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Association Between Diabetes-Related Nutrition Knowledge and Weight Status among Cadet and Non-cadet Students at Universiti Pertahanan Nasional Malaysia (UPNM)

Izzatul Hareesa Zaidi[1], Atiqa Nabiha Azizzul[1], Nazrul Hadi Ismail[1,2*], Wan Farizatul Shima binti Wan Ahmad Fakuradzi[3]

[1]Centre for Dietetic Studies, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

[2]Integrated Nutrition Science and Therapy Research Group, Faculty of Health Sciences, Universiti Teknologi MARA Cawangan Selangor Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

[3]Community Medicine, Faculty of Medicine and Defence Health, National Defence University of Malaysia, Kem Sungai Besi, 57000 Sungai Besi, Kuala Lumpur, Malaysia

ABSTRACT

The aim of this study is to investigate the association between diabetes-related nutrition knowledge and body weight status among non-diabetic young adults. This cross-sectional study utilized a questionnaire assessing socio-demographic and Diabetes-Related Nutrition Knowledge-Questionnaire (DRNK-Q). Weight, height, and waist circumference were measured using standard protocols, and body weight categories were established using the Body Mass Index (BMI). Data from 320 young adults, aged 18–26 years old, were collected from Universiti Pertahanan Nasional Malaysia (UPNM). Participants were divided into two categories based on their knowledge scores. Overall, the study's respondents exhibited low DRNK (52.8%) and high DRNK (47.2%). Majority of respondents have normal body weight (55.7%); nevertheless, there is no relationship between body weight and diabetes-related nutrition knowledge. To conclude, there is no knowledge difference between cadet and non-cadet. Therefore, public health initiatives must customize interventions suitable to support behavior and lifestyle changes based on the amount of diabetes awareness.

Keywords: diabetes-related nutrition knowledge, young adults

INTRODUCTION

Diabetes mellitus has emerged as one of the world's most pressing public health issues, exacting a massive worldwide toll on public health and socioeconomic development (Akhtar *et al.* 2022). Former Malaysia Health Minister Datuk Seri Dr. Dzulkefly Ahmad addressed that this is a concerning trend for diabetes that will result in a prevalence rate of 31.3% for adults who are 18 years of age and older (Bernama 2019). According to him, 3.6 million people in Malaysia today have the disease, making it one of the most common worldwide and the highest in Asia. Akhtar *et al.* (202) discovered a generally increasing trend in type 2 diabetes mellitus prevalence with age, ranging from 2.0% to the 18–19-year-old age, therefore type 2 diabetes is becoming much more common in teenagers and young people. Gupta and Bansal (2020) stated that having a higher Body Mass Index (BMI) increases the risk of developing both diabetes and prediabetes. Approximately 80–90% of type 2 diabetics are overweight or obese (Nianogo & Arah 2022). According to BMI, the prevalence of prediabetes varied; it was highest in those who were obese, intermediate in those who were overweight, and lowest in those who were normal weight or underweight (Andes *et al.* 2020).

A study by Schnurr *et al.* (2020) discovered that type 2 diabetes incidence is increased by obesity and poor lifestyle choices, regardless of genetic susceptibility. As a result, the global rise in obesity prevalence has coincided with an increase in Type-2 Diabetes Mellitus (T2DM) prevalence (Klein *et al.* 2022). According to the World Population Review 2019, Malaysia has the highest prevalence of adult obesity in Southeast

*Corresponding Author: email: nazrul2923@uitm.edu.my
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Asia at 15.6%, followed by Brunei (14.1%), Thailand (10.0%), and Indonesia (6.9%). In 2014, Ho *et al.* mentioned that this expanding trend is caused by various factors, including population growth, population ageing, urbanization, rising rates of obesity, and physical inactivity. To classify adults as overweight or obese, the simple Weight-to-Height Ratio (BMI) is usually utilized (WHO 2021). It is calculated by multiplying the person's height in meters by the square of their weight in kilograms (kgm^{-2}). Weight gain and body mass also have a substantial influence on the development and rising prevalence of type 1 and type 2 diabetes, and there is a considerable relationship between diabetes, insulin resistance, and BMI (Al-Goblan *et al.* 2014). In both established and developing nations, obesity is one of the biggest challenges to public health in the twenty-first century (Zatońska *et al.* 2021).

The key to managing diabetes is proper nutrition (Mphasha *et al.*2021). Knowledge of nutrition also affects the dietary habits and nutrient consumption of an individual (Dallongeville *et al.* 2001; Sun *et al.* 2021). A study by Mazzochi *et al.* (2014) found that 56% of those surveyed believed that the lack of nutrition knowledge is a contributing factor to overweight and obesity. In another study, students who scored higher on nutrition knowledge had lower daily intakes of total fat, saturated fat, and cholesterol than students who scored lower on nutrition knowledge (Yahia *et al.* 2016). According to studies by Brandhorst and Longo (2019), having a solid understanding of nutrition is essential for encouraging eating behaviors that support a healthy weight. Since both obesity and being overweight have an impact on health and encourage the development of chronic diseases. The majority of studies assess the general population's diabetes knowledge. However, a few studies have been made to assess diabetes-related nutrition knowledge among diabetic patients. Unfortunately, studies assessing diabetes-related nutrition knowledge among non-diabetics are scarce as they usually focus on diabetic patients. This study conducted between cadet and non-cadet as we expected their body weight status might be different due to military training that should be enrolled by cadet. Therefore, this study focuses at assessing diabetes-related nutrition knowledge among young adults as it could help health practitioners, other researchers, and the authorities to construct effective initiatives and strategies to prevent diabetes from early adulthood. Hence, this study aims to assess weight status, diabetes-related nutrition knowledge and the association between diabetes-related nutrition knowledge and weight status among young adults.

METHODS

Design, location, and time

This cross-sectional observational study was conducted by distributing the Diabetes-Related Nutrition Knowledge Questionnaire (DRNK-Q) to young adults at Universiti Pertahanan Nasional Malaysia (UPNM), a military institute located at Sungai Besi Camp. The DRNK-Q is to measure their level of knowledge of diabetes-related nutrition. Bonnie *et al.* (2015) defines individuals between the ages of 18 and 26 are considered young adults. It was conducted from October 2022 to August 2023. The ethical clearance for this study was obtained from the Faculty Ethics Review Committee (FERC) of Universiti Teknologi MARA with the reference number FERC/FSK/MR/2023/00011.

Sampling

Convenience sampling was used to select individuals based on their availability. The population of this study were between the ages of 18 and 26 who are willing to join, did not be diagnosed with type 2 diabetes mellitus, active students status at UPNM and also understand Malay or English language. The study population consisted of 320 respondents who participated in the cross-sectional observational study from UPNM. Summarily the number of respondents from cadet (120) and non-cadet (200). In general, the students at UPNM are divided into two groups: cadet and non-cadet. A cadet is a student enrolled in both military training and academic studies simultaneously, as opposed to non-cadets who are not members of the military and are exclusively enrolled in academic studies. In terms of academic hours, cadets and non-cadets have agreed to study at the same periods from 8.00 a.m. to 5.00 p.m., with intervals for both groups of students to engage in physical activity from 5.00 to 6.30 p.m. During this time, cadets are obliged to partake in military physical training. However, non-cadets were free to partake in any extracurricular activities they chose, including both individual and team sports. The diabetes-related nutrition knowledge questionnaire was distributed to participants of different ages, gender, race and education levels. A target sample size of 327 was calculated using the formula as shown below:

n= (Z1-α/2 2 SD2)/d2

n: abbreviation for sample size. Z1-α/2: standard normal variate (at 5% type 1 error, p<0.05 (1.96). SD: standard deviation of the variable from the previous study. d: absolute error or precision (50%). For estimation, the significance level is set at =0.05 (two-tailed), and the 95% CI is used. Therefore, the standard normal variate in this study is 1.96. Based on past research by Han *et al.* (2020) on "Development of a diabetes-related nutrition knowledge questionnaire for individuals with type 2 diabetes mellitus in Singapore", the average standard deviation of the DRNK-Q score in this study is (±4.4). The precision used in the study is 50% (0.5). Martínez-Mesa *et al.* (2016) stated to accommodate for predicted non-responses, refusals, or losses, sample sizes are increased by 10%. As a result, a sample size of n=327 was calculated.

Data collection

Participants were briefed on the study, which allowed them to consider participating. Participants should leave the briefing with a succinct explanation of the study, any potential harm, and knowledge of their rights. They are given the right of withdrawing from the study without penalty. Following an explanation of the study to the participants, they were given an informed consent form and freely participated in the study. The consent form is in English, and participants were guided to sign it in English or Malay if necessary. After collecting consent forms, participants' height and body weight were measured using stadiometers and weighing scales, respectively. The body mass index was then determined from the result. Finally, the Waist Circumference (WC) was measured with a SECA measuring tape. To take the measurement, the measuring tape is fastened to the housing and encircled the body. This enables the measurement result to be read accurately and simply. The questionnaire was finally circulated after all the necessary measurements were taken.

The validity and reliability of the DRNK-Q were established after it was implemented from a literature review in Singapore. The questionnaire was administered in person to the students at UPNM to gauge their understanding of diabetes-related diet. This could be approved for use in South-East Asian (SEA) nations with comparable multiethnic populations or in studies involving Chinese, Malays, and Indian populations of these ethnicities (Han *et al.* 2020). Socio-demographic data, such as age, gender, ethnicity, education, family history of diabetes mellitus and family history of overweight and obesity was self-reported by the participants first before answering DRNK-Q. The DRNK-Q composed of four sections and 27 questions related to the topics covered in dietetic therapy and education sessions for patients with T2DM: food portion and sizes; nutrition content of food; healthier food choices and safety; and food label reading. The score will vary from 0 to 100 depending on the population's knowledge. To categorize into poor and high knowledge, the median score needs to be calculated. If the DRNK-Q score below median, it is classified as poor while above median will be classified as high knowledge. Later, the information gathered through a self-administered questionnaire since Cella *et al.* (2015) stated it is less expensive and less susceptible to interviewer bias, and because it has historically been chosen.

Data analysis

The recorded data was analyzed using IBM SPSS Statistics for Windows (Version 27.0). The participant's sociodemographic, anthropometric, and diabetes-related nutrition knowledge were presented descriptively in mean and standard deviation. An independent t-test was used to dictate the significant difference in mean value between cadet and non-cadet participants for WC, BMI, and diabetes-related nutrition knowledge score. The Pearson Correlation Coefficient test was used to identify the association between body weight status and diabetes-related nutrition knowledge score.

RESULTS AND DISCUSSION

Socio-demographic characteristics

The socio-demographics of the study participants were shown in Table 1. The mean age was 20.76±1.12 years old. Most of the respondents were male (67.5%), non-cadet (62.5%) and were predominantly Malay (90.6%).

Table 1. Socio-demographic characteristics of respondents between cadet and non-cadet (n=320)

Socio-demographic	Cadet (n=120)		Non-cadet (n=200)		Total (n=320)
	n (%)	Mean±SD	n (%)	Mean±SD	n (%)
Age		21.12±0.68		20.54±1.26	
Gender					
Male	111 (92.5)		105 (52.5)		216 (67.5)
Female	9 (7.5)		95 (47.5)		104 (32.5)
Ethnicity					
Malay	107 (89.2)		183 (91.5)		290 (90.6)
Chinese	3 (2.5)		2 (1.0)		5 (1.6)
Indian	4 (3.3)		12 (6.0)		16 (5.0)
Bumiputera	6 (5.0)		3 (1.5)		9 (2.8)
Faculty					
Defense Science and Technology	44 (36.7)		16 (8.0)		60 (18.8)
Defense Studies and Management	53 (44.2)		13 (6.5)		66 (20.6)
Engineering	15 (12.5)		8 (4.0)		23 (7.2)
Medicine and Health Defense	5 (4.2)		47 (23.5)		52 (16.3)
Defense Fitness Academy			112 (56.0)		112 (35.0)
Others	3 (2.5)		4 (2.0)		7 (2.2)
Current education					
Diploma			80 (40.0)		80 (25.0)
Bachelor degree	120 (100.0)		120 (60.0)		240 (75.0)
Family history of diabetes mellitus					
Yes	18 (15.0)		44 (22.0)		62 (19.4)
No	90 (75.0)		137 (68.5)		227 (70.9)
I do not know	12 (10.0)		19 (9.5)		31 (9.7)
Family history of overweight/obesity					
Yes	17 (14.2)		39 (19.5)		56 (17.5)
No	99 (82.5)		140 (70.0)		239 (74.7)
I do not know	4 (3.3)		21 (10.5)		25 (7.8)

SD: Standard Devitation

Most of the respondents are from Defense Fitness Academy (35.0%) and are taking bachelor's degree (75.0%) and majority of them have no family history of diabetes mellitus (70.9%), and overweight or obesity (74.7%).

Table 2 shows the anthropometric data of the respondents. Their mean height was 166.47±7.97 cm, weight 62.13±7.97 kg, waist circumference 76.20±8.97 cm and BMI 22.38±3.25 kgm^{-2}. Most of the respondents have a normal BMI (55.7%) followed by overweight (29.1%), underweight (7.8%), obese I (5.0%) and obese II (2.2%). The finding shows the mean BMI of both groups are in normal classification however the mean BMI of non-cadets (22.70±3.77 kgm^{-2}) is higher than cadets (21.83±2.02 kgm^{-2}). Nevertheless, it was

Table 2. Anthropometric data of respondents between cadets and non-cadets' students in UPNM (n=320)

Anthropometric	Cadet (n=120)		Non-cadet (n=200)		Total (n=320)	*p*
	n (%)	Mean±SD	n (%)	Mean±SD	n (%)	
Height (cm)	-	170.20±5.93	-	164.23±8.20	-	-
Weight (kg)	-	63.35±7.50	-	61.40±11.91	-	-
Waist Circumference (cm)	-	75.22±4.72	-	76.79±10.71	-	0.008[a, b]
BMI (kgm^{-2})	-	21.83±2.02		22.70±3.77	-	0.073[a]
BMI Category						
Underweight	3 (2.5)	-	22 (11.0)	-	25 (7.8)	-
Normal	82 (68.3)	-	97 (48.5)	-	179 (55.9)	-
Overweight	34 (28.3)	-	59 (29.5)	-	93 (29.1)	-
Obese I	1 (0.8)	-	15 (7.5)	-	16 (5.0)	-
Obese II	-	-	7 (3.5)	-	7 (2.2)	-

BMI: Body Mass Index; SD: Standard Deviation; UPNM: Universiti Pertahanan Nasional Malaysia
[a]Independent sample t-test; [b]Significant at p<0.05

not statistically different (p=0.073). On the other hand, there is a statistically significant difference (p=0.008) in waist circumference between cadets (75.22±4.72 cm) and non-cadets (76.79±10.71 cm). This revealed that non-cadet has higher mean waist circumference than cadet. Hence, our result from this study is supported by Suwan *et al.* (2012) in which the mean BMI and WC of the medical cadet are 21.78 kgm^{-2} and 74.60 cm. While the mean BMI of University Putra Malaysia (UPM) students was 22.17±3.41 kgm^{-2} (Kamal *et al.* 2018), which was relatively similar to that of non-cadet respondents. However, this study found that both cadet and non-cadet respondents' mean BMI categories are normal. This could be because, while non-cadet students were not required to participate in military training, they were encouraged to participate in any type of activity to graduate.

There was a difference between the diabetes-related nutrition knowledge among UPNM cadets and non-cadets' students. It is worth mentioning that respondents had a wide range of DRNK from 0% to 72% and a median of 36%. Respondents in this study had overall poor DRNK (52.8%) while high DRNK (47.2%). Poor knowledge among non-cadet is 30%, while cadets are 22.8%. However, good knowledge among non-cadet is 32.5%, while cadets are 14.7%. As shown in Table 3, the results indicate that there was a significant (p=0.002) difference between the diabetes-related nutrition knowledge of cadets (32.89±14.50) and non-cadets (38.42±15.54) where the non-cadet scored higher DRNK compared to cadets.

Additionally, there is a statistically significant difference in diabetes-related nutrition knowledge in Section 1 on food and sizes portions between cadets (1.90±1.41) and non-cadets (2.31±1.37), (t (318)=2.573, p=0.011). This revealed that non-cadets have higher knowledge of the food and sizes portions than cadets. The mean difference was 0.41, with a 95% confidence interval of (0.10, 0.72). Meanwhile, there is a statistically significant difference in Section 2 on the nutrition content of food between cadets (2.81±1.68) and non-cadets (3.57±1.53), (318±4.127, p=<0.001). This revealed that non-cadets have higher knowledge of the nutrition content of food than cadets. The mean difference was 0.76, with a 95% confidence interval of (0.40, 1.12). Furthermore, the mean difference of Section 3 on healthier food choices and safety between cadets (1.29±1.02) and non-cadets (0.90±0.97) was statistically significant (318±3.47, p=<0.001). The mean difference was -0.40, with a 95% confidence interval of (-0.62, -0.17). It shows that non-cadets have

Table 3. Diabetes-related nutrition knowledge (DRNK) between cadets and non-cadets students in UPNM (n=320)

Variables	Cadets (n=120)	Non-cadets (n=200)	Mean diff (95% CI)	*p*
	Mean±SD	Mean±SD		
DRNK	32.89±14.50	38.42±15.54	5.54 (2.09, 8.98)	0.002
Food portion and sizes	1.90±1.41	2.31±1.37	0.41 (0.10, 0.72)	0.011
Nutrition content of food	2.81±1.68	3.57±1.53	0.76 (0.40, 1.12)	<0.001
Healthier food choices and safety	1.29±1.02	0.90±0.97	-0.40 (-0.62, -0.17)	<0.001
Food label reading	2.37±1.47	2.91±1.66	0.54 (0.19, 0.89)	0.003

DRNK: Diabetes-Related Nutrition Knowledge; SD: Standard Deviation; UPNM: Universiti Pertahanan Nasional Malaysia

more knowledge of healthier food choices and safety than cadets. While in Section 4 the mean difference in food label reading between cadets (2.37±1.47) and non-cadets (2.91±1.66) was statistically significant (273.80=3.02, p=0.003). This suggested that cadets have lesser knowledge of food label reading than non-cadets. The mean difference was 0.54, with a confidence interval of (95% CI:0.19, 0.89). In general, non-cadet respondents have high knowledge of three out of four sections of the diabetes-related nutrition knowledge questionnaire.

The results of diabetes-related nutrition knowledge among cadets are in line with the study by Bovill *et al.* (2003) results as they revealed that the mean nutrition knowledge score for soldiers was 48.5, meaning that less than half of the questions could be answered correctly by them. Another study by Belogianni *et al.* (2021) found students majoring in healthcare (41.1%) received higher knowledge scores than those majoring in non-healthcare fields (58.9%). Demographic research among the Danish discovered that despite being a somewhat well-educated demographic, there was a noticeable prevalence of poor health literacy. Therefore, having a higher education does not automatically equate to having better nutrition or health literacy (Svendsen *et al.* 2020). Unsatisfactory understanding may be exemplified by the fact that nutrition as a science is still in its early stages, with no formal nutrition education training being provided in schools. It is only studied at specific universities at the university level. As an outcome, properly developed nutrition education programmes must be provided early in life through school and then through the media to offset erroneous nutrition-related knowledge.

A Pearson correlation coefficient was performed to evaluate the relationship between body weight status and diabetes-related nutrition knowledge. The results r=0 indicate that there is no linear correlation between body weight status and diabetes-related nutrition knowledge. We can see in Figure 1 and Figure 2 that the data is widely scattered around the line. It is a fair correlation (0.25<r<0.50). Hence, the relationship between body weight status and diabetes-related nutrition knowledge was not statistically significant, r=0.46, p=0.411. In addition, no significant correlation was found between waist circumference and diabetes-related nutrition knowledge, r=-0.043, p=0.448. Therefore, we fail to reject the null hypothesis.

Nutritional knowledge affects diet quality because it influences people's decisions to choose a healthy diet (Ul Haq *et al.* 2018) and lead healthy lifestyles, particularly for young adults (El Ansari *et al.* 2015). This study demonstrates no significant correlation between both body weight status body mass index and waist circumference towards diabetes-related nutrition knowledge. A weak correlation existed between these two variables (p>0.05). This result was consistent with those of the research studies carried out by O'Brien and Davies (2007) who assessed the nutritional knowledge and body mass index as well as findings from Issahaku and Alhassan (2021) that overweight was not found to be significantly correlated with nutrition

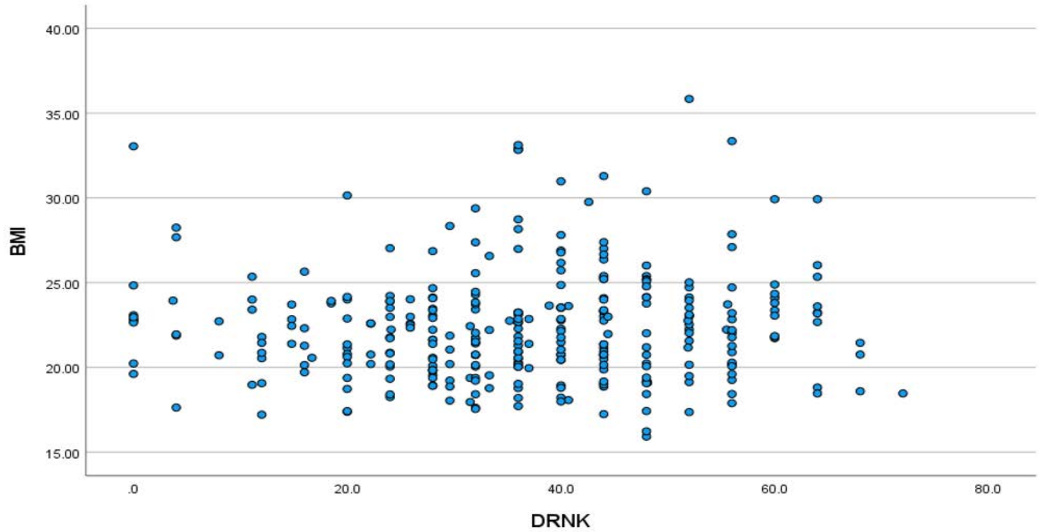

Figure 1. Correlation between Body Mass Index (BMI) and Diabetes-Related Nutrition Knowledge (DRNK)

knowledge. On the other hand, it is in contrast with the study by Valmórbida *et al.* (2017) where they conclude that respondents with lower knowledge scores had worse results in terms of BMI, waist circumference and waist-hip ratio and supported by Saintila *et al.* (2022) whereas they discovered that teachers with poor nutritional knowledge were more likely to be overweight. Although some findings do not corroborate with this study's result, they are still valuable data.

The Pearson correlation coefficient was used to examine the association between the DRNK and body weight status. First, the BMI-related DRNK exam revealed a positive association, with participants with lower BMIs scoring higher on the diabetes-related nutrition knowledge question. Conversely, there is a negative correlation between waist circumference and DRNK score, indicating that the two variables are moving in the opposing directions.

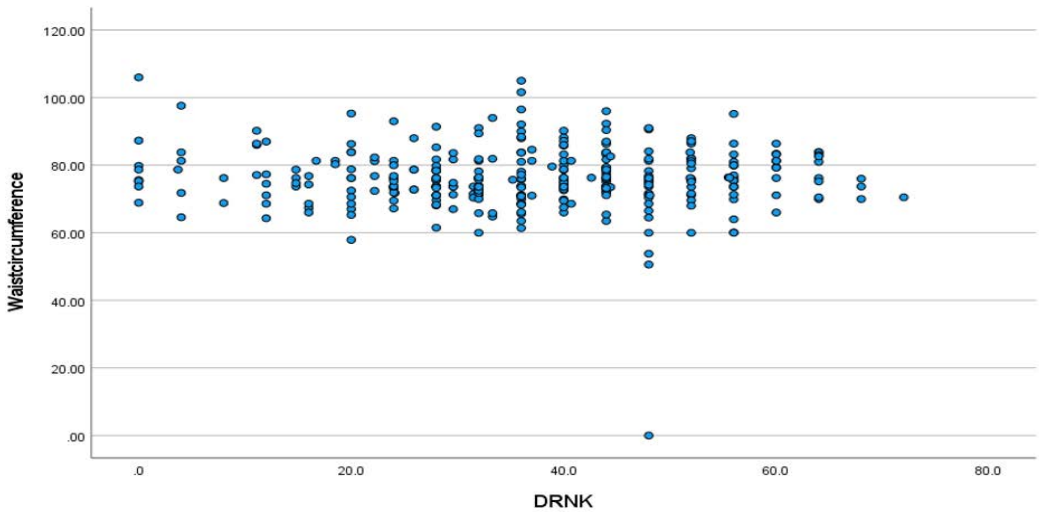

Figure 2. Correlation between Waist Circumference (WC) and Diabetes-Related Nutrition Knowledge (DRNK)

The participants' waist circumference increased with increasing DRNK score. This concludes that there is a relationship between body weight status and diabetes-related nutrition knowledge score, with lower BMI individuals demonstrating a greater level of nutrition knowledge.

CONCLUSION

We examined the relationships between body weight status and diabetes-related nutrition knowledge among young adults in UPNM. We found that the diabetes-related nutrition knowledge was poor among our participants. Furthermore, there was no significant association between body mass index and waist circumference to diabetes-related nutrition knowledge can be observed. It is advised to improve overall diet through nutrition education, which should set realistic healthy eating goals for each cadet's lifestyle and address motivational barriers to increase adherence.

The current findings should be interpreted in light of the following limitations such as the study was only carried out at UPNM, so it cannot give a comprehensive picture of the young adult population. We only consider university students in our study, which is also an inadequate representation of Malaysia's young adult population. The lack of prior study in the field is noteworthy because diabetes-related nutrition knowledge is employed frequently in the diabetic community to regulate and halt complications from the disease. Future research should link physical activity and dietary intake to cadets' knowledge of diabetes-related nutrition to gain a more complete picture of the variables that may affect this knowledge.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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