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Nutrition-Related Knowledge, Attitude, and Practices among Government Residential Trainees in Bangladesh: A Cross-Sectional Study

Farjana Rahman Bhuiyan[1*], Rahana Akther[1], Md Sadequl Islam[1], Samia Mahbuba[1], Md Rabiul Alam[1], Khaleda Islam[2]

[1]Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN), Narayanganj, Bangladesh
[2]Institute of Nutrition and Food Science (INFS), Dhaka University, Dhaka, Bangladesh

Email: *farjanarb@yahoo.com, rahanakoly@gmail.com, sadequl2009@gmail.com, mahbubasamia01@gmail.com mithunahmed228@gmail.com, arunadu15@gmail.com

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Abstract

Aim: This study aims to explore the basic nutrition-related knowledge, attitudes, and practices (KAP) among government residential trainees in Bangladesh towards their better health and well-being in order to enhance performance and service in professional life. **Subject and Methods:** This cross-sectional quantitative study included 518 trainees from six government residential institutes. Semi-structured questionnaires collected socio-demographic, anthropometric, and nutrition-related data. Comparison between two groups was done using the students' unpaired t-test for normally distributed continuous variables. Chi-squared tests were performed on categorical data to find the relationships between variables. The data were analyzed using SPSS software for Windows. **Results:** Among the participants, age [yrs, (Mean ± SD)] was 33 ± 4 and 32 ± 3 in the male and female groups, respectively. According to the WHO (2004), BMI categories, 56.8% of males and 48% of females were at increased risk, while 26.9% of males and 24.7% of females were at high risk. Males showed 98% good nutritional knowledge and a positive attitude, but 45.7% had poor daily practices. Similarly, 99% of females had good knowledge and a positive attitude, yet 38.7% demonstrated poor practices. Among males, nutritional knowledge was significantly associated with attitude ($p \leq 0.001$) and showed a trend toward significance with practices ($p = 0.080$). However, no significant associations were found in females. **Conclusions:** Despite having good nutritional knowledge, participants showed poor dietary practices, likely due to limited practical awareness. Ongoing nutrition education and fu-

ture research with larger samples are essential to promote healthier behaviors.

Keywords

Bangladesh, Nutritional Knowledge, Attitude, Self-Practices, Trainees, Dietary Practices, Non-Communicable Diseases (NCDs)

1. Introduction

Nutrition Knowledge (NK) refers to an individual's understanding and cognitive processing of information related to food and nutrition, which influences their dietary habits and is essential in preventing non-communicable diseases [1]. A significant portion of global mortality is caused by non-communicable diseases (NCDs), which can be reduced through lifestyle modifications, regular physical activity, and proper nutrition [2]. Although malnutrition has become one of the major obstacles to development in countries like Bangladesh, where the double burden of under- and over-nutrition exists. The non-communicable diseases (NCDs) like Diabetes, hypertension, ischemic heart disease, stroke, chronic respiratory diseases, and cancers have already appeared as leading public health problems in Bangladesh. These non-communicable diseases (NCDs) are estimated to account for 71% of total deaths in Bangladesh [3].

Nutritional status is one of the significant health indicators to evaluate a country's health standard and morbidity pattern [4]. Improving nutritional knowledge is important for many aspects, such as helping to balance intake of food, such as food that contains carbohydrates, proteins, fat, vitamins, and minerals [5].

However, eating behavior plays a crucial role in overall well-being, as it significantly impacts long-term health outcomes. Unhealthy eating habits, such as consuming nutrient-poor foods, skipping meals, and lacking a consistent eating schedule, can lead to a range of health problems and nutritional deficiencies [6] [7]. In contrast, maintaining a balanced diet and consuming high-quality, nutrient-rich foods can support both physical health and mental well-being, promoting overall stability and long-term wellness [8] [9]. Each country in Asia has distinct dietary patterns and culinary characteristics. Mixed dishes are a common practice, and people tend to share their food from the same bowl. The frequent use of condiments and spices is widely observed [10].

Notably, adequate physical activity is essential for maintaining optimal health. Globally, insufficient physical activity remains a significant public health concern, with approximately 23% of adults failing to meet the World Health Organization's recommended levels of physical activity [11]. Physical activity is operationally defined as any movement involving skeletal muscles that results in energy expenditure [12]. These include walking, jogging, cycling, swimming, and participation in various sports. WHO recommends at least 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity exercise per week, along with muscle-

strengthening activities on two or additional days per week. These guidelines are considered to promote health and prevent chronic diseases, especially cardiovascular diseases, which are responsible for an estimated 34% of total deaths in Bangladesh [3].

In addition to regular exercise, another critical factor is sleep. According to the Centers for Disease Control and Prevention (CDC), nearly 35% of adults in the United States reported sleeping less than the recommended 7 to 9 hours per night, which can have adverse effects on both physical and mental health [13]. Adequate sleep is closely linked to cognitive functioning, emotional regulation, and physical well-being.

Over the past decades, Bangladesh has made substantial progress in expanding higher training facilities. To enhance higher training in multifaceted disciplines and support various government officials, the government, in principle, has favored initiatives that establish residential training institutes. Such residential facilities offer a wonderful and hands-on experience in many aspects of their lives, as they spend a substantial amount of time there. Eating patterns and dietary habits are likely to be an additional challenge as they negotiate the many difficulties of the new environment and limited food budget. Though prioritizing the health of government employees is essential for sustainable national development. A healthy, motivated, and resilient public workforce is crucial. This workforce enables the effective implementation of policies and programs. As a result, the health of government employees should be viewed as a public health priority and a strategic element of good governance. However, this study aims to investigate the nutrition-related knowledge, attitude, and practices among government residential trainees in Bangladesh.

2. Methods

2.1. Study Design and Participants

The cross-sectional study design was adopted, and a total of 518 (five hundred eighteen) trainees from purposively selected six government residential training institutes in Bangladesh were included in this study. About 368 (three hundred sixty-eight) males and 150 (one hundred fifty) females were included in the study. Respected trainees who were beyond the age group of 25 - 45 years or were unable to answer a shortlist of questions (sociodemographic information such as name, address, having any systemic illness like acute severe septic conditions, acute and chronic gastrointestinal, endocrine, cardiac, hepatic, renal, respiratory diseases, etc.) were excluded from the study (**Figure 1**).

2.2. Questionnaire Development

Initially, a questionnaire validation workshop was conducted, with the participation of approximately 30 experts, including representatives from various government residential training institutes, healthcare professionals, nutritionists, academics, and researchers. Based on their consultation, a structured questionnaire

was developed, comprising three sections: socio-demographic information, anthropometric data, nutrition-related knowledge, attitudes, and practices (KAP).

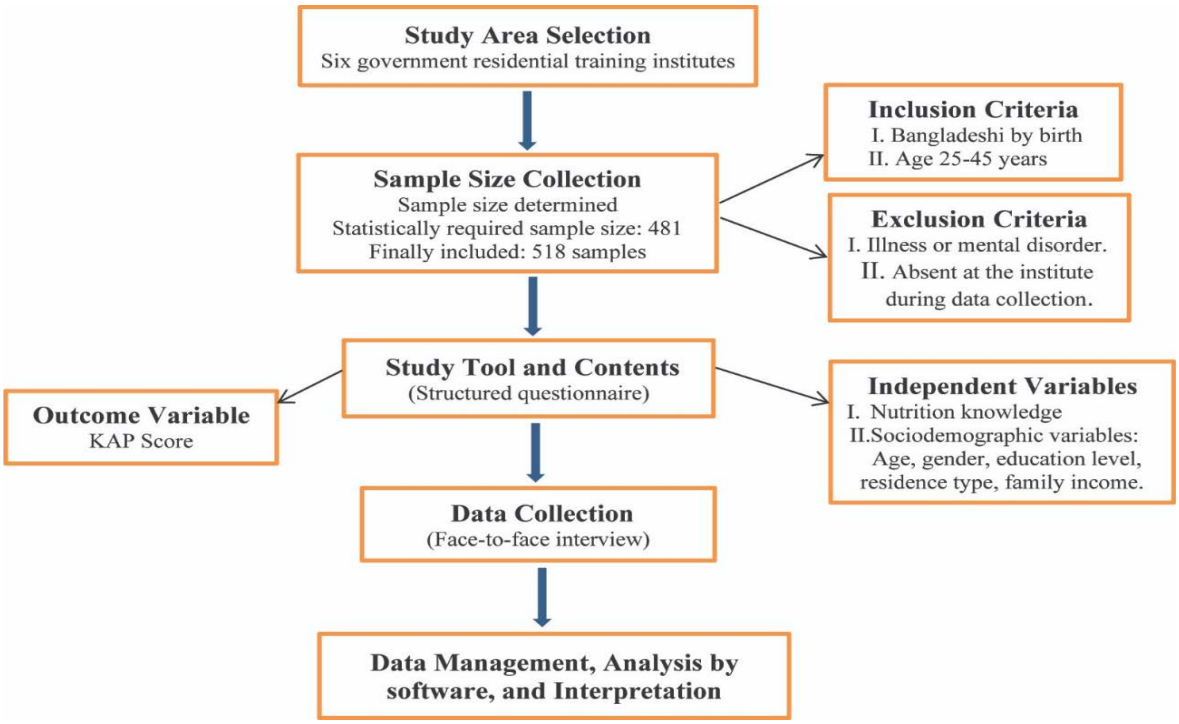

Figure 1. Methodological framework of the study.

2.2.1. Part 1: Socio-Demographics

The socio-demographic section of the questionnaire gathers information on participants' age, educational level, monthly income, religion, and residence to provide context for interpreting the study findings.

2.2.2. Part 2: Anthropometric

Body Mass Index (BMI)

Anthropometric measurements were employed to assess the height and weight of the participants. Standing height was measured to the nearest 0.5 cm using a stadiometer (Detect-Medic, Detecto Scales Inc., USA). Body weight was recorded to the nearest 0.5 kg using a portable weighing scale, with participants wearing light clothing and no footwear. The Body Mass Index (BMI) was subsequently calculated using the standard WHO-recommended formula: BMI = weight (kg)/height^2 (m^2) [14].

Waist circumference

The circumferences were measured to the nearest centimeter using a flexible tape with the respondent in a standing position. In women, the abdominal circumference (waist) was measured as the narrowest part of the body between the chest and hips, while in men it was measured at the level of the umbilicus.

Hip circumference

Hip circumference was measured to the nearest centimeter at the widest point

around the buttocks, approximately at the level of the greater trochanters (hip bones).

Waist to Hip Ratio (WHR)

WHR was calculated by dividing waist circumference by hip circumference. According to the WHO-2008 guidelines [15], cut-off points for waist circumference are 85 cm and 80 cm, and WHR cut-off values of 0.90 and 0.80 for men and women, respectively, where a higher ratio indicates an increased risk of adverse health outcomes.

2.2.3. Part 3: Nutritional Knowledge, Attitude, and Practices (KAP)

A structured questionnaire was developed and administered to evaluate the nutrition-related knowledge, attitudes, and practices (KAP) of the participants. The level of nutritional knowledge was assessed using 20 statements, attitudes were measured through 15 statements, and 10 statements were used to evaluate dietary practices. A pilot test of the questionnaire was conducted to verify the clarity and comprehensibility of the questionnaire items among the participants. The results of the pilot test suggested that changes should be made in the questionnaire to force participants to make a decision based on their given knowledge. The revised questionnaire was reviewed by a panel of experts to ensure that all questionnaire items were relevant, clear, and aligned with the objectives of the study.

The nutritional knowledge section was designed to assess each participant's level of knowledge, attitudes, and practices (KAP) related to nutrition. To ensure linguistic accuracy and cultural relevance, the questionnaire was translated into Bangla by two independent translators who were native speakers of the target language. Subsequently, two separate back-translations into English were performed by native English speakers. The nutritional knowledge component consisted of 20 dichotomous (yes/no) questions, with responses scored as 1 for "yes" and 0 for "no", resulting in a total possible score ranging from 0 to 20. The score was divided into three categories: poor knowledge with a score less than 50% {<10}, moderate knowledge from 50% to 75% (10 to 15), and good knowledge more than 75% {>15}. 15 questions for attitude answered with (1, 0) for agreed and not agreed. The total score ranged from 0 to 15. The score was divided into three categories: negative with a score of less than 50% {<8}, indifference from 50% to 75% {8 to 11}, and positive more than 75% {>11}. There were 10 questions scored (1, 0) for practices. The total score ranged from 0 to 10. The score was divided into three categories: poor practices with a score less than 50% {<5}, moderate from 50% to 75% {5 to 8}, and good more than 75% {>10} [16].

2.3. Sample Size and Statistical Analysis

The desired sample size was determined using Fisher *et al.*, 1998 formula. $n = Z^2 pq/d^2$, where n = the desired sample size, z = the standard normal deviation at the required confidence level of 1.96, d = the level of statistical significance set, p = the proportion in the characteristics being measured, and $q = 1 - p$ [17]. Statistical tests were considered significant at p-values ≤5% (≤0.05). Frequencies were cal-

culated for descriptive analysis. Comparison between two groups was done using the students' unpaired t-test for normally distributed continuous variables. Chi-squared tests were performed on categorical data to find the relationships between variables. All statistical measures were performed using Statistical Package for Social Sciences (SPSS) for Windows version 22.0 (SPSS Inc., Chicago, IL, USA).

3. Results

The sociodemographic characteristics of the study subjects are shown in Table 1. A total number of 368 (three hundred sixty-eight) males and 150 (one hundred fifty) females were included in the study. Among them, age [yrs, (Mean ± SD)] was 33 ± 4 and 32 ± 3 in the two groups, respectively. The majority were Muslim (88%) and lived in urban areas (78%). Individually, 65% of the participants reported having a monthly income. Based on education, 64% of male participants and 69% of female participants were postgraduates.

Table 1. Socio-demographic Characteristics of the participants.

Characteristics	Male (n = 368)	Female (n = 150)
Age (yrs)	33 ± 4	32 ± 3
Educational level		
Graduate	99 (26.9%)	41 (27.3%)
Post Graduate	236 (64.1%)	103 (68.7%)
Above Post Graduate	33 (9%)	6 (4%)
Monthly Family Income (TK)		
<30,000	7 (1.9%)	4 (2, 7)
30,000 - 40,000	115 (31.2%)	52 (34.7%)
>40,000	246 (66.8%)	94 (62.7%])
Marital Status		
Married	313 (95.1%)	116 (77.3%)
Single	55 (14.9%)	33 (22%)
Other	-	1 (0.7%)
Religion		
Muslim	325 (88.3%)	130 (86.7%)
Hindu	38 (10.3%)	20 (13.3%)
Christian	5 (1.4%)	-
Boddadh	-	-
Habitat		
Rural	121 (32.9%)	17 (11.3%)
Urban	247 (67.1%)	133 (88.7%)

Values are expressed as mean ± SD and number (%).

Figure 2 shows the distribution of the participants according to different BMI categories (adapted from the WHO guideline, 2004). The level of increasing but acceptable was 16.3% in males, and 22% in females. The level of increased risk was 56.8% in males, and 48% in females, and the high risk was about 26.9% in males, and 24.7% in females. respectively. The mean BMI was significantly higher in males compared to females (25.97 ± 3.23 vs. 25.09 ± 4.22, p = 0.011). A highly significant difference was observed in Waist-Hip Ratio (WHR) between males and females (0.93 ± 0.07 vs. 0.85 ± 0.08, p ≤ 0.001) in Table 2.

Table 2. Anthropometric characteristics of the participants.

Characteristics	Male (n = 368)	Female (n = 150)	t/p value
Body Mass Index (kg/m²)	25.97 ± 3.23	25.09 ± 4.22	**0.011**
Waist Hip Ratio (WHR)	0.93 ± 0.07	0.85 ± 0.08	**≤0.001**

Values are expressed as mean ± SD, p < 0.05 was considered as statistically significant.

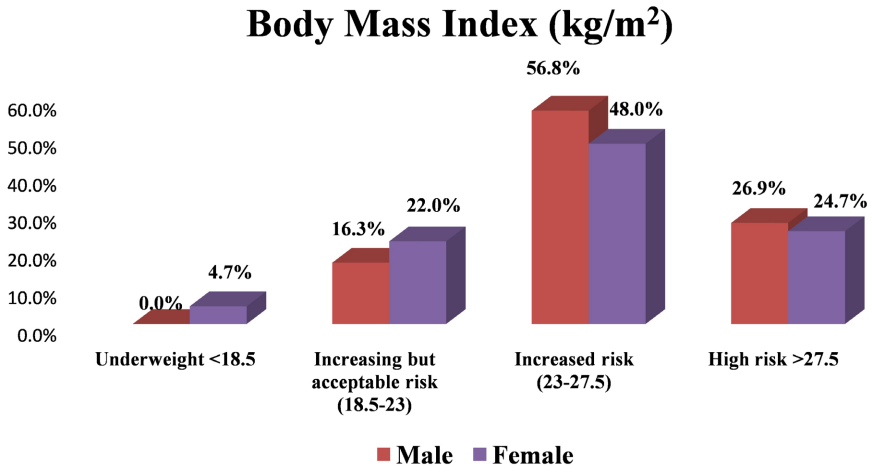

Figure 2. Percentile distribution of the participants by Body Mass Index (BMI).

The majority of the participants demonstrated a decent level of nutritional knowledge. They were well-informed about the functions of proteins, fats, carbohydrates, and vitamins and minerals. And about 91.85% was known about a balanced diet. About 99.45% knew that washing hands with soap and water before and after eating can prevent infectious diseases (Table 3). Most of the study subjects had a positive attitude about nutrition (Table 4). Table 5 shows that 57.6% males took breakfast before going outside, but 32% did not take a meal at a specific time more than 3 days per week. And about 60% females took breakfast before going outside, but 29% did not take a meal at a specific time more than 3 days per week respectively. Around 26% of participants consumed vegetables and fruits more than 3 days a week. And they also 40% avoid fast food or street food for better well-being. They had good practices on washing hands with soap and water before and after eating, which can prevent infectious diseases.

Table 3. Nutritional knowledge among study subjects.

Questions	Answer					
	Yes (%)		No (%)		Not Know (%)	
	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)
A balanced diet consists of all nutrients in proper proportion	330 (89.7)	142 (94)	38 (10.3)	9 (6)	-	-
Carbohydrates and fat produce heat & energy in the body	352 (95.7)	143 (95.3)	14 (3.8)	7 (4.7)	2 (0.5)	-
Vitamins and minerals need to protect our bodies from diseases	360 (97.8)	148 (98.7)	6 (1.6)	2 (1.3)	2 (0.5)	-
Protein is needed to build up our bodies	363 (98.6)	147 (98)	4 (1.1)	2 (1.3)	1 (0.3)	1 (0.7)
Rice would be an alternative to bread/noodles	312 (84.8)	139 (92.7)	53 (14.4)	10 (6.7)	3 (0.8)	1 (0.7)
Vegetables and fruits are rich sources of vitamins & minerals	362 (98.4)	147 (98)	4 (1.1)	3 (2.0)	2 (0.5)	-
Animal protein would be an alternative to plant proteins	131 (35.6)	48 (32)	233 (63.3)	101 (67.3)	4 (1.1)	1 (0.7)
Fish can be replaced with tofu/nuts/pulses	350 (95.1)	149 (99.3)	16 (4.3)	1 (0.7)	2 (0.5)	-
Milk and meat are also protein sources	356 (96.7)	147 (98)	12 (3.3)	3 (2.0)	-	-
A cold drink is good for health	50 (13.6)	11 (7.3)	318 (86.4)	139 (92.7)	-	-
Physical exercise helps to prevent obesity	365 (99.2)	149 (99.3)	3 (0.8)	1 (0.7)	-	-
Ideal body weight is an indicator of health status	323 (87.8)	131 (87.3)	40 (10.9)	17 (11.3)	5 (1.4)	-
Iron helps to make blood cells	360 (97.8)	149 (99.3)	6 (1.6)	1 (0.7)	2 (0.5)	-
Vitamin C is required for the absorption of non-iron	255 (69.3)	114 (76)	84 (22.8)	29 (19.3)	29 (7.9)	7 (4.7)
Anemia is a syndrome of Iron deficiency	324 (88)	139 (92.7)	33 (9.0)	11 (7.3)	11 (3.0)	-
Vitamin D is required with Ca for bone formation	341 (92.7)	142 (94.7)	19 (5.2)	6 (4.0)	8 (2.2)	2 (1.3)
Milk and milk products provide calcium and vitamin D for the body	339 (92.1)	147 (98)	18 (4.9)	3 (2.0)	11 (3.0)	-
Fiber-rich foods are good for health	360 (97.8)	150 (100)	8 (2.2)	-	-	-
A sufficient amount of oil is required for the absorption of all nutrients	329 (89.4)	148 (98.7)	32 (8.7)	1 (0.7)	7 (1.9)	1 (0.7)
Washing hands with soap and water before and after eating can prevent infectious diseases	364 (98.9)	150 (100)	4 (1.1)	-	-	-

Values are expressed as number (%).

Table 4. Nutritional attitude among study subjects.

Question	Answer			
	Agree		Disagree	
	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)
Breakfast makes it easy to learn	366 (99.5)	150 (100)	2 (0.5)	-
A variety of foods provides all the nutrients	355 (96.5)	140 (93.3)	13 (3.5)	10 (6.7)

Continued

Healthy food is expensive	34 (9.2)	6 (4.0)	334 (90.8)	144 (96)
Consume 2 - 3 servings of fruit per day	349 (94.8)	143 (95.3)	19 (5.2)	7 (4.7)
Consume 1 cup of leafy vegetables per day	362 (98.4)	150 (100)	6 (1.6)	-
Consume 1/2 cup of vegetables per day	363 (98.6)	149 (99.3)	5 (1.4)	1 (0.7)
Consume 2 - 3 servings of protein per day	265 (72.0)	114 (76)	103 (28)	36 (24)
Vegetables and fruits are inevitable for the body to be healthy and fit	363 (98.6)	149 (99.3)	5 (1.4)	1 (0.7)
Animal protein is better than vegetable protein	243 (66)	89 (59.3)	125 (34)	61 (40.7)
Consuming fish is good for health	362 (98.4)	148 (98.7)	6 (1.6)	2 (1.3)
Drinking 1 glass or 150 ml of milk per day is good for sound health	354 (96.2)	149 (99.3)	14 (3.8)	1 (0.7)
Drink at least 8 glasses or 2 liters of water per day	364 (98.9)	149 (99.3)	4 (1.1)	1 (0.7)
Use Iodized salt for cooking food	363 (98.6)	149 (99.3)	5 (1.4)	1 (0.7)
Necessary to monitor weight for at least a month	354 (96.2)	142 (99.3)	14 (3.8)	8 (5.3)
To cut & clean the nails for healthy behavior	365 (99.2)	150 (100)	3 (0.8)	-

Values are expressed as number (%).

Table 5. Nutritional practices among study subjects.

Question	Answer									
	yes		<3 days in a week		>3 days in a week		Seldom		No	
	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)
Take breakfast before going to outside	212 (57.6)	90 (60)	19 (5.2)	6 (4.0)	109 (29.6)	44 (29.3)	19 (5.2)	5 (3.3)	9 (2.4)	5 (3.3)
Consumption of vegetables per day	185 (50.3)	90 (60)	45 (12.2)	14 (9.3)	117 (31.8)	41 (27.3)	16 (4.3)	3 (2.0)	5 (1.4)	2 (1.3)
Consumption of fruit every day	153 (41.6)	69 (46)	80 (21.7)	32 (21.3)	84 (22.8)	33 (22)	47 (12.8)	12 (8.0)	4 (1.1)	4 (2.7)
Avoid fast food or street food	141 (38.3)	62 (41.3)	84 (22.8)	34 (22.7)	56 (15.2)	22 (14.7)	65 (17.7)	21 (14)	22 (6.0)	11 (7.3)
Take a meal at a specific time	164 (44.6)	78 (52)	47 (12.8)	16 (10.7)	117 (31.8)	43 (28.7)	31 (8.4)	10 (6.7)	9 (2.4)	3 (2.0)
Take lunch at the office	235 (63.9)	105 (70)	21 (5.7)	4 (2.7)	97 (26.4)	36 (24)	7 (1.9)	2 (1.3)	8 (2.2)	3 (2.0)
Wash your hands with soap and water before and after eating	251 (68.2)	112 (74.7)	6 (1.6)	2 (1.3)	95 (25.8)	30 (20)	10 (2.7)	2 (1.3)	6 (1.6)	4 (2.7)
Eat an egg every day	147 (39.9)	79 (52.7)	57 (15.5)	24 (16)	107 (29.1)	32 (21.3)	43 (11.7)	11 (7.3)	14 (3.8)	4 (2.7)
Drink a glass of milk every day for good health	110 (29.9)	50 (33.3)	55 (14.9)	37 (24.7)	49 (13.3)	23 (15.3)	103 (28)	26 (17.3)	51 (13.9)	14 (9.3)
Drink eight glasses of water a day for better health	217 (59)	100 (66.7)	23 (6.2)	6 (4)	98 (26.6)	33 (22)	18 (4.9)	7 (4.7)	12 (3.3)	4 (2.7)

Values are expressed as number (%).

Figure 3 illustrates that approximately 98% of males and 99% of females had good nutritional knowledge and maintained a positive attitude. However, 45.7% of males and 38.7% of females demonstrated poor dietary practices in daily life.

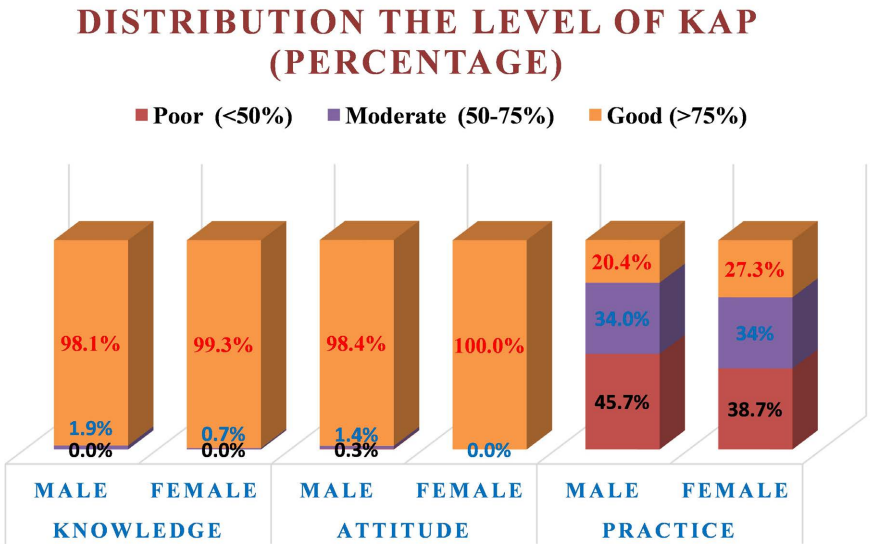

Figure 3. Frequency distribution of the level of Knowledge, Attitude & Practice (KAP) of the participants.

Table 6 shows the relationship between their knowledge, attitude, and practices among the participants. Among the males, there is a significant association of nutritional knowledge with attitude ($p \leq 0.001$) and a trend toward significance to practices ($p = 0.080$). But in females, there was no significant association of nutritional knowledge with attitude and practices.

Table 6. The relationship between knowledge, attitude, and practice among the study subjects.

Attitude and Practice		Knowledge						Significance test p value	
		Poor Knowledge		Moderate Knowledge		Good Knowledge			
		Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)	Male (n = 368)	Female (n = 150)
Attitude	Negative	0	0	1	0	0	0	$X^2 = 60.87$ **$P \leq 0.001$**	
	Indifference	0	0	1	0	4	0		
	Positive	0	0	5	1	357	149		
Practice	Poor	0	0	6	1	162	57	$X^2 = 5.06$ $P = 0.080$	$X^2 = 1.59$ $P = 0.450$
	Moderate	0	0	0	0	125	51		
	Good	0	0	1	0	74	41		

Values are expressed as number (n), $p < 0.05$ was considered as statistically significant.

As shown in Table 7, approximately 36.7% of male participants reported engaging in physical activity 1 - 2 days per week, whereas about 32% of female par-

ticipants reported engaging in physical activity more than 5 days per week. For better health, nearly 62% of participants reported sleeping between 6 to 8 hours per day, which aligns with general sleep recommendations for adults (Table 8).

Among the participants, educational level was significantly associated with practice (p = 0.025), while total sleep time showed a trend toward significance (p = 0.070). No other factors were significantly associated with self-practices (Table 9).

Table 7. Physical activity per week of the participants.

Physical Activity	Male (n = 368)	Female (n = 150)
≥5 days/week	57 (15.5%)	48 (32%)
3 - 4 days/week	115 (31.2%)	42 (28%)
1 - 2 days/week	135 (36.7%)	44 (29.3)
No activity	61 (16.6%)	16 (10.7)

Values are expressed as number (%).

Table 8. Total sleep time of the participants.

Total Sleep Time	Male (n = 368)	Female (n = 150)
<4 hours/day	7 (1.9%)	4 (2.7%)
4 - 6 hours/day	97 (26.4)	60 (40%)
6 - 8 hours/day	253 (68.8)	81 (54%)
>8 hours/day	11 (3%)	5 (3.3%)

Values are expressed as number (%).

Table 9. Participants' self-practice score by the selected factors.

Variables	Practice Score			Chi square	p value
	Poor	Moderate	Good		
	n (%)	n (%)	n (%)		
Gender					
Male	168 (32.4%)	125 (24.1%)	75 (14.5%)	3.492	0.174
Female	58 (11.2%)	51 (9.8%)	41 (7.9%)		
Age (yr)					
<33	121 (23.4%)	105 (20.3%)	67 (12.9%)	1.595	0.450
>33	105 (20.3%)	71 (13.7%)	49 (9.5%)		
Educational level					
Graduate	70 (13.5%)	39 (7.5%)	31 (6.0%)	11.158	**0.025**
Post Graduate	141 (27.2%)	128 (24.7%)	70 (13.5%)		
Above Post Graduate	15 (2.9%)	9 (1.7%)	15 (2.9%)		

Continued

Monthly Family Income (TK)					
<30,000	5 (1.0%)	4 (0.8%)	2 (0.4%)	0.478	0.976
30,000 - 40,000	75 (14.5%)	57 (11.0%)	35 (6.8%)		
>40,000	146 (28.2%)	115 (22.2%)	79 (15.3%)		
Habitat					
Rural	58 (11.2%)	46 (8.9%)	34 (6.6%)	1.825	0.768
Urban	167 (32.2%)	130 (25.1%)	82 (15.8%)		
Physical Activity					
≥5 days/week	41(7.9%)	33 (6.4%)	31 (6.0%)	7.469	0.280
3 - 4 days/week	69 (13.3%)	49 (9.5%)	39 (7.5%)		
1 - 2 days/week	84 (16.2%)	64 (12.4%)	31 (6.0%)		
No activity	32 (6.2%)	30 (5.8%)	15 (2.9%)		
Total Sleep Time					
<4 hours/day	4 (0.8%)	2 (0.4%)	5 1.0%	11.665	0.070
4 - 6 hours/day	83 (16.0%)	43 (8.3%)	31 (6.0%)		
6 - 8 hours/day	133 (25.7%)	125 (24.1%)	76 (14.7%)		
>8 hours/day	6 (1.2%)	6 (1.2%)	4 (0.8%)		
Body Mass Index (kg/m²)					
Underweight (<18.50)	3 (0.6%)	2 (0.4%)	2 (0.4%)	1.497	0.960
Increasing but acceptable risk (18.5 - 23)	36 (6.9%)	34 (6.6%)	23 (4.4%)		
Increased risk (23 - 27.5)	126 (24.3%)	96 (18.5%)	60 (11.6%)		
High risk (≥27.5)	61 (11.8%)	44 (8.5%)	31(6.0%)		

Values are expressed as number (n), $P < 0.05$ was considered as statistically significant.

4. Discussion

Nutrition-related knowledge, attitudes, and practices (KAP) are widely recognized as critical determinants of dietary behaviors. Inadequate dietary practices, often resulting from poor KAP, significantly contribute to the rising global burden of chronic non-communicable diseases (NCDs). In our country, one of the main causes of NCDs is unhealthy eating habits, which often lead to overweight or obesity. In the present study, 48% of females and 56.8% of males were found to be at increased risk, while 24.7% of females and 26.9% of males were classified as high risk based on different BMI categories, following the WHO 2004 guidelines [14]. These findings are somewhat comparable to the 39.26% documented by Onamika *et al.* [18], yet significantly higher than the levels observed by Hossain *et al.* [19]. According to the BDHS 2020 data, approximately 30% of adult females (aged 20 -

49 years) and 20% of adult males are overweight in Bangladesh [20]. In contrast to national data, this study observed a significantly higher mean BMI in males compared to females (25.97 ± 3.23 vs. 25.09 ± 4.22; p = 0.011). Waist-Hip Ratio (WHR), another important risk factor for NCDs, showed a highly significant difference between males and females (0.93 ± 0.07 vs. 0.85 ± 0.08; p = 0.001). These findings are consistent with a study conducted among elderly individuals in Singapore, where 79.8% were found to have a high WHR [21].

In the present study, it is encouraging to observe that the majority of respondents possessed basic nutrition knowledge. The majority of participants (91.85%) were familiar with the concept of a balanced diet, which aligns with the findings of Spronk *et al.* [1]. Although their results were derived from a systematic review, the current study employed a cross-sectional design. Additionally, 97% of participants demonstrated awareness of the role of nutrients, which contrasts with the findings reported by Park *et al.* [22]. Nevertheless, participants demonstrated a high level of knowledge regarding personal hygiene, particularly the importance of handwashing with soap and clean water before and after eating, which is essential in preventing infectious diseases (**Table 2**). This finding is consistent with a study conducted in Nepal in 2017 among a village community, where 90% of respondents demonstrated sanitary knowledge [23]. In contrast, a study by Begum *et al.* among the adult population in Dhamrai, Dhaka, reported that only 60% practiced good personal hygiene, while 40% did not follow adequate hygiene practices [24].

Regarding participants' attitudes, the majority (99%) demonstrated a positive attitude toward nutrition. Most respondents agreed that consuming vegetables and fruits is essential for maintaining good health (98.95%), daily vegetable consumption is beneficial (99%), drinking at least 8 glasses or 2 liters of water per day is important (99.1%), and maintaining hygiene through practices like cutting and cleaning nails contributes to healthy behavior. Overall, the findings indicate a strong positive attitude among participants toward these health-related behaviors, which is somewhat consistent with the results reported by Nayan *et al.* [25].

Breakfast is an important part of a healthy diet and lifestyle, with the potential to positively influence participants' overall health and well-being. In this study, 58.8% of participants reported eating breakfast before going outside, while 29% skipped breakfast more than three times per week. Skipping breakfast not only sets a poor nutritional tone for the day but also leads to missing out on essential nutrients. Additionally, the study found that only 55% of participants consumed vegetables daily, highlighting further gaps in dietary habits. Vegetable consumption plays a vital role in protecting against NCDs and reducing micronutrient deficiencies in Bangladesh. According to the dietary guidelines for Bangladesh [26], a varied and balanced diet for adults should include at least 100 g of leafy and 200 g of non-leafy vegetables daily, equivalent to five servings. However, the latest Household Income and Expenditure Survey [27] reports that the average per capita intake of vegetables (both leafy and non-leafy) is approximately 201.9 g per

day, which falls short of the recommended amount. Intended for a healthier life cycle, we should increase vegetable consumption every day. Nevertheless, in the present study, educational level was significantly associated with practices among the participants ($p = 0.025$), closely aligning with findings by Nayan *et al.* [25], who reported a similar association ($p = 0.078$). Conversely, no other factors demonstrated a significant association with practices.

This study is the first of its kind of research to assess the contribution of Knowledge, Attitudes, and Practices (KAP) towards nutritional awareness and a healthy lifestyle among government residential trainees in Bangladesh. Based on the KAP scoring system, results were categorized as poor (<50%), moderate (50% - 75%), and good (>75%). Among male participants, 98.1% demonstrated good nutritional knowledge, 98.47% maintained a positive attitude, and 20.4% reported good practices in their daily lives. In comparison, 99.3% of female participants showed good nutritional knowledge, all maintained a positive attitude, and 27.3% reported good daily practices. Among male participants, nutritional knowledge showed a significant association with attitude ($p \leq 0.001$) and a trend toward significance with practices ($p = 0.080$). However, no significant association was found between nutritional knowledge and either attitude or practices among female participants. Although participants demonstrated high knowledge, this did not consistently translate into proper practice. Rather than a lack of awareness, this gap may be influenced by factors such as time constraints, the institutional food environment, and stress associated with residential training as well as professional exertion. Addressing these structural and behavioral barriers is essential to ensure that nutritional knowledge is effectively applied in practice.

Nonetheless, Physical activity enhances cardiovascular health and positively impacts other areas of well-being. Studies showed that individuals who engage in at least 150 minutes of moderate-intensity physical activity per week have a 33% lower risk of all-cause mortality compared to those who are sedentary [28]. This study found that approximately 36.7% of male participants engaged in physical activity 1 - 2 days per week, while 32% of female participants reported being physically active more than 5 days per week. Although physical activity can help regulate the circadian rhythm, it also plays a key role in improving sleep patterns. About 62% of participants reported sleeping between 6 to 8 hours per day, which aligns with general sleep recommendations for adults. Moreover, among the participants, total sleep time showed a trend toward significance in relation to practices ($p = 0.070$).

To date, no other study in Bangladesh has specifically examined the KAP (Knowledge, Attitude, and Practices) scoring system related to nutrition among government residential trainees. The association between knowledge, attitude, and practice is thoroughly interconnected. Knowledge serves as the foundation, shaping attitudes by influencing how individuals observe and interpret information. Nonetheless, it is well established that nutrition-related knowledge and a positive attitude play a crucial role in promoting healthy dietary practices. Con-

versely, poor dietary habits are major contributors to the development of NCDs.

5. Conclusion

The findings of this study reveal that although participants possess nutritional knowledge, their actual practices remain insufficient. Despite being well-educated, professionally established, and having no financial barriers to access nutritious food, a lack of awareness remains an obstacle to maintaining good health. Training institute administrators should actively arrange nutrition or health education courses and organize practical nutrition workshops to promote positive changes in self-care and dietary habits. Future research should include follow-up studies with larger sample sizes to provide more comprehensive insights.

Ethics (Consent to Participate)

The study protocol was approved by the ethics committee (Ref: 12.09.0000.004.71.001.24-1532) of the Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN). Participants were recruited from six purposively selected government residential training institutes across Bangladesh. Firstly, written consent was obtained from the individual participants before going through the interview for the study. Various domains of privacy, such as the reasonable expectation of an individual's privacy (e.g., name, address, contact number, health history, and social status), were removed before analyses to maintain confidentiality.

Authors' Contributions

FRB: contributed her intellectual ability to the conception and design of the research, analysis, and interpretation of data; revised it critically for important intellectual content, and final approval of the version to be published. RK and KI supervised the study. SM and MRA conducted the data collection, editing, and sorting. FRB and MSI drafted the manuscript. RK, KI, and FRB contributed their intellectual skill in the revision of the manuscript, revised the manuscript analytically for important intellectual content. All of the above authors read and approved the published version of the manuscript.

Consent for Publication

All participants provided written informed consent prior to their inclusion in the study and for the publication of their data.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

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Conflicts of Interest

The authors declare that they have no competing interests.

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Abbreviation

KAP: Knowledge, Attitudes, and Practices
BMI: Body Mass Index
WHR: Waist-Hip Ratio
WHO: World Health Organization
BIRTAN: Bangladesh Institute of Research and Training on Applied Nutrition