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A study to assess the knowledge and competency of future medical practitioners regarding nutrition in health and disease

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Abstract: *Background:* Medical practitioners are a very credible source of information related to nutrition that decides an individual's health status. Hence, this study was conducted with an objective to assess the knowledge and competency of the future medical practitioners regarding nutrition in health and disease. *Methods:* This study was conducted among the interns of two batches. Interns answered a pre tested structured questionnaire containing multiple choice questions regarding knowledge related to nutrition. Based on the points scored in this, study participants were classified as high and low scorers. Among the high and low scoring interns, 10% were randomly selected. Their competency was assessed by Objective Structured Clinical Examination (OSCE) as they counselled simulated patients regarding nutrition in health and disease. Means and proportions were used to represent the descriptive data. Mann Whitney U test and Wilcoxon sign rank test were used to test the associations. *Results:* Mean knowledge score was 16.63 ± 2.43**.** As many as 176 (90.3%) were high scorers and 19 (9.7%) were low scorers. Mean competency score was 21.1 ± 4.7. Association between knowledge score (high and low scoring categories) and competency score (mean) was found statistically significant ($Z = -2.67$, $p < 0.05$). *Conclusion:* Though most of the interns were high scorers the mean knowledge as well as competency scores were still unsatisfactory. However, it was noted that knowledge and competency scores were associated showing that with better knowledge, competency also becomes better.

Keywords: Antenatal Nutrition, Postnatal Nutrition, Under five Nutrition, Common Nutrient Sources, Nutrition in NCD, Nutrition.

Introduction

Nutrition is the science of food and its relationship to health. Dietetics is the practical application of the principles of nutrition [1]. Over-nutrition is a recognized modifiable risk factor for non-communicable diseases (NCDs). These NCDs kill 41 million people each year, equivalent to 71% of all deaths globally [2]. Specifically, the NCD burden is associated with diets low in fruits and vegetables, high in sodium, low in nuts and seeds, low in whole grains, and low in seafood-derived omega-3 fatty acids [3].

The other end of the nutritional spectrum is under-nutrition in its varied forms like protein energy malnutrition and specific micro-nutrient deficiencies which are the biggest killers among under-five population. Malnutrition is also a key risk factor for NCDs [4]. Medical practitioners are viewed as a very credible source of information related to nutrition. There are several specialities and sub-specialities in medical field today. Importance of nutrition cannot be undermined in any specialty. Every specialist must be well equipped with the knowledge and competency related to nutrition in order to give credible information to their patients. Studies have shown that over two-thirds of physicians provide dietary counselling to 40% or less of patients and spend 5 or fewer minutes discussing dietary changes. Despite this pattern, nearly three-quarters of these physicians feel that dietary counselling is important and is the responsibility of the physician. Ranking of perceived barriers to delivery of dietary counselling were lack of time, patient noncompliance, inadequate teaching materials, lack of counselling, training, lack of knowledge, inadequate reimbursement, and low physician confidence [5].

Given the prominent role of nutrition in the global burden of disease, it is essential that today's medical students receive adequate nutrition education so that as practicing physicians of tomorrow they can provide their patients with evidence-based nutritional counselling. In order to achieve this, a student must acquire nutrition related knowledge longitudinally and at the end of the course must be competent to advise regarding the common sources of various nutrients, special nutritional requirements according to age, sex, activity and physiological condition, health problems related to nutrition and community nutritional programs. They should be competent to plan and recommend suitable diet to individuals and families in health and disease bearing in mind the local availability of foods and economic status of the individual.

Now the question is how much knowledge do medical graduates have about nutrition in health and disease? Are they capable of applying the principles of nutrition and dietetics in day-to-day patient care practice and give nutritional counselling? Hence, this study was conducted with an objective to assess the knowledge and competency of future medical practitioners related to nutrition in health and disease which can be used as a basis to conduct further training programs regarding the same.

Material and Methods

This study was conducted among the interns of two batches. The study was conducted in the years 2018 and 2019. Ethical clearance of the study was obtained from institutional ethical committee. On the day of interns' orientation program, a pre tested structured questionnaire containing multiple choice questions to assess their knowledge regarding nutrition were distributed and collected after 15 minutes. These questions were framed based on the must know topics from the syllabus of Rajiv Gandhi University of Health Sciences [6]. Questionnaire had a total score of 27 points. Then the questionnaire was evaluated. Interns were classified as high scorers i.e., the ones who scored more than or equal to 13.5 marks which is more than or equal to 50% of the score and low scorers i.e., the ones who scored less than 13.5 marks which is less than 50% of the score.

Annexure-1: OSCE checklists

You are a doctor who has to counsel the following people about nutrition.

1. A mother of a under-five child who has recovered from acute severe protein energy malnutrition.

Key:

- Greeting the patient – 0.5
- Introducing one self – 0.5
- Explaining to the mother causes of malnutrition – 1
- Explain the importance of variety in diet – 2
- Explain in detail how the meal plan for the day should be and how to initiate feeding – 2
- Explain how to make food nutrient and energy dense – 2
- Explain cooking procedures which may lead to loss of nutrients – 1
- Describe hygienic practices – 1

2. A primi gravida with history of 3 months of amenorrhea.

Key:

- Greeting the patient – 0.5
- Introducing one self – 0.5
- Explain about nausea and loss of appetite – 1
- Explain the importance of variety in diet – 2
- Advice regarding small frequent meals – 2
- Advice regarding how to meet extra protein and calorie intake – 2
- Advice regarding iron rich and calcium rich foods – 2

3. A primi para who has delivered 24 hours prior.

Key:

- Greeting the patient – 0.5
- Introducing one self – 0.5
- Advice regarding how to meet extra protein and calorie intake – 2
- Advice regarding fluid intake – 1
- Advice regarding food fads in post natal period – 5

4. A mother of a 6 month old baby who wants to wean her infant.

Key:

- Greeting the patient – 0.5
- Introducing one self – 0.5
- Start with liquid diet – 1
- Solidify the diet slowly within 1 to 1 and half month – 1
- Start with cereal based diet – 1
- Then shift slowly to double, triple and quadruple mixes. Explain what foods they are? – 2
- Explain regarding gradual increase in giving food – 1
- Explain regarding hygiene and regarding fresh food at every food – 1
- Psychosocial support during feeding – 1
- Continue breast feeding till 2 years of age – 1

5. An elderly obese, hypertensive and diabetic person.

Key:

- Greeting the patient – 0.5
- Introducing one self – 0.5
- Intake of dietary fibres – 2
- No sugar – 1
- Reduced intake of calorie dense foods – 2
- Intake of salt < 5g/day – 1
- Intake of complex carbohydrates – 2
- Physical activity – 1

Among the high and low scoring interns, 10% were randomly selected. Only 10% were selected for the purpose of feasibility. During their postings in the Department of Community Medicine, they were made to counsel simulated patients of protein energy malnutrition, hypertension, diabetes mellitus and obesity regarding nutrition. They were also made to counsel a simulated antenatal woman and a postnatal mother regarding their nutrition as well as a mother of a 6 months old child regarding complementary feeding. Simulated patients were trained prior.

Interns were observed during this Objective Structured Clinical Examination (OSCE) using a checklist (Annexure-1). Maximum competency score was 50 with 10 marks each for the five case scenarios. Data analysis was done using IBM SPSS Statistics for Windows, Version 25.0. Answers given to the questions assessing the knowledge domain were represented as proportions. Mean knowledge score with standard deviation was calculated. Mann Whitney U test was used to find the statistical difference in the scores of each OSCE questions. Wilcoxon sign rank test was used to calculate the association between knowledge and the competency scores.

Results

Two batches of interns were included, the total strength of which was 203. Out of these 195 interns participated in the study.

Table 1 shows the distribution of study participants according to the knowledge regarding the sources of various nutrients. A large number of 190 (97.4%) interns knew the source of carbohydrates. However, only 33 (17.2%) interns could name the source of simple carbohydrates and 35 (17.9%) interns could name the complex carbohydrates. A majority of 192 (98.5%) interns knew the source of proteins. However, as many as 110 (56.4%) interns could name only non-vegetarian sources of proteins. Sources of poly unsaturated fatty acid (PUFA) were known to 113 (57.9%) interns but only 80 (41.1%) could name the specific oils which give PUFA. Vitamin A sources were named correctly by 181 (92.8%) interns. Sources of folic acid and vitamin B12 were known to 165 (84.6%) and 151 (77.4%) interns respectively. Rich sources of minerals like iron, iodine and calcium were known to 170 (87.2%), 176 (90.3%) and 195 (100%) respectively.

Table-1: Distribution of study participants according to the knowledge regarding the sources of various nutrients

Sources of nutrients	Appropriate source (%)	Inappropriate source (%)
Carbohydrates	190 (97.4%)	5 (2.6%)
Simple carbohydrates	33 (17.2%)	162 (82.8%)
Complex carbohydrates	35 (17.9%)	160 (82.1%)
Protein	192 (98.5%)	3 (1.5%)
Polyunsaturated fatty acids	113 (57.9%)	82 (42.1%)
Vitamin A	181 (92.8%)	14 (7.2%)
Folic acid	165 (84.6%)	30 (15.4%)
Vitamin B12	151 (77.4%)	44 (22.6%)
Iron	170 (87.2%)	25 (12.8%)
Iodine	176 (90.3%)	19 (9.7%)
Calcium	195 (100%)	0 (0%)

As many as 113 (57.9%) interns could name specific sources of dietary fibres, whereas, 82 (42.1%) interns named non-specific sources like fruits and vegetables. Daily protein, carbohydrate and fat requirements in terms of percentage of daily energy intake from these proximal principles were appropriately known to 80 (41.1%), 102 (52.3%) and 80 (41.1%) interns respectively.

Table 2 shows the distribution of study participants according to their knowledge regarding control and prevention of nutritional diseases. Only 93 (47.7%) interns knew that the maximum daily salt intake must be 5g. Additional calorie intake in pregnancy and lactation was known correctly to 69 (35.4%) and 77 (39.5%) interns respectively. A small number of 19 (9.7%) interns knew correctly the additional protein requirement in pregnancy as well as during lactation. A large number of 178 (91.3%) of interns knew that growth monitoring is the simple screening method to detect protein energy malnutrition (PEM) at the earliest. Unfortunately, none of the interns knew long term method for prevention of Vitamin A deficiency. Dose of iron and folic acid supplements among pregnant women was correctly known to only 11 (5.6%) interns and the dosage for children was known to even lesser number of 5 (2.6%) interns only. Food toxins of public health importance were named correctly by only 85 (43.6%) interns. The two scenarios representing food fortification and food adulteration each were recognised correctly by 184 (94.4%) interns.

Table-2: Distribution of study participants according to their knowledge about control and prevention of nutritional diseases.

Prevention and control of nutritional diseases	Correct answer (%)	Wrong answer (%)
Optimal daily salt intake	93 (47.7)	102 (52.3)
Additional calorie intake in pregnancy	69 (35.4)	126 (64.6)
Additional calorie intake in lactation	77 (39.5)	118 (60.5)
Additional protein intake in pregnancy	19 (9.7)	176 (90.3)
Additional protein intake in lactation	19 (9.7)	176 (90.3)
Screening test for early detection of PEM	178 (91.3)	17 (8.7)
Long term measure to prevent Vitamin A deficiency	0 (0)	195 (100)
Dose of Iron and folic acid in pregnancy	11 (5.6)	184 (94.4)
Dose of Iron and folic acid in children	5 (2.6)	190 (97.4)
Principles of mid-day meal planning	159 (81.5)	36 (18.5)
Food toxins of public health importance	85 (43.6)	110 (56.4)
Identification of food fortification	184 (94.4)	11 (5.6)
Identification of food adulteration	184 (94.4)	11 (5.6)

Mean knowledge score was 16.63 ± 2.43with a range of 11.6 to 20.6. Graph 1 shows the distribution of interns based on their score. As many as 176 (90.3%) were high scorers and 19 (9.7%) were low scorers.

Graph-1: Distribution of interns according to the knowledge score

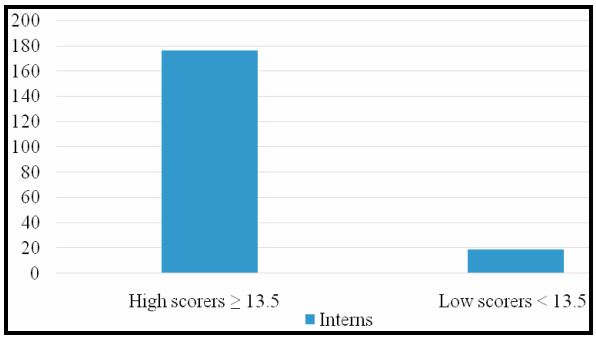

Table 3 shows the association between knowledge and competency scores among high scorers and low scorers. Mean knowledge score and standard deviation of high scorers was 17.1 ± 2.0 with a range of 14 to20.6. Mean knowledge score of low scorers was 28.5% lesser than the high scorers (12.2 ± 0.4 with a range of 11.6 to 13.0). Mean competency score and standard deviation based on objective structured clinical examination was21.1 ± 4.7 with a range of 15.5 to 29.0. Among the high scorers, the mean competency score and standard deviation was 25.9 ± 3.5 with a range of 19.0 to 29.0 and the same among low scorers was 17.3 ± 2.5 with a range of 15.5 to 19.0 which was 33.2% lesser than the mean score of the high scorers. Association between knowledge score (high and low scoring categories) and

competency score (mean) was tested using Wilcoxon Sign Rank test. The association between knowledge and competency scores was statistically significant (Z = -2.67, p < 0.05). This means that the interns who had better knowledge had better competency too.

Table-3: Mean knowledge score among high and low scorers

Interns	Knowledge score Mean ± SD (Range)	Competency score Mean ± SD (Range)	Wilcoxon Sign Rank test Z and p values
High scorers	17.1 ± 2.0 (14 – 20.6)	25.9 ± 3.5 (19.0 – 29.0)	Z = -2.67*
Low scorers	12.2 ± 0.4 (11.6 – 13.0)	17.3 ±2.5 (15.5 – 19.0)	p < 0.05**

*Z statistic calculated using Wilcoxon sign rank test; **p value < 0.05 and hence significant

Table 4 shows the mean competency scores in individual objective structured clinical examination case scenarios. OSCE scenario 1 was regarding advising a mother of an under-five child who is in the rehabilitative phase of severe acute protein energy malnutrition. The overall mean score for this was 4 ± 1.4 and high scorers had a mean score of 5.6 ± 1.8 whereas low scorers had 38% lesser mean score of 3.8 with a standard deviation of ± 0.4; this difference in competency score of 1st case scenario was statistically significant (p = 0.03). Scenario 2 was to counsel a primi-gravida in first trimester of pregnancy regarding nutrition. Overall mean score of 20 participants in this scenario was 2.9 with a standard deviation of ± 1.3 and high scorers had a mean score of 4.1 and a standard deviation of 0.7. Low scorers scored 63.4% lesser than the high scorers (1.5 ± 0.7); this difference was statistically significant (p = 0.03). Scenario 3 used to examine the competency of interns was to counsel a primi-para who has delivered 24 hours prior. Overall mean score was 2.4 ± 1.1 with high scorers scoring 3.8 ± 1.1 and low scorers scoring 60.5% lesser than them (1.5 ± 0.8). This difference in the competency score among the high and low scorers was statistically significant (p = 0.01). The fourth scenario was to counsel a mother of a 6 months old baby regarding weaning. Mean score of overall 20 participants was 4.6 with a standard deviation of ± 1.4 and in this competency high scorers had scored 20% lesser than the low scorers with a mean of 4.8 and 6 respectively. The difference in the mean competency scores was statistically significant (p = 0.047). The last scenario was to counsel an elderly obese, diabetic and hypertensive man. The overall mean score was 7.3 with a standard deviation of 2.2; high scorers had 7.6 mean score and low scorers had 40.8% lesser than them with a mean score of 4.5. this difference was statistically significant (p = 0.03).

Table-4: Mean competency score in individual objective structured clinical examination case scenarios

Sl. No.	OSCE Case scenario	Overall (n = 20) (Mean ± SD)	High scorers (n = 18) (Mean ± SD)	Low scorers (n = 2) (Mean ± SD)	Z statistic* and p value
1.	Mother of an under-five child being rehabilitated in Nutritional Rehabilitation Centre after Severe Acute Malnutrition	4 ± 1.4	5.6 ± 1.8	3.8 ± 0.4	1.9 0.03**
2.	Primi-gravida in her first trimester	2.9 ± 1.3	4.1 ± 0.7	1.5 ± 0.7	1.9 0.03**
3.	Primi-para who has delivered 24 hours prior	2.4 ± 1.1	3.8 ± 1.1	1.5 ± 0.8	1.8 0.03**
4.	Mother of a 6 months old baby planning to wean her infant	4.6 ± 1.4	4.8 ± 0.9	6	-1.7 0.047**
5.	Elderly obese, hypertensive and diabetic patient	7.3 ± 2.2	7.6 ± 1.3	4.5 ± 0.7	1.8 0.03**

*Z statistic calculated using Mann Whitney U test; **p value < 0.05 and hence significant

Discussion

A majority of 90.3% interns had a knowledge score above 50%. However, the mean knowledge score was 63.3% of the total score. Since, the questions to assess the knowledge were chosen from the must know aspects of the medical university syllabus, interns having a knowledge score of 63.3% of expected is unsatisfactory. Furthermore, majority of the interns could not name the source of complex carbohydrates, vegetarian source of proteins, specific sources of polyunsaturated fatty acids which are the macro-nutrients of our diet. Similarly, though a majority could, but not all could name the common sources of micronutrients like vitamins A and B12, folic acid, iron and iodine. Low scorers had 28.7% lesser score than the high scorers.

Mean competency score was 51.8% of expected score which was further more unsatisfactory. Competency score was better among interns who had a knowledge score more than 50% in all the competencies except in the competency of giving nutritional counselling a mother regarding weaning a6 month sold infant in which the low scorers had better score. There was a positive association between knowledge and competence. Highest competency was observed in counselling an elderly, obese, diabetic and hypertensive patient and least was observed in counselling a primi-para who delivered just 24 hours earlier probably because it involved cultural aspects and food fads.

A study conducted by Norman J. Temple showed that there was overall gap in knowledge among the 84 Canadian physicians and their knowledge score was 63.1% [7]. Marion L. Vetter conducted a study among 114 internal medicine interns with 54% response rate and showed that the average knowledge score was 66% of the expected [8]. Yet another study done among 219 senior residents from Departments of Family medicine, Internal medicine and Obstetrics and Gynaecology in Ohio with a response rate of 62% showed that the knowledge score was 50.8 ± 15.6 on a scale of 0 – 100 [9]. The results of these international studies were comparable to the results of our study showing that the knowledge regarding nutrition among current doctors as well as the trainees has gap which needs to be filled essentially.

A study conducted by Victor Mogre et [10] al in Ghana among the future doctors has shown an average knowledge score of 64%. The same study showed mean scores in different nutritional domains; malnutrition in children had mean score of 41% of expected and diabetes and obesity had mean score of 59% of expected. Our study had a similar score of 40% for the competency of counselling a mother of an under-five child being rehabilitated in Nutritional Rehabilitation Centre after Severe Acute Malnutrition. Competency of counselling an elderly obese, hypertensive and diabetic patient had a better score of 73% in our study.

Strength of this study was that the knowledge questions were framed from the must know part of the Rajiv Gandhi University of Health Sciences syllabus for Community Medicine. Study did not stop at testing the knowledge. Competency of the interns in giving nutritional counselling during health and disease was also tested by using the Objective Structured Clinical Examination. Competency Based Medical Education (CBME) has been introduced in India in the year 2019 which is aimed at making the medical graduates more competent which also includes nutritional competencies. This study can serve as a baseline to compare the competency of Indian Medical Graduates trained using CBME.

Limitations of the study is that all the interns whose knowledge was tested were not tested for competency due to constraints of time and manpower. Competency was tested in a simulated environment instead of real-life situations. Usage of principles of health counselling by interns and time taken to give counselling were not noted during OSCE.

Such studies should be done at a greater number of medical colleges because nutrition is one of the most important factors that determines health. Also, a greater number of Indian medical graduates as well as specialists must be involved in the study. Different innovative teaching methods must be involved in training the undergraduates regarding nutrition and they must be tested.

Conclusion

Though most of the interns had high knowledge score the mean score was still unsatisfactory. Same holds good for the competency score as well which was further lesser. However, it was noted that knowledge and competency scores were associated showing that with better knowledge, competency also becomes better. There must be some short comings in curriculum and teaching learning methods due to which medical graduates have lower than required knowledge even in must know aspects. They are under competent as well. Hence, we need to conduct further studies to answer this and implement it to improve the nutrition related knowledge and competency of doctors.

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