		
Ever observed ABG analysis procedure in clinical posting				
Yes	53(88.33)	7(11.67)	0.769	0.333*
No	7(77.78)	2(22.22)		
Ever performed ABG analysis in clinical posting				
Yes	6(75)	2(25)	1.141	0.279*
No	54(88.52)	7(11.48)		
Attended ABG analysis class/presentation before				
Yes	45(83.33)	9(16.67)	2.875	0.189*
No	15(100)	0		

* Fisher's Exact Test ** Likelihood Ratio

attended ABG analysis class/ presentation before ($\chi^2= 2.875$, $p= 0.189$) (Table 5).

The respondent's posttest level of knowledge is statistically significant with their age group ($\chi^2= 4.249$, $p= 0.039$), academic level ($\chi^2= 14.838$, $p= 0.001$), ever observed ABG analysis procedure in clinical posting ($\chi^2= 7.174$, $p= 0.018$) and attended ABG analysis class/ presentation before ($\chi^2= 14.708$, $p= 0.003$) and not significant with clinical expo-

DISCUSSION

This study was conducted to assess the effectiveness of structured teaching program on knowledge regarding Arterial Blood Gas analysis among nursing students of Narayani Samudayik Nursing College, Chitwan. A total of 69 students are studying BSc. Nursing students across different years (second year= 20, third year= 20, fourth year=29) were taken for the purpose of this study.

Result shows that among the respondents participated in this study, majority 56.5% were 20-22 years of age group whereas, 43.5% were above 22 years. This

respondents respond yes. With respect to ever performed arterial blood gas analysis in clinical posting, most 87% of the respondents did not performed the

Table 6. Association of Posttest Knowledge with Socio-demographic Variables. (n=69)

Variables	Posttest Level of knowledge		Chi Value	p Value
	Average	Adequate		
Age Group				
20-22	10(25.64)	29(74.36)	4.249	0.039*
> 22	2(6.67)	28(93.33)		
Academic level				
B.Sc. Nursing 2nd year	9(47.37)	10(52.63)	14.838	0.001**
B.Sc. Nursing 3rd year	1(5)	19(95)		
B.Sc. Nursing 4th year	2(6.67)	28(93.33)		
Clinical exposure at critical care				
Yes	9(14.52)	53(85.48)	3.517	0.095*
No	3(42.86)	4(57.14)		
Ever observed ABG analysis procedure in clinical posting				
Yes	7(12.07)	51(87.93)	7.174	0.018
No	5(45.45)	6(54.55)		
Ever performed ABG analysis in clinical posting				
Yes	1(25)	3(75)	0.171	0.543*
No	11(16.92)	54(83.08)		
Attended ABG analysis class/ presentation before				
Yes	8(12.50)	56(87.50)	14.708	0.003*
No	4(80)	1(20)		

* Fisher's Exact Test

** Likelihood Ratio

finding was contradictory with the findings of study conducted in Bombay Hospital College of Nursing, Indore, M.P, India where majority of 67.5% B.Sc. Nursing students were in the age group of 20-21 years and 32.5% were in the age group of 18-19 years.¹⁰ Regarding academic level, 42% of the respondents were from fourth year of B.Sc. Nursing whereas, 29% of each were from second year and third year respectively. It is found that most 88.4% of the respondents were clinically exposed at critical care. The above result was supported by the study conducted in Bombay Hospital College of Nursing, Indore, MP, India in which the most 85% of the respondents were clinically exposed at critical care.¹⁰ Concerning ever observed arterial blood gas analysis procedure in patient during clinical posting, most 87% of the

analysis in their clinical posting. Regarding attended arterial blood gas analysis class/presentation before, above three-fourth 78.3% of the respondents attended the analysis class/presentation. The findings were similar to study conducted at Lumbini Medical College and Teaching Hospital, palpa where most 89.2% of the respondents respond yes as observed arterial blood gas analysis procedure in patient during clinical posting. Likewise, most 89.2% of the respondents did not performed the analysis in their clinical posting whereas two third 69.2% of the respondents attended the analysis class/presentation.⁶ This study revealed that, most 87% of the respondents had average level of knowledge on arterial blood gas analysis and only 13% of them had adequate level of knowledge in the pretest which was inconsistent with the

result obtained from the study conducted with staff nurses at selected hospital, Chennai, where most 90% of the respondents had inadequate knowledge and only 10% had average knowledge during pre-test.¹³ Similarly, most 82.6% of the respondents had adequate and only 17.4% had average level of knowledge in the posttest which was consistent with the result obtained from the study conducted with staff nurses at selected hospital, Chennai where most 80% of the respondents had adequate knowledge and only 20% had average level of knowledge during post-test.¹³ The study showed that mean knowledge score in pretest was 67.15 with 9.7 standard deviation whereas, in the posttest, mean knowledge score was 87.7 with 8 standard deviation whereas the result further shows that pretest and posttest mean knowledge score is statistically significant i.e., $t(df=68) = -13.89$, $p < 0.001$ which was supported by the study conducted at Lumbini Medical College and Teaching Hospital, palpa in which pre-test mean was 23.46 with 4.139 standard deviation. Similarly, in post-test mean was 28.38 with 3.652 standard deviation. The enhancement mean was 4.923. Paired 't' test value is 7.644, $p < 0.001$. therefore, there is a significant difference in the pretest and posttest knowledge score after attending a Structured Teaching Programme. Hence, alternative hypothesis (H1) was accepted.⁶ This study revealed that the respondent's pretest level of knowledge is statistically not significant with their age group ($\chi^2 = 0.433$, $p = 0.722$), academic level ($\chi^2 = 3.711$, $p = 0.156$), clinical exposure at critical care ($\chi^2 = 1.141$, $p = 0.278$), ever observed ABG analysis procedure in clinical posting ($\chi^2 = 0.769$, $p = 0.333$), ever performed ABG analysis in clinical posting ($\chi^2 = 1.141$, $p = 0.279$) and attended ABG analysis class/presentation before ($\chi^2 = 2.875$, $p = 0.189$). This finding was corresponding with the findings of studies

conducted in Punjab, Bombay and Chennai where the socio-demographic variables had not significant association with level of knowledge on pre-test.

During posttest level of knowledge is statistically significant with their age group ($\chi^2 = 4.249$, $p = 0.039$), academic level ($\chi^2 = 14.838$, $p = 0.001$), ever observed ABG analysis procedure in clinical posting ($\chi^2 = 7.174$, $p = 0.018$) and attended ABG analysis class/presentation before ($\chi^2 = 14.708$, $p = 0.003$) and not significant with clinical exposure at critical care ($\chi^2 = 3.517$, $p = 0.095$) and ever performed ABG analysis in clinical posting ($\chi^2 = 0.171$, $p = 0.543$). This finding was contradictory with the finding of studies conducted in Punjab, Bombay and Chennai where the socio-demographic variables had not significant association with level of knowledge on post-test.

CONCLUSIONS

Teaching Programme significantly enhanced knowledge of arterial blood gas analysis. Prior to the program, 87% had average knowledge, increasing to 82.6% with adequate knowledge post-program. Mean knowledge scores improved from 67.15 to 87.7, indicating the program's effectiveness in elevating understanding. Thus, Structured teaching program had significant effect on the level of knowledge of respondents.

RECOMMENDATION

Structured health teaching can be provided to student nurses in order to enhance their knowledge regarding ABG Analysis.

ACKNOWLEDGEMENT

We are thankful to all the students for their valuable participation in this research during data collection.

Conflict of Interest: None

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Citation: Ghimire B, Acharya A, Upadhyay HP. Effectiveness of Structured Teaching Program on Knowledge Regarding Arterial Blood Gas Analysis among Nursing Students. *JNHLS*. 2023; 2(2):103-08.