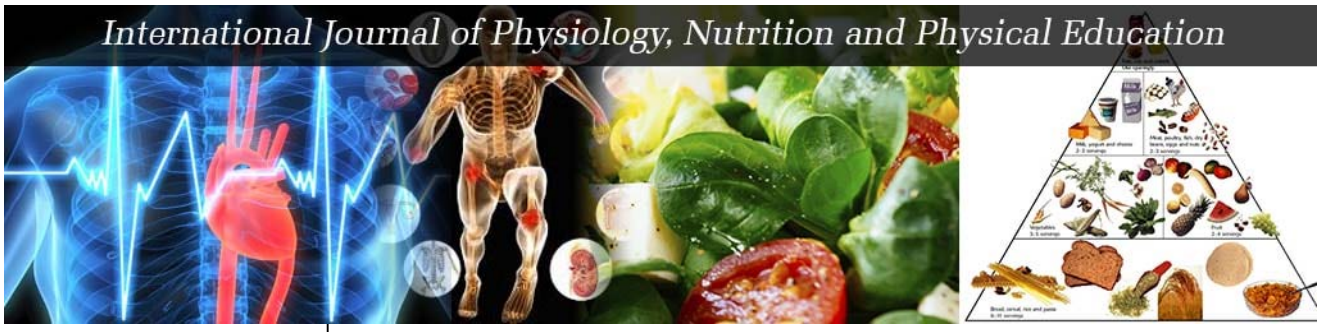

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Case-based learning in nutrition for first-year MBBS students

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Abstract
This complete enumeration, comparative, before-and-after study (without controls) was conducted at a municipal medical college in Western India to compare the cognitive domain scores of the participating first-year medical students before and after an educational intervention (case-based learning). The pre-test was conducted after the conventional lectures on nutrition. Participants were randomly assigned to two sub-groups. The same faculty jointly exposed participants in each sub-group to identical case scenarios pertaining to nutrition-related conditions and deficiency diseases and encouraged discussion among the participants. The post-test was conducted after case-based learning, using a questionnaire that was identical to that of the pre-test. The mean score increased from 5.39±1.51 (pre-test) to 7.11±1.19 (post-test) with statistically significant difference (P<0.00001). The gender-wise differences in pre- and post-test scores were not statistically significant. The results of the present study imply that nutrition-related case-based learning enhanced cognitive domain scores of first-year medical students.

Keywords: Case-based learning, Cognitive domain scores, Nutrition

1. Introduction
In case-based learning (CBL), small groups of students discuss a case scenario, which pertain to a clinical situation wherein clinical signs and symptoms, vital parameters and laboratory results are provided. The direction of discussion may be guided by a facilitator.
Studies have reported that early clinical exposure motivated students, [1] increased their self-confidence, [2-5] enhanced their level of satisfaction with their studies, [6] sensitized them about the psycho-social problems faced by patients, [7,8] and reinforced students' interest in maintaining a healthy diet and in prevention of chronic disease [9]. Students also become aware of the cost implications when various diagnostic tests are ordered [10]. CBL amplifies higher-order thinking and cognitive learning and can facilitate the development of skills that are identified as essential for overcoming the multi-faceted problems that are likely to be encountered in professional practice [11].
The Medical Council of India's "Vision-2015" document has emphasized early clinical exposure as one of the strategies to improve medical education, [12] but till date, this has not been made obligatory. Early clinical exposure may assist in creating interest in basic sciences amongst pre-clinical students by making them know the practical applications. Though doctors convey the importance of prudent dietary choices to their patients, they seldom receive formal training in nutrition as undergraduate medical students [13]. As a consequence of the epidemics of lifestyle and nutrition-related diseases, it is necessary for medical teachers to devise and deploy creative learning methods to ascertain that medical students are competent to discern the association between lifestyle and chronic disease and promote a healthy lifestyle [14]. Applications that incorporate video interactions, case simulations, and problem-solving formats have been found to be particularly effective [13].
The objectives of the present study were to compare the cognitive domain scores of the participating first-year MBBS students after attending conventional lectures on nutrition (using a pre-CBL test) and to compare these with the cognitive domain scores after using CBL as the educational intervention (using an identical post-CBL test).

2. Materials and Methods

2.1 Place of study

This complete enumeration, comparative, before-and-after study (without controls) was conducted at Rajiv Gandhi Medical College, a municipal medical college, which is located at Kalwa, Thane, about 30 kms from Mumbai city in Western India.

2.2 Inclusion criteria

All first-year MBBS students, aged 18 years and above, of either sex, who gave written informed consent to participate in the study.

2.3 Exclusion criteria

Those students who did not give written informed consent or were below 18 years of age or those who were absent during either pre- or post-test.

2.4 Procedure

After obtaining permissions from the Institutional Ethics Committee (IEC) and institutional authorities for conducting the study, the purpose of the study was explained to first-year MBBS students and written informed consent was obtained from those willing to participate in the study. Teachers from the Departments of Physiology (SB, RW) and Community Medicine (AM, SK) conducted lectures on nutrition and its applied aspects, as per syllabus for the first-year MBBS course. The pre-test, conducted after the lectures, comprised ten questions (one mark per question; total ten marks). For CBL, the participating students were randomly assigned (using lottery system) to two sub-groups comprising 30 and 27 students to enable small-group discussion. Each sub-group was identically exposed to case-based learning modules using case scenarios pertaining to nutrition-related conditions and deficiency diseases. The same faculty jointly guided the discussion and encouraged participation of all students in each sub-group. The post-test was conducted after CBL, using a questionnaire that was identical to that of the pre-test. The scores from students in the two sub-groups were merged for analyzing results of the pre- and post-tests. The outcome studied was the difference in cognitive domain scores after attending lectures (by a pre-test) and CBL (by a post-test).

2.5 Statistical analysis

The data were statistically analyzed using EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA). Categorical data were presented as percentages and continuous data as Mean and Standard Deviation (SD). Confidence interval (CI) was stated as: [Mean-(1.96)* Standard Error)] - [Mean + (1.96)* Standard Error)]. Karl Pearson's Chi-square test with Mantel-Haenszel correction (where required) was used. The standard error of difference between two means was calculated. Statistical significance was determined at $p<0.05$.

3. Results and Discussion

A total of 57 students (females: n=29; 50.87% and males: n=28; 49.13%) participated in the study.

3.1 Scores obtained by all participating students

The mean score in the pre-test was 5.39±1.51 (95% CI: 4.83-5.94), while that in the post-test was 7.11±1.19 (95% CI: 6.80-7.41). The difference between the mean scores was highly significant (Z=6.754; $P<0.00001$). Similar results have been obtained by a study from Nashville (Texas), USA, which reported increased the percentage of correct responses amongst first-year medical students from 25% (pre-test) to 73.5% (post-test) [15]. Studies from Western India [16] and Central India [17] have also reported improved performance of medical students who had early clinical exposure. An American study concluded that nutrition-related knowledge can be enhanced through pre-clinical educational intervention and that the knowledge level can be retained through the clinical years. [18]

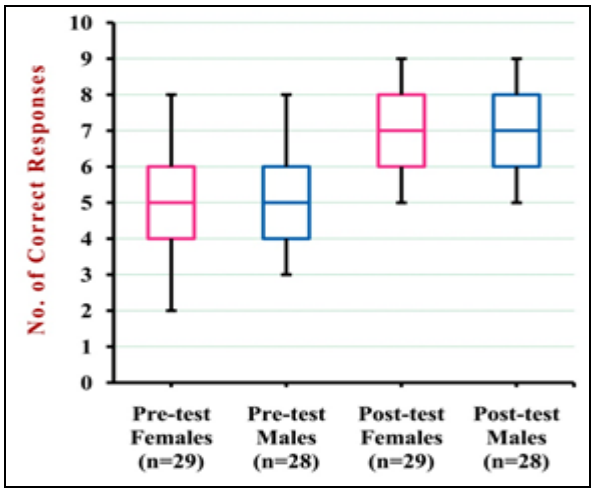

Fig 1: Box plot of correct responses in pre- and post-tests

The box plot (Fig. 1) reveals that the maximum, third quartile, median and first quartile of correct responses by female and male students were identical in the pre-test. The minimum correct response for female and male students in the pre-test was 2 and 3, respectively. In the post-test, the maximum, third quartile, median, first quartile and minimum of correct responses by female and male students were identical, indicating considerable improvement in cognitive domain scores. The gender-wise differences in pre- and post-test scores were not statistically significant in the present study. These results agree with that reported by other researchers [19, 20]. However, some studies [21, 22] have obtained contrasting results and have reported that female students had significantly greater nutrition knowledge as compared to their male counterparts.

3.2 Scores obtained by female students

The mean score obtained by 29 female students improved from 5.34±1.61 (95% CI: 4.76-5.93) in the pre-test to 7.14±1.33 (95% CI: 6.65-7.62) in the post-test. The difference between the mean scores was highly significant (Z=4.641; $P<0.00001$). The question-wise analysis of correct responses by female students (Table 1) reveals statistically significant differences between the pre- and post-test scores for question No. 3 ($P=0.028$), question No. 7 ($P= 0.036$) and question No. 9 ($P=0.019$). In contrast, a Sudan-based study [23] reported inadequate knowledge of nutrition among 350 female students.

Table 1: Question-wise correct responses by female students in pre- and post-tests

Q. No.	Females (n=29)		Chi square value #	*P* value	Odds Ratio
	Pre-test	Post-test			
1	12	16	1.104	0.293	0.574
2	21	24	0.877	0.349	0.547
3	19	26	4.774	0.028 *	0.219
4	13	18	1.732	0.188	0.497
5	13	19	2.51	0.113	0.428
6	12	19	3.4	0.070	0.372
7	10	18	4.419	0.036 *	0.322
8	25	27	0.731	0.392	0.463
9	17	25	5.429	0.019 *	0.227
10	13	17	1.105	0.293	0.574

Karl Pearson's Chi square test with Mantel-Haenszel correction, where required
* Statistically significant

3.3. Scores obtained by male students

The mean score obtained by 28 male students progressed from 5.43±1.43 (95% CI: 4.90-5.96) in the pre-test to 7.11±1.07 (95% CI: 6.72-7.49) in the post-test. The difference between the mean scores was highly significant (Z=4.977; *P*<0.00001).

Table 2: Question-wise correct responses by male students in pre- and post-tests

Q. No.	Males (n=28)		Chi square value #	*P* value	Odds Ratio
	Pre-test	Post-test			
1	14	15	0.072	0.789	0.867
2	18	19	0.08	0.778	0.853
3	21	25	1.913	0.167	0.36
4	13	20	3.625	0.057	0.347
5	07	16	5.976	0.014 *	0.25
6	17	18	0.076	0.783	0.859
7	11	19	4.595	0.032 *	0.307
8	23	25	0.572	0.449	0.552
9	22	25	1.17	0.279	0.44
10	06	17	8.768	0.003 *	0.176

Karl Pearson's Chi square test with Mantel-Haenszel correction, where required
* Statistically significant

The question-wise analysis of correct responses by male students (Table 2) reveals statistically significant differences between the pre- and post-test scores for question No. 5 (*P*=0.014), question No. 7 (*P*= 0.032) and question No. 10 (*P*=0.003). However, a study on 378 Kuwaiti male students reported deficiency in nutrition-related knowledge [24].

3.4 Limitations

The present study was conducted on only one batch of 57 first-year MBBS students. They could not be exposed to real-life patients due to time constraints for the first-year MBBS course. A larger study with a wide range of cases pertaining to the entire curriculum of Physiology would be necessary in order to generalize the results.

4. Conclusion

The results of the study indicated that nutrition-related case-based learning enhanced the cognitive domain scores of first-year medical students. The gender-wise differences in scores were not found to be statistically significant.

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