



Myths about Nutrition among Health Professionals

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ABSTRACT

Background: Healthcare professionals are important role models and their daily management practices can often include nutrition counseling, which requires adequate nutrition knowledge. **Objectives:** To assess the prevalent nutrition myths and nutrition-related knowledge among healthcare professionals. **Methods:** A cross-sectional analytical study was conducted involving physicians of different specialties as well as non-medical professionals, including nurses, pharmacists, and laboratory specialists. A total of 500 questionnaires were randomly submitted to health professionals in multiple hospitals in the Arar region, Saudi Arabia. Demographic data, including gender and specialty, and answers to 21 questions regarding nutrition myths were collected. The total and scaled scores for knowledge were computed based on participants' responses, with maximum scores of 42 and 100, respectively, where higher scores indicated respondents' disagreement with the suggested myths. **Results:** Two hundred and three healthcare professionals responded (a response rate of 40.6%). The scaled knowledge score was 53.95 ± 16.70 . The most wrongfully perceived myths were the causative relationship between eating meals at night and weight gain and the lower caloric content of olive oil as compared to butter. Males had significantly greater knowledge scores (56.85 ± 12.62 , versus 52.03 ± 18.74 , $P=0.03$) and perceived fewer myths than females. Non-physicians endorsed myths more frequently, while family medicine physicians had significantly higher scores than other specialties in debunking myths (69.44 ± 14.13 , $P<0.001$). **Conclusion:** Knowledge levels among health professionals are relatively acceptable, although frequently affected by nutrition-related myths. The improvement of curricula for medical students, the implementation of adequate and continuing medical education programs for physicians and non-physicians, and the emphasizing of the role of the media and the internet as important sources of knowledge are all warranted in the Saudi environment.

Keywords: Health knowledge; Attitudes; Practice; Health education; Nutrition sciences

INTRODUCTION

The general health and wellness of individuals rely on consuming a healthy diet, which, in turn, contributes to reducing morbidity, disability, and premature mortality [1]. In the 2011 report issued by the Association of American Medical Colleges, [2] more than 50% of premature morbidity and mortality was attributable to social and behavioral health practices, such as diet, smoking, and exercise. However, considering the impact of nutrition, it is difficult to address the exact outline of healthy food in line with the overwhelming data produced by researchers and food hygienists coupled with contradictory findings in some instances. Besides, there is a significant discrepancy in recommendations, with a flood of misinformation published constantly in books and the media. Importantly, those seeking health information have recently utilized internet-based healthcare resources, such as social media platforms, which create additional confusion and the misunderstanding of nutrition information [3]. Subsequently, the basics of healthy eating are presented in a perplexing manner and the consumer is inevitably misled [4, 5].

In this context, it seems that there are multiple misleading concepts, namely, nutrition myths that are poorly supported, or even that contrast the scientific evidence. These incorrect beliefs may involve food energy (the capacity to accomplish work as quantified in calories), macronutrients (proteins, fats, and carbohydrates), micronutrients (vitamins and minerals), and non-nutrients (food components that are not primarily required for growth and maintenance) [6]. Indeed, this is unfortunate given the robust and simple evidence available from reliable sources that is sufficient to conclude invaluable recommendations regarding diet. As such, it is necessary for healthcare professionals, who are able to extract these data from their authentic resources, to be knowledgeable about nutrition facts and to avoid such myths. Consequently, individuals/patients can benefit from their advisors in the optimum interactive way, enhancing their own predictive judgments, which are critical for further understanding, and implementing suitable and prophylactic interventions [7].

However, there may be a significant gap in nutrition education under the medical curricula, which may affect future physicians. In addition, several studies have emphasized the existence of nutrition myths among physicians and other healthcare professionals, the majority of which are attributable to insufficient nutrition knowledge [1,8,9]. From another perspective, receiving adequate nutrition educational interventions leads to a significant improvement in physicians' knowledge and their ability to discuss and clarify misunderstood information for their patients [10]. The application of such training programs may be relatively limited in several Arab countries, including Saudi Arabia [11]. Therefore, we sought to investigate the levels of awareness and knowledge of several nutrition concepts and widespread nutrition myths among healthcare professionals.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted in multiple hospitals and primary healthcare centers (PHCs) in northern and Riyadh regions of the Kingdom of Saudi Arabia. The confidentiality of the information was preserved for the participants to protect their privacy. Ethical approval was obtained from the Research Ethical Committee of the Northern Border University. All participants signed an informed consent form after they had been made aware of the rationale and aims of the study by a physician.

Sampling Technique

A total of 430 healthcare professionals were selected and contacted from several departments in the local hospitals (n=16) during the period from December 2019 to February 2020. A random selection of health care providers, in Tabuk, Sakaka, Riyadh, and Arar City with [10] primary healthcare sectors, and [6] hospitals. Subsequently, healthcare professionals were randomly selected and were invited to participate. Of those who were contacted, 203 responded and returned the completed study tool, with a response rate of 47%.

Data Collection

Data collection was performed using a structured, self-administered questionnaire designed by the authors. The questionnaire consisted of two main domains: 1) Demographic data, including participants' sex and specialty. 2) Nutrition myths, comprising 21 items, including the negative impacts of coffee drinking, eating meals at night, eating snacks between meals, and drinking water while eating on body weight, as well as incorrect recommendations for diabetics, such as refraining from fruits completely and avoiding sweets solely to control blood glucose. For questions allocated to the second domain, the respondents had to choose "yes," "no," or "I don't know." Medical specialists were classified into family physicians, general practitioners, internal medicine physicians, and other specialists, such as gynecologists, orthopedic surgeons, radiologists, and pediatricians. Non-physicians specialists included nurses, laboratory specialists, and pharmacists.

Scores Calculation

Each question in the second domain was assigned a score as follows: 0 for "yes," 1 for "I don't know," and 2 for "no." This way, "no" answers indicated correct perceptions about nutrition myths, and thus, higher scores indicate better perceptions. Subsequently, the total raw score for all questions (n=21) answered by each participant ranged between 0 (bad) and 42 (excellent). To be easily interpreted, scaled scores were computed using the following formula: scaled score=raw score *100/42. Hence, scaled scores ranged between 0 and 100, and scores greater than 50 indicated acceptable levels of knowledge.

Statistical Analysis

The Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for the statistical analysis. Variables of the first and second domains were presented in frequencies and percentages as qualitative data while the quantitative data for the total scores and scaled scores were presented as means $\pm$ standard deviations (SDs). The internal consistency of the questionnaire was assessed using Cronbach's alpha. Tests of the normality of score variables, including Shapiro-Wilk and Kolmogorov-Smirnov tests, revealed normally distributed data ($P=0.021$ and 0.20 for each test, respectively). Consequently, a chi-square test and an independent sample T test were applied to test the associations between the variables in the first and second domains. In addition, the associations between total raw and total scaled scores and demographic variables were assessed using an independent sample T test and analysis of variance (ANOVA). Statistical significance was deemed to be present at a P value of <0.05 .

RESULTS

Internal Consistency of the Questionnaire

Analysis of the internal consistency of the second domain revealed a Cronbach's alpha of 0.721 (21 items), indicating a good level of consistency. The application of such a test to the first domain was irrelevant as it only contained two items.

Demographic Characteristics

Of the total respondents, 122 (60.1%) were female. More than half of the participants (57.14%) worked in non-medical specialties, including nurses, laboratory specialists, and pharmacists. Most physicians ($n=38$ out of 87) were general practitioners (GPs), representing 18.7% of the total respondents, followed by family physicians, and other specialists (Figure 1).

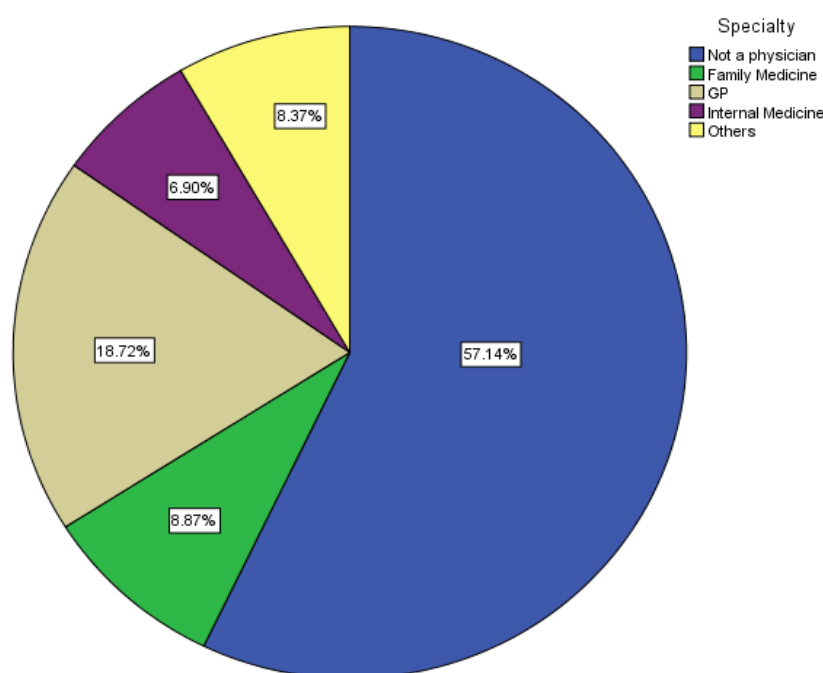


Figure 1: The distribution of participants based on their specialties

Responses to Nutrition Myths

The responses of healthcare professionals are depicted in Figure 2. The majority of the respondents thought that eating meals at night causes weight gain (85.2%), that olive oil contains fewer calories than butter (71.9%), that the common cold can be treated with vitamin C (68.5%), and that drinking water cut with lemon or fruit remove toxins from the body (68.0%). Conversely, most participants denied the assertions that diabetics should definitely avoid eating fruit because of its high

fructose content (84.7%), that eating only one meal per day helps to lose weight (81.8%), that pregnant women should eat for two people (79.3%), and that drinking milk or eating milk products after fish causes food poisoning (74.9%). The mean total score of nutrition knowledge was 22.67 ± 7.02 , whereas the overall scaled score was 53.95 ± 16.70 .

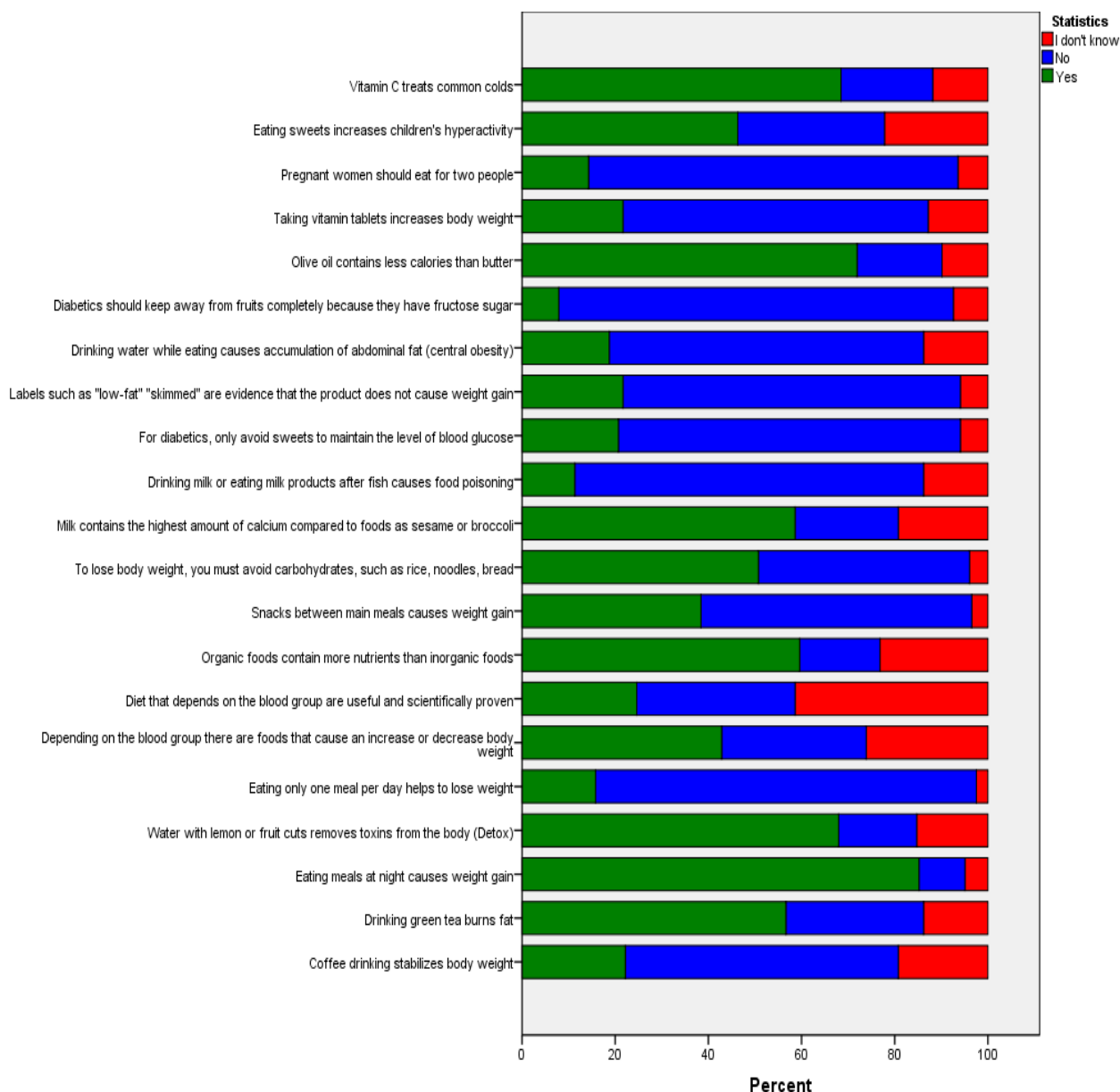


Figure 2: The responses of the participants to different nutrition concepts in the questionnaire

Associations between Demographic Variables and Nutrition Myths

Gender-based differences in the responses to the study questionnaire are demonstrated in (Table 1). Females agreed with the following statements in a significantly greater proportion than males: eating sugars increases the hyperactivity of children (56.56% versus 30.86%, respectively; $P=0.001$), diabetic patients should only avoid the consumption of sweet food to maintain blood sugar levels (27.87% versus 9.88%, respectively; $P=0.006$), and coffee consumption is a stabilizer of body weight (27.87% versus 13.58%, respectively; $P=0.026$). However, male healthcare professionals perceived snack consumption between meals to increase body weight more significantly than females (49.38% versus 31.15%, respectively; $P=0.028$) (Table 1).

Table 1: The correlation between participants' genders and their responses to the study questions

Item	Male (n = 89)			Female (n = 122)			P
	Yes	No	Don't know	Yes	No	Don't know	
Coffee drinking stabilizes body weight	11 (13.58)	56 (69.14)	14 (17.28)	34 (27.87)	63 (51.64)	25 (20.49)	0.026*
Drinking green tea burns fat	49 (60.49)	17 (20.99)	15 (18.52)	66 (54.10)	43 (35.25)	13 (10.66)	0.053
Eating meals at later times causes weight gain	72 (88.89)	4 (4.94)	5 (6.17)	101 (82.79)	16 (13.11)	5 (4.10)	0.139
Water with lemon or fruit cuts removes toxins from the body (detox)	55 (67.9)	9 (11.11)	17 (20.99)	83 (68.03)	25 (20.49)	14 (11.48)	0.066
Eating only one meal per day helps to lose weight	17 (20.99)	64 (79.01)	0 (0.00)	15 (12.30)	102 (83.61)	5 (4.10)	0.056
Depending on the blood group there are foods that cause an increase or decrease body weight	28 (34.57)	27 (33.33)	26 (32.1)	59 (48.36)	36 (29.51)	27 (22.13)	0.12
Diets that depend on the blood group are useful and scientifically proven	14 (17.28)	32 (39.51)	35 (43.21)	36 (29.51)	37 (30.33)	49 (40.16)	0.118
Organic foods contain more nutrients than inorganic foods	49 (60.49)	19 (23.46)	13 (16.05)	72 (59.02)	16 (13.11)	34 (27.87)	0.05
Snacks between main meals cause weight gain	40 (49.38)	38 (46.91)	3 (3.70)	38 (31.15)	80 (65.57)	4 (3.28)	0.028*
To lose weight, you must avoid carbohydrates, such as rice, noodles, and bread	36 (44.44)	43 (53.09)	2 (2.47)	67 (54.92)	49 (40.16)	6 (4.92)	0.166
Milk contains a higher amount of calcium than food (sesame, or broccoli)	50 (61.73)	18 (22.22)	13 (16.05)	69 (56.56)	27 (22.13)	26 (21.31)	0.63
Drinking milk and milk products while eating fish causes food poisoning	5 (6.17)	67 (82.72)	9 (11.11)	18 (14.75)	85 (69.67)	19 (15.57)	0.083
Diabetics should only avoid sweets to maintain their levels of blood glucose	8 (9.88)	69 (85.19)	4 (4.94)	34 (27.87)	80 (65.57)	8 (6.56)	0.006*
Labels such as "low-fat" and "skimmed" are evidence that the product does not cause weight gain	14 (17.28)	62 (76.54)	5 (6.17)	30 (24.59)	85 (69.67)	7 (5.74)	0.465
Drinking water while eating causes abdominal fat (central obesity)	11 (13.58)	61 (75.31)	9 (11.11)	27 (22.13)	76 (62.30)	19 (15.57)	0.148
Diabetics should keep away from fruits completely because they have fructose sugar	5 (6.17)	70 (86.42)	6 (7.41)	11 (9.02)	102 (83.61)	9 (7.38)	0.762
Olive oil contains fewer calories than butter	53 (65.43)	20 (24.69)	8 (9.88)	93 (76.23)	17 (13.93)	12 (9.84)	0.144
Taking vitamin pills increases weight gain	13 (16.05)	60 (74.07)	8 (9.88)	31 (25.41)	73 (59.84)	18 (14.75)	0.112
Pregnant women should eat for two people	15 (18.52)	60 (74.07)	6 (7.41)	14 (11.48)	101 (82.79)	7 (5.74)	0.306
Eating sugar increases children's hyperactivity	25 (30.86)	38 (46.91)	18 (22.22)	69 (56.56)	26 (21.31)	27 (22.13)	0.001*

Vitamin C treats common colds	58 (71.60)	15 (18.52)	8 (9.88)	81 (66.39)	25 (20.49)	16 (13.11)	0.697
Results are expressed as frequencies (percentages); * statistically significant at $P < 0.05$							

Regarding the total scores, the mean scaled score was significantly higher for males than for females (56.85 ± 12.62 versus 52.03 ± 18.74 , respectively; $P=0.03$ (Table 2). Based on the specialties of the healthcare professionals, there were significant differences between the groups throughout the six questions. Participants who did not specialize as medical physicians falsely perceived that obese individuals should cease the intake of carbohydrates to lose weight (61.21%), that sugar consumption increases children's hyperactivity (55.17%), and that sweets should only be avoided to maintain blood glucose levels in diabetics (30.17%); these rates were significantly higher than those of the participants with medical specialties ($P=0.001$, 0.016, and 0.003, respectively). Additionally, the majority of the internal medicine physicians thought that organic food contains more nutrients than inorganic food (85.71%), and that water with lemon or fruit can remove toxins from the body (78.57%), revealing significant differences between those with and without medical specialties ($P=0.01$ and 0.007, respectively).

Table 2: The total and scaled scores of nutrition knowledge among all participants

Parameter	Raw score			Scaled score			P
	Ref.	Mean	SD	Scale	Mean	SD	
Total Score	42	22.67	7.02	100	53.95	16.7	NA
Gender-stratified Scores							0.03
Male	42	23.88	5.29	100	56.85	12.62	
Female	42	21.85	7.87	100	52.03	18.74	
Specialty-stratified Scores							<0.001
Not a physician	42	21.11	7.18	100	50.27	17.09	
Family medicine	42	29.17	5.93	100	69.44	14.13	
General practitioners	42	23.03	6.32	100	54.82	15.04	
Internal medicine	42	23.5	4.57	100	55.95	10.88	
Others	42	24.82	5.76	100	59.1	13.71	

Finally, a significantly higher proportion (76.32%) of GPs than other healthcare professionals perceived that drinking green tea burns fat ($P=0.001$; Table 3). As for the total scores, family medicine physicians had significantly higher mean scaled scores (69.44 ± 14.13) than non-physicians (50.27 ± 17.09), GPs (54.82 ± 15.04), internal medicine physicians (55.95 ± 10.88), and other specialists (59.10 ± 13.71 , $P<0.001$).

Table 3: The correlation between participants' specialties and their responses to the study questions

Parameter	Answer items	Not physician¶ (n = 116)	Family medicine (n = 18)	GP (n = 38)	Internal medicine (n = 14)	Others‡ (n = 17)	P
Coffee drinking stabilizes body weight	Yes	31 (26.72)	1 (5.56)	7 (18.42)	3 (21.43)	3 (17.65)	0.429
	No	63 (54.31)	15 (83.33)	21 (55.26)	9 (64.29)	11 (64.71)	
	Don't know	22 (18.97)	2 (11.11)	10 (26.32)	2 (14.29)	3 (17.65)	
Drinking green tea burns fat	Yes	66 (56.90)	4 (22.22)	29 (76.32)	8 (57.14)	8 (47.06)	0.001*
	No	38 (32.76)	12 (66.67)	6 (15.79)	1 (7.14)	3 (17.65)	
	Don't know	12 (10.34)	2 (11.11)	3 (7.89)	5 (35.71)	6 (35.29)	
Eating meals at later times	Yes	97 (83.62)	16 (88.89)	32 (84.21)	14 (100)	14 (82.35)	0.181

causes weight gain	No	14 (12.07)	2 (11.11)	4 (10.53)	0 (0)	0 (0)	
	Don't know	5 (4.31)	0 (0)	2 (5.26)	0 (0)	3 (17.65)	
Water with lemon or fruit cuts removes toxins from the body (detox)	Yes	82 (70.69)	5 (27.78)	29 (76.32)	11 (78.57)	11 (64.71)	0.007*
	No	18 (15.52)	8 (44.44)	6 (15.79)	1 (7.14)	1 (5.88)	
	Don't know	16 (13.79)	5 (27.78)	3 (7.89)	2 (14.29)	5 (29.41)	
Eating only one meal per day helps to lose weight	Yes	19 (16.38)	1 (5.56)	6 (15.79)	0 (0)	6 (35.29)	0.114
	No	92 (79.31)	17 (94.44)	32 (84.21)	14 (100)	11 (64.71)	
	Don't know	5 (4.31)	0 (0)	0 (0)	0 (0)	0 (0)	
Depending on the blood group there are foods that cause an increase or decrease in body weight	Yes	59 (50.86)	5 (27.78)	14 (36.84)	5 (35.71)	4 (23.53)	0.342
	No	33 (28.45)	7 (38.89)	12 (31.58)	4 (28.57)	7 (41.18)	
	Don't know	24 (20.69)	6 (33.33)	12 (31.58)	5 (35.71)	6 (35.29)	
Diets that depend on the blood group are useful and scientifically proven	Yes	32 (27.59)	4 (22.22)	8 (21.05)	4 (28.57)	2 (11.76)	0.576
	No	38 (32.76)	8 (44.44)	13 (34.21)	6 (42.86)	4 (23.53)	
	Don't know	46 (39.66)	6 (33.33)	17 (44.74)	4 (28.57)	11 (64.71)	
Organic foods contain more nutrients than inorganic foods	Yes	68 (58.62)	9 (50)	19 (50)	12 (85.71)	13 (76.47)	0.01*
	No	13 (11.21)	5 (27.78)	11 (28.95)	2 (14.29)	4 (23.53)	
	Don't know	35 (30.17)	4 (22.22)	8 (21.05)	0 (0.00)	0 (0.00)	
Snacks between main meals cause weight gain	Yes	41 (35.34)	3 (16.67)	18 (47.37)	8 (57.14)	8 (47.06)	0.096
	No	71 (61.21)	15 (83.33)	19 (50.00)	6 (42.86)	7 (41.18)	
	Don't know	4 (3.45)	0 (0.00)	1 (2.63)	0 (0.00)	2 (11.76)	
To lose weight, you must avoid carbohydrates, such as rice, noodles, and bread	Yes	71 (61.21)	4 (22.22)	21 (55.26)	5 (35.71)	2 (11.76)	0.001*
	No	40 (34.48)	11 (61.11)	17 (44.74)	9 (64.29)	15 (88.24)	
	Don't know	5 (4.31)	3 (16.67)	0 (0.00)	0 (0.00)	0 (0.00)	
Milk contains a higher amount of calcium than food (sesame, or broccoli)	Yes	76 (65.52)	6 (33.33)	22 (57.89)	6 (42.86)	9 (52.94)	0.269
	No	22 (18.97)	7 (38.89)	9 (23.68)	4 (28.57)	3 (17.65)	
	Don't know	18 (15.52)	5 (27.78)	7 (18.42)	4 (28.57)	5 (29.41)	
Drinking milk and milk products while eating fish causes food poisoning	Yes	18 (15.52)	1 (5.56)	2 (5.26)	1 (7.14)	1 (5.88)	0.237
	No	79 (68.1)	16 (88.89)	33 (86.84)	12 (85.71)	12 (70.59)	
	Don't know	19 (16.38)	1 (5.56)	3 (7.89)	1 (7.14)	4 (23.53)	
Diabetics can maintain their blood glucose levels by staying away from sweets	Yes	35 (30.17)	0 (0.00)	7 (18.42)	0 (0.00)	0 (0.00)	0.003*
	No	73 (62.93)	18 (100.00)	30 (78.95)	13 (92.86)	15 (88.24)	
	Don't know	8 (6.09)	0 (0.00)	1 (2.63)	1 (7.14)	2 (11.76)	
Labels such as "low-fat" and "skimmed" are evidence that the product does not cause weight gain	Yes	30 (25.86)	0 (0.00)	7 (18.42)	3 (21.43)	4 (23.53)	0.28
	No	78 (67.24)	18 (100.00)	28 (73.68)	11 (78.57)	12 (70.59)	
	Don't know	8 (6.90)	0 (0.00)	3 (7.89)	0 (0.00)	1 (5.88)	
Drinking water while eating causes abdominal fat (central obesity)	Yes	28 (24.14)	0 (0.00)	7 (18.42)	1 (7.14)	2 (11.76)	0.179
	No	72 (62.07)	17 (94.44)	26 (68.42)	11 (78.57)	11 (64.71)	
	Don't know	16 (13.79)	1 (5.56)	5 (13.16)	2 (14.29)	4 (23.53)	
Diabetics should keep away from fruits completely because they have fructose sugar	Yes	9 (7.76)	1 (5.56)	6 (15.79)	0 (0.00)	0 (0.00)	0.421
	No	97 (83.62)	16 (88.89)	30 (78.95)	14 (100.00)	15 (88.24)	
	Don't know	10 (8.62)	1 (5.56)	2 (5.26)	0 (0.00)	2 (11.76)	
Olive oil contains fewer calories	Yes	86 (74.14)	14 (77.78)	23 (60.53)	12 (85.71)	11 (64.71)	0.095

than butter	No	21 (18.1)	3 (16.67)	10 (26.32)	2 (14.29)	1 (5.88)	
	Don't know	9 (7.76)	1 (5.56)	5 (13.16)	0 (0.00)	5 (29.41)	
Taking vitamin pills increases weight gain	Yes	26 (22.41)	3 (16.67)	7 (18.42)	3 (21.43)	5 (29.41)	0.109
	No	68 (58.62)	15 (83.33)	27 (71.05)	11 (78.57)	12 (70.59)	
	Don't know	22 (18.97)	0 (0)	4 (10.53)	0 (0.00)	0 (0.00)	
Pregnant women should eat for two people	Yes	15 (12.93)	2 (11.11)	6 (15.79)	1 (7.14)	5 (29.41)	0.463
	No	92 (79.31)	15 (83.33)	31 (81.58)	13 (92.86)	10 (58.82)	
	Don't know	9 (7.76)	1 (5.56)	1 (2.63)	0 (0.00)	2 (11.76)	
Eating sugar increases children's hyperactivity	Yes	64 (55.17)	5 (27.78)	13 (34.21)	6 (42.86)	6 (35.29)	0.016*
	No	23 (19.83)	9 (50)	17 (44.74)	6 (42.86)	9 (52.94)	
	Don't know	29 (25)	4 (22.22)	8 (21.05)	2 (14.29)	2 (11.76)	
Vitamin C treats common colds	Yes	83 (71.55)	10 (55.56)	25 (65.79)	9 (64.29)	12 (70.59)	0.034
	No	14 (12.07)	7 (38.89)	11 (28.95)	5 (35.71)	3 (17.65)	
	Don't know	19 (16.38)	1 (5.56)	2 (5.26)	0 (0.00)	2 (11.76)	
Results are expressed as frequencies (percentages); * statistically significant at P < 0.05; ‡others include gynecology, orthopedics, radiology, and pediatrics; non-physicians include nursing, laboratory specialists, and pharmacists.							

DISCUSSION

A healthy lifestyle, particularly with proper nutrition, has been identified as a cost-effective modification to the risk factors of multiple diseases [12, 13]. Therefore, there is considerable interest regarding nutrition therapy and practice in healthcare systems. In the present study, we have sought to identify the prevalent nutrition myths that might affect the daily practices of healthcare professionals, and that, consequently, could affect their potential for nutrition counselling. In general, the scaled scores of all participants showed acceptable levels of knowledge, despite being slightly higher than the midpoint score (53.95 ± 16.70). Females reported more frequent agreement with nutrition myths than males, mostly related to the capacity of sugars and sweets to increase children's hyperactivity and the disruption of blood glucose levels in diabetics, respectively. Additionally, males scored significantly higher scaled scores for "refusing" myths. Regarding specialties, family physicians were not duped by nutrition myths because of their significant knowledge, unlike other medical and non-medical healthcare professionals. Conversely, non-medical workers, such as pharmacists, nurses, and laboratory specialists wrongfully validated nutrition myths more frequently than physicians.

In a recent cross-sectional study conducted among cardiovascular medicine specialists in the American College of Cardiology [14], 930 participants responded to the questionnaire, representing a 4.5% response rate. Nutrition myths were prevalent among physicians and more than 95% of cardiologists believed that they could provide patients with minimal or basic nutrition information. In contrast, only 8% thought that they could be regarded as "experts" in nutrition. As for their personal lifestyles, 20% of cardiologists and 21% of fellows-in-training consumed ≥ 5 servings of vegetables and fruits daily.

In Saudi Arabia, Al-Numair [15] found that more than 75% of primary care physicians working in government hospitals described their own knowledge of nutrition as "poor." Further, while these physicians were aware of the public nutrition information published in the media, including antioxidant nutrients, the anticancer effects of fruits and vegetables, and nutrients that help prevent thrombosis, they had poor knowledge of distinct and important topics, such as sources of vitamin B12, the association between protein intake and calcium loss, and the role of soluble fiber in lowering blood cholesterol levels. Al-Numair's study reported a mean mark of correct answers of 51.7% [15], which approximates our overall scaled score. In Jeddah, Al-Zahrani and Al-Raddadi [11] revealed similar results pertinent to the knowledge of common nutrition topics, also finding that awareness of other important topics, such as the biochemical structure of different types of fat, frequently covered in continuing medical education, was poor.

Notably, the identified gaps in nutrition knowledge and the existence of falsely perceived myths about nutrition among those working in the healthcare sector are attributable to deficits in education during early medical life. In a study in the United States, only one-third of the participants received considerable nutrition education during medical school [14]. Another study found that only 14% of internal medicine interns were adequately trained to effectively provide suitable nutrition counseling [16]. In our study, internal medicine physicians reported more frequent myths than other physicians. Additionally, in other

cross-sectional studies in Canada, more than one-third of gastrointestinal fellows did not receive any nutrition education during their fellowships [17,18]. The majority of physicians in the aforementioned studies (predominantly >90%) acknowledged the importance of nutrition education during medical school and within fellowship training programs.

Intriguingly, another potential explanation of these nutrition myths is the presence of multiple defects in information provided by parents to their children, of whom a proportion would be future physicians. Scaglioni et al, [19]. analyzed the factors that affect children's food preferences and the perceived thoughts about dietary components, and found that early parental habits and feeding strategies significantly affected the eating behavior of children as well as their eating choices. This corroborates the effect of parents as role models for their children, which might be targeted in interventions aimed at improving nutrition knowledge [19,20].

Importantly, several studies have shown that the presence of a physician nutrition specialist has an effective role in the training of other physicians and healthcare professionals [16,21-23]. Medical students and resident physicians evidenced a significant increase in their knowledge levels and were more compliant with nutrition recommendations after being engaged in a nutrition education program [10, 24]. Nonetheless, these early studies are outdated, and there has been a need to address the gaps in nutrition education via recent approaches. Unfortunately, Johnston et al. [25] found no recent reviews (published between 2013 and 2018) assessing the type and impact of nutrition-related educational programs conducted in major American conferences, particularly those related to cardiovascular health and targeting healthcare professionals.

In the current study, we found a significant, gender-based difference in the frequency of acceptance of nutrition myths and in the overall scaled score for holding the correct knowledge, which favoured males. In contrast, Allafi et al. demonstrated that female and male physicians provided 65% and 56% correct answers to nutrition-related questions, respectively, and that this difference was statistically significant. The physicians in Allafi et al.'s study experienced major gaps in knowledge regarding hypertension, obesity, and osteoporosis. Moreover, Devries et al. [14] found that female cardiologists and fellows-in-training spent more time in counselling for nutrition than males in the United States. Indeed, the increased levels of knowledge among males in our study were surprising since females are known for their willingness to acquire diet-related information from different sources, such as the media and the internet, as a consequence of social motives and enjoyment.

In our study, non-medical healthcare professionals reported the most frequent acceptance of myths about nutrition. Expectedly, the levels of knowledge were higher among physicians, given that they are exposed to more scientific information regarding the physiological and pathological consequences of dietary components. Likewise, physicians answered nutrition questions significantly more often than nurses in an early study, although overall scores were low (50.9% and 44.5%, respectively).

The present study is not without limitations. The cross-sectional design poses inherent obstacles to a suitable analysis of the confounding factors that might have affected the significant differences/associations. Additionally, the response rate to our distributed surveys was low. As such, the statistical power of the obtained results may have been affected and may not reflect the actual attitudes of medical and non-medical specialists. Further, the relationship between undertaking a previous nutrition-related training program and the number of perceived nutrition myths was not investigated in our analysis. However, to the best of our knowledge, our survey was the first in the Arar region to address nutrition myths and is one of the most comprehensive analytical studies spanning different healthcare specialties in Saudi Arabia.

CONCLUSION

In conclusion, healthcare professionals in the Arar region, Saudi Arabia, had relatively acceptable levels of nutrition-related knowledge. However, they wrongfully perceived several nutrition myths that should be corrected via adequate education and training. Additionally, medical curricula provided to medical students (future physicians) should emphasize nutrition-related subjects and courses in different categories and continuing medical education programs should be offered to physicians and other non-medical health professionals. Increasing knowledge about a number of topics is receiving a great deal of media coverage in Saudi Arabia. Wiggins emphasized the role of interactive media, including the internet, in optimizing the nutrition knowledge of healthcare professionals. This might be of particular importance for decision makers to tailor suitable policies and plans accordingly. In addition, training courses on nutrition should be provided to healthcare providers, including non-medical specialists, to enrich and support their nutrition-related information—an investment that would ultimately be reflected in patient counselling and would improve patient health.

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Conflicts of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article

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