

## Knowledge, Attitude, and Practice of Health Care Practitioners Regarding Micronutrient Recommendations

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### ABSTRACT

The present study was designed to assess the knowledge, attitude, and practice of 130 randomly chosen healthcare practitioners (physicians and pharmacists) in Ahmedabad, India, regarding Recommended Dietary Allowances (RDA) of micronutrients and dietary supplementation. A self-administered, 15-item, closed-ended, multiple-choice questionnaire was developed to evaluate participants' knowledge, attitudes, and practice related to micronutrient knowledge. The first section consisted of demographic information (educational qualification, experience, and patient visits), the second was regarding RDA for different micronutrients, and the third included general practice (nutrient-nutrient interaction, conversion ratio, and tolerable upper limit of micronutrients). The range for the score was between 0-15. Results revealed that 9.2% of physicians and 12.3% of pharmacists had good knowledge while most of the physicians and 50% of the pharmacists had acceptable knowledge regarding the RDA of micronutrients. A significant difference was found between physicians and pharmacists regarding the knowledge of micronutrients (knowledge score (KS) 7.98/15 and 6.52/15 respectively) ( $p < 0.05$ ). Education, experience, practice of healthcare practitioners, and the number of patient visits revealed no significant effect on knowledge score ( $p > 0.05$ ). Therefore, it would be beneficial to include advanced nutrition in terms of suggested dietary allowances, adequate use, tolerable upper limits, and effects of micronutrient toxicity in their curricula.

**Keywords:** Recommended Dietary Allowance, micronutrients, knowledge, attitude, practice

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### INTRODUCTION

Nutrition plays an enormous role in enhancing health and the prevention of disease. ICMR-NIN, 2020 defines Recommended dietary allowance (RDA) for all nutrients as "is daily dietary nutrient intake level that is sufficient to meet the nutrient requirements of nearly all (97-98 percent) healthy individuals in a particular life stage and gender group" (14).

Essential vitamins and minerals in micronutrients must be obtained through the diet to keep all regular cellular and molecular functions in homeostatic conditions. The World Health Organization (WHO) defines 'Micronutrients' as compounds required in very minute amounts to regulate vital body processes (21).

Countries like India, which is going through a nutritional transformation stage; malnutrition is the main cause of poor illness, with micronutrient deficiencies taking center stage. According to the data of the National Family Health Survey (NFHS)-5 of India, 37.3% of children were observed stunted in rural areas and 4.2% of children were observed overweight in urban areas (18). Therefore, micronutrient supplementation is an effective and required strategy to combat the widespread deficiency of micronutrients.

To tackle their micronutrient deficiency, supplement recommendation is on the rise with increased awareness about the role of micronutrients in achieving optimal health and prevention of diseases. According to the Dietary Supplements Market Size Report, 2022-2030, "the size of the global market for

dietary supplements was observed at USD 151.9 billion in 2021, and it is supposed to touch a Compound Annual Growth rate (CAGR) of 8.9% between 2022 to 2030" (9).

As an adequate number of micronutrients plays a vital role in various physiological functions, but consumption beyond a certain limit can have various health problems. Therefore, Nutrition agencies from all over the world have proposed a tolerable upper limit (TUL). ICMR-NIN,2020 refers to TUL as "it is the highest average daily intake level that likely to pose no risk of adverse health effects to almost all individuals in the general population" (14). As intake increases above the limit, the risk of adverse effects will increase.

Healthcare practitioners play a major guiding role in the beliefs and practices regarding health and the prescription of supplementation in the general population. So, it is believed that their knowledge will be reflected in their attitude while counselling patients regarding nutritional supplements. Most of the nutritional supplements are under the category of "over-the-counter" products that do not require a medical prescription for purchase. Pharmacists play a major role in suggesting these supplements to their consumers. With this background, the study was conducted to assess the knowledge regarding RDA of micronutrients of physicians and pharmacists of Ahmedabad city, Gujarat, India regarding recommended dietary allowances for micronutrients.

## **MATERIAL AND METHODS**

This study was a cross-sectional, questionnaire-based survey of healthcare practitioners of Ahmedabad city about their knowledge, attitude, and practice of recommended dietary allowances for micronutrients in India.

### **Study Instrument**

A self-administered, close-ended, multiple-choice questionnaire consisting of three sections with a total of 15 questions was developed. The first section consisted of demographic information (age, gender, educational qualification, experience, and patient visits) while the second section was regarding the RDA of micronutrients (in terms of vitamins and minerals), and the third section was related to general practice towards dietary supplements (nutrient-nutrient interaction, conversion ratio, and tolerable upper limit of micronutrients). Correct responses were evaluated as 1 while incorrect were scored as 0. Therefore, the possible range for the score was between 0-15.

### **Reliability and Validity of the Questionnaire**

The test re-test method was used to assess the reliability of the developed questionnaire. A questionnaire was asked to fill to the same thirty respondents twice at intervals of ten days and the correlation coefficient between the first and second scores was evaluated. A panel of fifteen experts assessed the content validity of the questionnaire.

### **Methods and Material**

A pilot study was conducted on twenty samples to determine the present study's sample size. A questionnaire was given to selected participants and they were asked to fill it within a time limit. Afterward, selected 130 participants responded to that validated questionnaire, and using the formula " $N = Z^2 S^2 / D^2$ " with a confidence level of 95% and a margin of error of <1%, samples have been calculated to be included in the study (15).

### **Data Collection**

The survey was conducted in various medical stores, hospitals, and clinics in Ahmedabad city. A list of private and government hospitals in Ahmedabad was prepared previously with the help of the Internet. The respondents included physicians working in the selected hospitals and clinics, and pharmacists running their medical stores with a valid license. From the list, fifteen hospitals and sixty-five medical stores were randomly selected from five clusters East, West, North, South, and Central Ahmedabad city.

### **Statistical Analysis**

Mean, standard deviation (SD), standard error (SE), and percentage (%) was calculated for the first section (demographic questions). An independent 't' test was used to compare knowledge between physicians and pharmacists and between genders. Analysis of variance (ANOVA) and Post hoc (Turkey and Duncan) analysis were performed to assess knowledge according to experience and qualification (19). Statistical results were considered to be significant at  $p \leq 0.05$  at a 95% confidence interval. The software SPSS (statistical package for social sciences) version 17.0, USA for all statistical analysis.

## **RESULT**

### **Demographic Characteristics of Study Participants**

Of the total number of participants (130) who participated in the study, the majority of participants (93.1%) were graduates. The study group included participants with 75.4% men and 24.6% women aged

33.8 (± 34) years of mean age. The highest number of respondents were observed between 0-10 years of working experience (96.1%) while only 3.8% of respondents had been in practice for more than ten years. (Reference Table I)

#### **Comparison Between Knowledge of Physicians and Pharmacists**

A significant difference was found between physicians and pharmacists regarding the knowledge of micronutrients (knowledge score (KS) 7.98/15 and 6.52/15 respectively) ( $p < 0.05$ ). Healthcare practitioners who had experienced the practice for fewer years had more knowledge scores compared to more years of practice. The analysis of variance method was used to determine the knowledge of physicians and pharmacists and discovered that the working experience and the number of patient visits revealed no significant effect on individual and overall knowledge scores ( $p > 0.05$ ). (Reference Table II). An independent 't-test', Analysis of variance (ANOVA), and Post hoc analysis were used simultaneously to compare knowledge between physicians and pharmacists, between males and females, and to evaluate knowledge according to experience and qualification.

#### **Knowledge of Healthcare Practitioners Regarding RDA of Micronutrients**

The survey results are presented in the form of frequency and percentage of the correct responses. When the healthcare practitioners were asked about the institute or an agency that derives RDA guidelines for Indians, none of the pharmacist participants knew that the ICMR-NIN, India had developed RDA values for all nutrients while 29.3% of the participating physicians were knowledgeable. Overall, 100% of physicians and 89.3% of pharmacists had good knowledge about anti-co-regulating drugs, enhancing the vitamin K requirement. About three-quarters (74.6%) of healthcare practitioners were aware of the desirable ratio of calcium-phosphorus in adults while 25.4% could not indicate the suggested ratio. Vitamin B<sub>1</sub> requirements were the most poorly understood by both healthcare practitioners (80.7%), followed by the recommended amount of vitamin K (69.3%) and RDA of vitamin B<sub>12</sub> (68.5%). (Reference Table III)

#### **Awareness and General Practice Toward Dietary Supplements**

Table IV portrays the awareness and general practice of respondents. Regarding the common deficiency they observed in their patients, 84.6% of physicians suggested iron deficiency, followed by calcium and Vitamin B<sub>12</sub> deficiency, while 78% of pharmacists were in support of calcium inadequacy. Multivitamins and/or multimineral were the most commonly prescribed supplements by physicians (83.1%) and pharmacists (72.3%), followed by calcium-vitamin D, and iron-folic acid with vitamin B<sub>12</sub> supplements. Physicians claimed that they prescribed supplements based on blood reports and clinical signs (84.6% and 52.3%); on the other side, 100% (n=65) of pharmacists claimed to provide supplements based on a doctor's prescription. Compared to physicians (66.2%), almost 90% of pharmacists have always informed patients about the overconsumption of micronutrient supplements.

Assessing healthcare practitioners' concerns about the knowledge of RDA of micronutrients and micronutrient supplementation; revealed that, out of all participants, 9.2% of physicians and 12.3% of pharmacists were having good knowledge, 84.6% of physicians and 46.2% of pharmacists had acceptable knowledge while only 4.6% of physicians and 36.9% of pharmacists were unaware.

## **DISCUSSION**

Nutraceutical use is growing fast in the healthcare market. Healthcare providers should be aware of the scientific data supporting the nutritional necessity of these ingredients as well as the circumstances in which an increased consumption of nutritional supplements could have positive therapeutic effects. The reason behind the widespread of nutritional supplements might be increased awareness in the general population about well-being and the positive effect on the downward of illnesses.

The present study was conducted to assess the knowledge, attitude, and practice of 130 randomly chosen health practitioners (physicians (65) and pharmacists (65)) in Ahmedabad, India, regarding RDA of micronutrients and dietary supplementation resulted in acceptable knowledge (84.6% and 46.2% simultaneously).

Maintaining a healthy diet to meet nutritional needs has become increasingly popular. As an outcome of rapid urbanization and changing lifestyles, increased awareness regarding both communicable and non-communicable diseases, and the usage of dietary supplements is observed in the general population. A healthy lifestyle and adequate nutrients become key terms for optimal health. (5; 2).

As this study reveals that multivitamins or multimineral are the most prescribed or sold supplements by physicians (83.1%) and pharmacists (72.3%) and 66.2% of physicians and 87.7% of pharmacists are always aware of their patients regarding the tolerable upper limit of micronutrients, their interactions, and the negative outcomes of overdose. It is equivalent to different studies that found 29% and 22% (simultaneously) of physician's counsel their patients on eating habits on a regular or frequent basis. (1; 16). The possible causes might be no routine practice involving dietitians in the treatment regime.

Respondent pharmacists (100%) of this study claimed that they sell nutrient supplements on the basis of a doctor's prescription however they must be aware of their knowledge and attitudes and practices regarding micronutrient supplement use. Pharmacists should be a part of core members of healthcare teams to advise accessible nutrition support to patients, and other health practitioners. Researchers reported that 33.3% of Ethiopian pharmacists (3) were unaware of nutritional supplements. In other research, the absence of information varied from 40-60% (11). One of the factors affecting pharmacy practice in recommending dietary supplements might be because of a lack of evidence on the safe use of dietary supplements (7; 6) or illegal online pharmacies (13).

To counteract sickness, mortality, and medical expenses in overall aspects, the knowledge of nutrition care by healthcare practitioners like physicians, pharmacists, and nurses is important to bring up teamwork with other health workers, especially dietitians for improving healthy eating patterns. Ani *et al.*, 2022 evaluated the nutrition knowledge and attitude of medical and nursing students of Babcock University, Nigeria. They were less knowledgeable in clinical nutrition; management of hypertension, type 2 diabetes, and renal diseases respectively while a significant majority of the students who had good nutrition knowledge were aware of it (4). Also, nutrition education was not seeming sufficient for both professions. However, with an average of 23-68 hours of nutrition education in some forms are necessary to include it in most medical school curricula (8) as nutrition education was supposed to be a crucial part to understand the majority of the undergraduate medical students (12). Dunic *et al.*, 2017 reported in their article that the majority of family physicians are aware of the presence of dietitians while providing nutrition care to patients, especially when such patients are at risk because of their eating habits and body mass index (10). Almost one-third (87.7%) of pharmacists and more than half of physicians (66.2%) said that they counsel their patients aware of excess consumption consistent with a study by (17) that revealed 74% of healthcare practitioners counsel their patients on nutrition. Healthcare experts, who consider nutrition an essential component of the health background, can advise patients on nutritional supplement consumption awareness.

Healthcare practitioners significantly influence public attitudes and perceptions about health-related problems; hence, they must be well-informed about nutrition and its role in health maintenance (20). Healthcare practitioners appear not to be aware of the intake and excessive consumption of micronutrients. Advanced nutrition education should be a part of their curriculum for their awareness and experience will enable them to provide advice to their patients (individuals) on the adequacy, deficiency, and toxicity of micronutrients. To encourage nutrition education among their patients, and improve illness prevention and, adverse consequences due to excessive consumption; healthcare practitioners should make continuous efforts.

**Table I: Demographic Characteristics Among Study Respondents(N=130) \***

<b>Characteristics</b>	<b>N (%)</b>
<b>Sex</b>	
Male	98(75.4)
Female	32(24.6)
<b>Age (years)</b>	
21-30	25(19.2)
31-40	43(33.1)
41-50	50(38.5)
51-60	10(7.7)
> 60	2(1.5)
<b>Educational Qualification</b>	
B. Pharm	65(50)
BHMS/BDS/MBBS	56(43.1)
MD/MS/M. Pharm	9(6.9)
<b>Working Experience</b>	
< 5 years	70(53.8)
5-10 years	55(42.3)
11-20 years	2(1.5)
>20 years	3(2.3)

\*values in parenthesis show the percentage

**Table II: Comparison of Knowledge Score Between Physicians and Pharmacists**

Parameter	Knowledge Score	
	Physicians	Pharmacists
<b>Year of Practice</b>		
<5	8.35±0.26	6.77±0.59
5-10	7.12±0.42	6.24±0.48
11-20	8.33±0.88	-
>20	7.0±1.08	-
<b>Number of Patient Visits</b>		
<10	8.38±0.25	6.93±0.70
10 to 25	7.35±0.48	6.52±0.46
26 to 40	6.66±0.55	5.00±1.27
>40	7.66±1.76	-
<b>Overall Knowledge*</b>		
Total	7.98±0.21 <sup>b</sup>	6.52±0.36 <sup>a</sup>
Male	7.76±0.32 <sup>a</sup>	6.45±0.37 <sup>a</sup>
Female	8.17±0.30 <sup>a</sup>	7.00±0.00 <sup>a</sup>

\*values with different alphabets within the same row differ significantly (p<0.05)

**Table III: Frequency and Percentage of the Correct Responses to the Knowledge, Attitude, and Practice of Participants Regarding RDA\* (N=130)**

SrNo.	Statement (Questions)	Total		Physicians		Pharmacists	
		Correct N (%)	Incorrect N (%)	Correct N (%)	Incorrect N (%)	Correct N (%)	Incorrect N (%)
1.	ICMR-NIN derived RDA data for different nutrients in India	19(14.4)	111(85.6)	19(29.3)	46(70.7)	00(0)	65(100)
2.	The Daily recommended dose of Iron for adult women should be 29mg/d	72(55.4)	58(44.6)	38(58.5)	27(41.5)	34(52.4)	31(47.6)
3.	Vitamin B <sub>1</sub> requirement based on total calorie consumption	25(19.3)	105(80.7)	12(18.5)	53(81.5)	13(20.0)	52(80.0)
4.	The daily requirement of vitamin C for women should be 65mg/d	63(48.5)	67(51.5)	36(55.4)	29(44.6)	27(41.5)	38(58.5)
5.	RDA of Vitamin A for adults should be 840-1000 µg/day	81(62.4)	49(37.6)	47(72.4)	18(27.6)	34(52.4)	31(47.6)
6.	Calcium: Phosphorus desirable ratio in adults should be 1:1	97(74.6)	33(25.4)	52(80)	13(20.0)	45(69.3)	20(30.7)
7.	>55µg vitamin K consumption for 3 months can be toxic	40(30.7)	90(69.3)	22(33.8)	43(66.2)	18(27.6)	47(72.4)
8.	10-15 min sun exposure 2-3 times a week is enough to synthesize 600 IU of Vitamin D for adult women	63(48.5)	67(51.5)	37(56.9)	28(43.1)	26(40.0)	39(60)
9.	Selenium performs the function of Vitamin E	40(30.7)	90(69.3)	23(35.4)	42(64.6)	17(26.2)	48(73.8)
10.	Excess consumption	98(75.4)	32(24.6)	51(78.5)	14(21.5)	47(72.4)	18(27.6)

	of Vitamin E reduces the absorption of Vitamin A						
11.	Anti-coagulating drugs increase the requirement for Vitamin K	122(93.8)	8(6.2)	65(100.0)	00(0.0)	58(89.3)	7(10.7)
12.	1tsp salt contains 2300 mg of sodium	67(51.5)	63(48.5)	33(50.7)	32(49.3)	34(52.4)	31(47.6)
13.	During pregnancy, the folic acid recommended dose jumps from 220 to 570 µg/day	54(41.5)	76(58.5)	32(49.3)	33(50.7)	22(33.8)	43(66.2)
14.	The RDA of pyridoxine in a normal adult is 1.6-2.1mg/day	61(46.9)	69(53.1)	33(50.7)	32(49.3)	28(43.1)	37(56.9)
15.	The RDA of cyanocobalamin in a normal adult is 2.5µg/day	41(31.5)	89(68.5)	20(30.7)	45(69.3)	21(32.4)	44(67.6)

\* values in parenthesis show a percentage

**Table: IV General Practice Toward Dietary Supplements Among Study Respondents\* (N=130)**

		Physicians (65) (%)	Pharmacists (65) (%)
1.	What deficiency do you generally observe in individuals or patients? a. Vitamin B <sub>12</sub> b. Iron c. Vitamin A d. Calcium	27.7 84.6 0.0 73.8	20.0 63.1 1.5 78.5
2.	Which supplements do you sell more or prescribe? a. Calcium + Vitamin D b. Iron-folic acid, Vitamin B <sub>12</sub> c. Multivitamin/Multi mineral d. Other	40.0 40.0 72.3 0.0	47.7 24.6 83.1 1.53
3.	On which basis do you give/prescribe supplements? a. Blood reports b. Clinical signs c. Experience d. Doctor's Prescription/Lifestyle	84.6 52.3 3.1 36.9	1.5 1.5 0.0 100.0
4.	Do you make the patient aware of excess consumption? a. Always b. No c. Yes d. Often	66.2 0.0 35.4 0.0	87.7 0.0 10.8 1.5

\*values in parenthesis show a percentage

**Table: V Recommended Dietary Allowances (RDA) Report – 2020 (By ICMR-NIN) (For Reference)**

Micronutrients	Recommended Dietary Allowances
Vitamin B <sub>1</sub> (Thiamine)	1.4-2.3 mg/day
Vitamin B <sub>2</sub> (Riboflavin)	1.9-3.2 mg/day
Vitamin B <sub>3</sub> (Niacin)	11-23 mg/day
Vitamin B <sub>5</sub> (Pantothenic acid)	5 mg/day
Vitamin B <sub>6</sub> (Pyridoxine)	2.1 mg/day

Vitamin B <sub>9</sub> (Folic acid)	260 µg/day
Vitamin B <sub>12</sub> (Cobalamin)	2.5 µg/day
Vitamin H (Biotin)	30 µg/day
Vitamin C (Ascorbic acid)	65-80 mg/day
Vitamin A (Retinoids)	840-1000 µg/day
Vitamin D (Calciferol, 1,2,5-dihydroxy vitamin D)	600 IU
Vitamin E (Tocopherol)	7.5-10mg/day
Vitamin K	55 µg/day
Calcium	1000 mg/day
Phosphorous	1000 mg/day
Potassium	3500 mg/day
Magnesium	325-385 mg/day
Iron	19-29 mg/day
Zinc	13.2-17 mg/day
Copper	2000µg/day
Chromium	50-200 µg/day
Fluoride	0.7-1.2 mg/litre
Iodine	150 mg/day
Selenium	40 µg/day
Manganese	4mg/day
Molybdenum	45 µg/day

### Ethical considerations

Ethical approval was obtained from the Ethics Committee of Gujarat University, Ahmedabad. The investigator individually contacted the respondents and inquired about their willingness to participate in the study. If they accepted, the study was described to them, and written informed consent was obtained from all the respondents. Additionally, they were told that any information gathered from them would be kept private and anonymous, with codes used in place of any personal information.

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Richa Soni designed the study and supervised the work, Shweta Kapadia developed research questions, collected the data, and analyzed it; Vidhi Shah, Nehal Chavda, and Tarun Yogi wrote the article.

### Competing Interests

The authors have declared that no competing interest exists.

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