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A pilot study of high-protein diet consumption and its effects on waist circumference and body fat percentage among gym goers in Cyberjaya

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***Abstract*---**Introduction: High-protein diet, whereby 1.2 – 1.6g protein/kg of body weight is consumed per day, has been popularised as a weight-loss technique. While some people truly believe in its health benefits, some consume high-protein diets for other reasons. However, it is not yet proven whether consuming a high-protein diet improves your overall health. Thus this study is to discover if consuming a high-protein diet has any health benefits. We focus our study on the evidence of the impact of a high-protein diet on those who routinely exercise, either by weightlifting or cardio. Methods: This cross-sectional study was carried out among gym goers in Cyberjaya aged 18 years and above and have not been diagnosed with any underlying disease (N=46). Data collection was done via online interview and individual questionnaire and analysed using Pearson chi-square and Fisher's exact test with SPSS version 26. The

statistical significance level was set at 0.05. Results: Majority of the gym goers in Cyberjaya we sampled consumed a high-protein diet (57.8%). Prevalence of high protein diet are mainly among males (55%), among respondents aged 18-30 years old (51.5%), of Malay ethnicity (44.4%), those who completed secondary school (72.7%), and those who work by shifts (66.7%). We found a significant association between high-protein diet and waist circumference ($p<0.05$). There is also a significant association between high-protein diet and body fat percentage ($p<0.05$). However, there is no significant association between high-protein diet and blood pressure. Conclusion: We conclude that consuming a high-protein diet does have an impact on waist circumference and body fat percentage.

***Keywords*---** high-protein diet, impact, gym goers, Cyberjaya.

Introduction

According to the National Academy of Medicine, an adult should consume approximately 0.8g of protein/kg of body weight per day. Therefore for a person weighing 50.0 kg, that works out to about 40g of proteins daily; for a 90kg person, they require 70g of proteins daily. The National Academy of Medicine also established a broad range of appropriate protein consumption, ranging from 10% to 35% of daily caloric consumption. Aside from that, there isn't any solid data on the optimal amount of protein that should be included in one's diet or the healthiest calorie target for proteins (1).

Dietary protein was frequently increased at the expense of carbohydrates in these trials. The amount of energy consumed was frequently underestimated merely by lowering carbohydrate intake, leading in with a higher proportion of protein intake. Furthermore, the loss of lean mass during hypoenergetic weight loss is reduced with higher consumption of a high protein diet. (2)

The exact physiological impact of consuming a high protein diet is yet to be clearly discerned. However, it is important to assess the benefits of consuming a high-protein diet and investigate for detrimental effects, if any, it may have on a person, especially for those who are physically active. Hence, the objective of this research is to assess the impact of a high-protein diet on a person’s waist circumference, and body fat percentage.

Materials and Methods

This was a cross-sectional study conducted on the community of gym-goers in Cyberjaya from October 2020 until January 2021. Ethical approval for this study was obtained from the Cyberjaya Research Ethics Review Committee, University of Cyberjaya. Sample size was calculated, with margin for non-respondents, at 179 respondents with a 25.7% response rate, giving a total of 46 adults between the ages of 19 and 56 years old who took part in this study. Multiple attempts were made to obtain the maximum response rate. Inclusion criteria were adult residents of Cyberjaya, aged 18 years and above who are gym regulars in

Cyberjaya, and did at least 3 workouts for an hour per week. Adults diagnosed with metabolic disorders or chronic diseases, and pregnant women were excluded from this study. Convenience sampling was done by distribution of a Google Form via social media which collected contact details and sociodemographic data, and an online interview was arranged between the respondent and interviewers. Consent was reaffirmed and accuracy of the data was reconfirmed during the interview which included answering the prepared questionnaire on dietary practices for 7 days prior to the interview, physical activity, and anthropometric measurements which were done under the guidance of the interviewer by the respondents themselves, and the measurements reported thereafter. Abdominal circumference, height and weight were measured using the respondent's own measuring device (tape measure and electronic weighing scale). The questionnaire used was adapted from the National Health and Morbidity Survey 2014: Malaysia Adult Nutrition Survey (NHMS 2014: MANS). The questionnaire contained 5 sections, which are sociodemographic data, dietary habits, dietary practices by food groups, physical activity level, and anthropometric measurements. Dietary habits asked included the types of diet practised, if a high-protein diet is practised, and how long the diets have been in practice. The respondents' food intake for one week leading up to the interview was recorded in the questionnaire, whereby the serving size was discussed and determined prior to the interview. The protein content of each food and beverage as per serving size was then determined from various sources, including but not limited to, the United States Department of Agriculture (USDA), Nutrionix, the Malaysian Food Composition Database (myFCD), local food brands, and various other sources. The average daily protein intake was calculated from total weekly intake divided by 7 days, which was used to reflect the protein intake of the respondents throughout the duration of dietary practice.

Descriptive analyses were performed such as calculating the frequency, percentages of sociodemographic factors, gender, age group, ethnicity, education level, and working hours. Bivariate analysis was then performed using Pearson chi-square and Fisher's exact test to form associations between categorical variables. For all tests, statistical significance was defined as $p \leq 0.05$. Descriptive and statistical analyses were carried out using SPSS version 26.

Results

We obtained a 26% response rate with 46 respondents.

Table 1 shows the body mass index (BMI) status according to sociodemographic factors among gym goers in Cyberjaya. Prevalence of obesity is highest among females (25%), age group >49 years old (66.7%), of Indian ethnicity (100%), had completed a Master's degree (60%) and those who work office hours (55.6%).

The prevalence of overweight gym goers is highest among males (33.3%), age group 31-49 years old (33.3%), of Malay ethnicity (33.3%), had completed a doctorate (100%), and those who are unemployed (100%).

The prevalence of normal weight among gym goers is highest among males (42.9%), 18-30 years old (42.4%), of Chinese ethnicity (57.1%), completed secondary education (63.6%), and those who work by shift (66.7%).
The prevalence of underweight gym goers is highest among females (16.7%), 18-30 years old (12.1%), of Chinese ethnicity (14.3%), had completed an undergraduate degree (14.3%), and those who are part-timer (13.8%).

Table 2 shows the prevalence of abdominal obesity status according to sociodemographic factors among gym goers in Cyberjaya. The prevalence of abdominal obesity is highest among females (33.3%), age group >49 years (66.7%), of Indian ethnicity (100%), had completed a doctorate (100%), and those who worked office hours (60%).

Table 3 shows the prevalence of body fat percentage status according to sociodemographic factors among gym goers in Cyberjaya. The prevalence of body fat percentage is the highest among females (29.2%), age group >49 years old (66.7%), of Indian ethnicity (100%), had completed a doctorate (100%) and those who worked office hours (55.6%).

Table 4 shows the prevalence of high-protein diet status according to sociodemographic factors among gym goers in Cyberjaya. The prevalence of gym goers who consumed a high protein diet is the highest among females (55%), age group 18 - 30 years old (51.5%), of Malay ethnicity (44.4%), had completed secondary education (72.7%) and those who worked by shift (66.7%).

Based on Table 5, 89.5% of respondents who consume a high-protein diet were not abdominally obese, while 44% of respondents who did not consume a high-protein diet did have abdominal obesity. We found there is a significant association between consuming a high-protein diet and abdominal obesity among the gym goers in Cyberjaya ($p=0.016$).

Based on Table 6, 94.7% of those who consume a high-protein diet had a normal body fat percentage, while 36% of those who did not consume a high-protein diet had a high body fat percentage. We found there is a significant association between consuming a high-protein diet and high body fat percentage among gym goers in Cyberjaya ($p=0.027$).

Discussion

There are many people in Cyberjaya who frequent gymnasiums, amongst whom practise a high protein diet. In our study, we found that 57.8% of our respondents adopt a high-protein diet. These numbers include respondents whose protein intake exceeded recommended levels. Our study was based on Cheraghpour et al. (2017), where the definition of a normal protein intake is 0.8g protein/kg body weight and a high protein intake is 1.6g protein/kg body weight (3). The recommended protein intake for endurance athletes are marginally higher at 1.2-1.4g protein/kg body weight, while protein recommendations for power athletes are moderately higher at 1.2-1.7g protein/kg body weight. While it is generally assumed that athletes need a high amount of protein because of the extreme physical activity, the population as a whole generally consumes more protein than

what is needed. Additionally there are some foods which are overlooked as containing protein, thus not taken into account when protein consumption amount is calculated. Therefore in a typical diet, the minimum recommended amount of protein is easily met by most people and there is no need to supplement the diet with protein supplements (4).

Based on our study among gym goers in Cyberjaya, we found that a high-protein diet is significantly associated with abdominal obesity as estimated by waist circumference.

A study reported that higher-protein diets are associated with lower BMI, waist circumference, and higher HDL cholesterol. The potential effects on health by higher-protein diets appear to be more overt in overweight individuals (BMI: 25.0–29.9 kg/m^2) than in normal weight (BMI: 18.5–24.9 kg/m^2) and obese individuals (BMI: >30 kg/m^2) (5).

118 adults with metabolic syndrome were enrolled in a randomised controlled trial, and provided with either a standard protein diet (0.8 g/kg body weight) or high protein diet (1.34 g/kg body weight) in tandem with hypocaloric diets (500 kcal below resting metabolic rate) for 6 months. At the end of the study, those who were provided a high protein diet had higher percentage weight loss (7.0% vs 5.1%), but there were no statistically significant differences in the reduction of waist circumference (6).

Several factors may have influenced the result such as caloric and other macronutrient intake, basal metabolic rate, daily energy expenditures, sample size, etc. A study published in 2018 showed that calorie restriction significantly reduced waist circumference compared to high-protein diet. The study also states that a slightly lower reduction of waist circumference in the high-protein group compared to the standard protein group might be caused by the slightly higher mean daily calorie intake in the high protein group (7).

Another study showed an association between macronutrient intake and waist circumference. This association was sustained even after adjustment for energy intake, while no associations were detected with the relative intakes of carbohydrates and fats. Relative protein intakes, on the other hand, were positively associated with risks of abdominal obesity with multivariable adjustment, with an odds ratio (95% CI) of 1.48 (1.28-1.70) ($p<0.001$) (8).

Our study found a significant association between the consumption of a high-protein diet and higher body fat percentage amongst gym goers in Cyberjaya. This is inconsistent with clinical trials done in Iran (3), which found that a high-protein diet showed significant reduction in fat mass (28.05 ±2.38 kg to 24.85 ±3.06 kg), compared to a normal protein diet (29.55 ±6.09 kg to 26.00 ±5.43 kg), with a high protein diet showing less loss in fat-free mass than the normal protein diet. Another study also showed significant differences in pre- and post-intervention fat mass for a high-protein diet (31.46 ±7.69 kg to 28.43 ±8.65 kg) ($p=0.001$), but is not significant when comparing a high-protein diet to a normal protein diet ($p=0.062$) (9). In both these studies the subjects were also put on a low caloric diet, which was not evaluated in our study.

However, absolute macronutrient intakes (including protein) has been shown to be significantly associated with body fat percentage, while relative intake of protein (to total energy intake) is also significantly associated with body fat percentage, regardless of total energy intake, with an increasing trend of odds ratios based on a quintile classification with an average of 51.0g (Q1), 58.9g (Q2), 65.2g (Q3), 71.4g (Q4), and 81.8g (Q5) of protein intake per day. The trend shows that the higher the relative protein intake, the higher the risk of having excessive adiposity. The ORs for Q5 is 1.57 (1.35-1.82, 95% CI) ($p<0.001$) (8).

Hence, our findings are consistent with Liu et al (2019), which finds a high-protein dietary intake is associated with a higher risk or incidence of an increased body fat percentage.

Moreover, as our questionnaire was conducted online, there are several factors that affected our study including, but not limited to, the response rates. A review in 2009 explored several factors that changed response rates at different stages of the survey process (10). The review reported a general negative linear relationship between survey length and response rates in both mail and web-type surveys despite vastly varying effect sizes in the studies they reviewed. This variation can be attributed to the different methods of determining survey length, whether the number of pages, questions or screens, or the time of survey completion (11). Two other studies which were conducted on college-level students estimated a maximum survey time of 13 minutes as ideal to obtain a good response rate. Another study also suggests that online surveys should consist of about 20 items, which is often considered too short for major commercial and academic research (12). In contrast, our questionnaire is quite long with over 100 items and took about an hour to complete. Thus, this would certainly negatively affect the response rates as more time and effort is required from the respondents.

The impact of the pandemic is also one of the main reasons for the limited numbers of our sample. A study done in Japan on the impact of COVID-19 on the research environment reveals that 45.3% of researchers had a negative impact on their work (13). Another study also revealed that the majority of the sample study (82%) stated that they were unable to complete their research, with 52% indicating that this was for a period of one to two months (14).

The first COVID-19 epidemic and nationwide lockdown resulted in the greatest shift in time utilisation. The last two lockdowns, combined with new highs in COVID-19 instances and deaths, had the greatest influence on people's subjective well-being. Despite the fact that the later two lockdowns imposed rigorous rules aimed at reducing physical contact, people's time utilisation did not respond as significantly as it did during the first lockdown (15). This shows that the limitation to our study is that there is a reduced amount of physical contact in order to further our research in the gymnasium.

The glomerular filtration rate (GFR) has been shown to increase when protein consumption is increased. The kidneys may be harmed by this long-term increase in GFR (16). A cross-sectional study included 599 adult patients diagnosed with stage 3 to 5 Chronic Kidney Disease in nephrology and nutrition outpatient clinics in Taiwan. The energy and protein intakes in CKD patients were

significantly higher and lower than recommended levels ($P < .001$). high protein intake was associated with worsening GFR at increments of −3.50 mL/min/1.73m2, compared with moderate and low protein intake ($P < .001$) (17). However, while it is well known that a high-protein diet is dangerous to people who already have renal disease, there is little evidence that a high-protein diet is harmful to healthy people (16). Further investigations are needed to determine the effects of a high protein diet consumption on kidney function which unfortunately could not be done in this study due to limited resources and time.

A cross-sectional study by Tsakos (2008), shows that there is no significant difference between self administered and interviewer administered ($p > 0.206$) (18). This research is done using a self administered questionnaire due to the restriction of physical contact, which shows that it does not affect the accuracy of our data.

Recommendation

To improve the number of respondents, collaboration with more gymnasiums in Cyberjaya is needed. This is also to ensure ease of interaction with the respondents during the body statistics examination. Also, in order to gain more respondents, increased distribution of advertisement material via emails, letters, phone calls and use of social media platforms should be employed.

Evidence suggests that second only to face-to-face recruitment, telephone recruitment may yield the highest response rates from participants, and hence should be explored as a possible alternative during COVID-19 (19). The value of online recruitment approaches in health research has been underlined by studies as internet technology has advanced. Even though distributing promotional materials via email may provide lower response rates than phone or postal mail techniques, it allows for the identification and contact of a larger number of potential participants (20).

Thus, collaborating with multiple gymnasiums by sending them emails and having them disseminate information about our questionnaire would increase the number of respondents to participate in our research. This study was also conducted with a small sample size, therefore waist circumference and body fat percentage may not be a direct effect of the respondents' protein dietary intakes, but of other factors which were not analysed in this study.

Conclusions

The prevalence of high-protein diets in Cyberjaya is the highest among males, Malays, those who have completed their secondary school education and those who work by shifts. There are statistically significant association between consuming a high-protein diet and waist circumference (abdominal obesity), and with body fat percentage.

Acknowledgements

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Tables

Table 1 : Body Mass Index (BMI) status by Sociodemographic Factors amongst gym goers in Cyberjaya*

Sociodemographic Factors		**Body Mass Index (BMI)† status**				**p-value**	**Total n (%)**
		Underweight n (%)	**Normal n (%)**	**Overweight n (%)**	**Obese n (%)**		
Gender	Male	0(0)	9(42.9)	7(33.3)	5(23.8)	0.641‡	21(100)
	Female	4(16.7)	9(37.5)	5(20.8)	6(25.0)		24(100)
Age	18-30 years old	4(12.1)	14(42.4)	9(27.3)	6(18.2)	0.208§	33(100)
	31-49 years old	0(0)	3(33.3)	3(33.3)	3(33.4)		9(100)
	>49 years old	0(0)	1(33.3)	0(0)	2(66.7)		3(100)
Ethnicity	Malay	3(8.3)	14(38.9)	12(33.3)	7(19.4)	0.722§	36(100)
	Chinese	1(14.3)	4(57.1)	0(0)	2(28.6)		7(100)
	Indian	0(0)	0(0)	0(0)	2(100)		2(100)
Education Level	Complete secondary	0(0)	7(63.6)	3(27.3)	1(9.1)	0.260§	11(100)
	Complete undergrad	4(14.3)	10(35.7)	7(25)	7(25)		28(100)
	Complete masters	0(0)	1(20)	1(20)	3(60)		5(100)
	Complete doctoral	0(0)	0(0)	1(100)	0(0)		1(100)
Working Hours	Part-Timer	4(13.8)	13(44.8)	8(27.6)	4(13.8)	0.079§	29(100)
	Office hours	0(0)	2(22.2)	2(22.2)	5(55.6)		9(100)
	By shift	0(0)	2(66.7)	0(0)	1(33.3)		3(100)
	Not set/ flexible	0(0)	1(33.3)	1(33.3)	1(33.4)		3(100)

*None of the sociodemographic factors in this study are significantly associated with BMI status. Obese BMI is highest in females (25%), those aged >49 years (66.7%), of Chinese ethnicity (28.6%), those who completed a Master's degree (60%), and those who work office hours (55.6%). Overweight BMI is highest among males (33.3%), those aged 31-49 years (33.3%), of Malay ethnicity (33.3%), those who have completed a doctoral degree (100%), and unemployed (100%).

† Body Mass Index is defined using WHO Asian BMI values, where underweight is <18.5 kg/m^2, normal is 18.5-22.9 kg/m^2, overweight is 23.0-27.5 kg/m^2, and obese is >27.5 kg/m^2.

‡ P-values for association between gender and BMI status were calculated using Pearson chi-square.

§ P-values for association of other sociodemographic factors with BMI status were calculated using Fisher's exact test by categorising the top outcome against the other outcomes in each sociodemographic factor to form a 2x2 table.

Table 2 : Prevalence of Abdominal Obesity status by Sociodemographic Factors amongst gym goers in Cyberjaya*

Sociodemographic Factors		**Abdominal obesity†**		**Total‡ n (%)**	**p-value**
		No n (%)	**Yes n (%)**		
Gender	Male	16(76.2)	5(23.8)	21(100)	0.482§
	Female	16(66.7)	8(33.3)	24(100)	
Age	18-30 years old	26(78.8)	7(21.2)	33(100)	0.076‖
	31-49 years old	5(55.5)	4(44.5)	9(100)	
	>49 years old	1(33.3)	2(66.7)	3(100)	
Ethnicity	Malay	27(75)	9(25)	36(100)	0.411‖
	Chinese	5(71.4)	2(28.6)	7(100)	
	Indian	0(0)	2(100)	2(100)	
Education Level	Complete secondary	10(90.9)	1(9.1)	11(100)	0.136‖
	Complete undergrad	20(71.4)	8(28.6)	28(100)	
	Complete masters	2(40)	3(70)	5(100)	
	Complete doctoral	0(0)	1(100)	1(100)	
Working Hours	Part-Timer	24(82.8)	5(17.2)	29(100)	0.022‖
	Office hours	4(40)	6(60)	10(100)	
	By shift	2(66.7)	1(33.3)	3(100)	
	Not set/ flexible	1(50)	1(50)	2(100)	
	Unemployed	1(100)	0(0)	1(100)	

*Working hours are significantly associated with abdominal obesity in this study (p=0.022). Highest rates of abdominal obesity are among females (33.3%), those aged >49 years (66.7%), of Indian ethnicity (100%), those who have completed a doctoral degree (100%), and those who work according to office hours (60%).

†Abdominal obesity is defined using Asian population waist circumference, which are ≥90 cm for males, and ≥80cm for females.

‡Two respondents were excluded due to missing data.

§ P-value for association between gender and abdominal obesity were calculated using Pearson chi-square.

|| P-values for association of other sociodemographic factors were calculated using Fisher's exact test by categorising the top outcome against the other outcomes in each sociodemographic factor to form a 2x2 table.

Table 3 : Prevalence of Body Fat Percentage status by Sociodemographic Factors amongst gym goers in Cyberjaya*

Sociodemographic Factors		**Body Fat Percentage† status**		**Total ‡ n (%)**	**p-value**
		Normal n (%)	**High n (%)**		
Gender	Male	15(75)	5(25)	20(100)	0.757§
	Female	17(70.8)	7(29.2)	24(100)	
Age	18-30 years old	26(78.8)	7(21.2)	33(100)	0.139||
	31-49 years old	5(62.5)	3(37.5)	8(100)	
	>49 years old	1(33.3)	2(66.7)	3(100)	
Ethnicity	Malay	27(77.1)	8(22.9)	35(100)	0.227||
	Chinese	5(71.4)	2(28.6)	7(100)	
	Indian	0(0)	2(100)	2(100)	
Education Level	Complete Secondary	9(81.8)	2(18.2)	11(100)	0.698||
	Complete Undergrad	21(75)	7(25)	28(100)	
	Complete Masters	2(50)	2(50)	4(100)	
	Complete Doctoral	0(0)	1(100)	1(100)	
Working Hours	Part-Timer	24(82.8)	5(17.2)	29(100)	0.071||
	Office Hours	4(44.4)	5(55.6)	9(100)	
	By shift	2(66.7)	1(33.3)	3(100)	
	Not Set/flexible	1(50)	1(50)	2(100)	
	Unemployed	1(100)	0(0)	1(100)	

* None of the sociodemographic factors are significantly associated with a high body fat percentage in this study. High body fat percentages are highest among females (29.2%), those aged >49 years (66.7%), of Indian ethnicity (100%), those who have completed a doctoral degree (100%), and those who work by office hours (55.6%)

† High body fat percentage is defined as >23% for males and >35% for females

‡ Two respondents were excluded due to missing data

§ P-value for association between gender and body fat percentage were calculated using Pearson chi-square.

|| P-values for association of other sociodemographic factors were calculated using Fisher's exact test by categorising the top outcome against the other outcomes in each sociodemographic factor to form a 2x2 table.

Table 4 : Prevalence of High Protein Diet status by Sociodemographic Factors amongst gym goers in Cyberjaya*

Sociodemographic Factors		**High Protein Diet** †		**Total n (%)**	**p-value**
		No n (%)	**Yes n (%)**		
Gender	Male	9(45)	11(55)	20(100)	0.142 §
	Female	17(68)	8(32)	25(100)	
Age	18-30 years old	16(48.5)	17(51.5)	33(100)	0.046 |||
	31-49 years old	7(77.8)	2(22.2)	8(100)	
	>49 years old	3(100)	0(0)	3(100)	
Ethnicity	Malay	20(55.6)	16(44.4)	36(100)	0.712 |||
	Chinese	4(57.1)	3(42.9)	7(100)	
	Indian	2(100)	0(0)	2(100)	
Education Level	Complete Secondary	3(27.3)	8(72.7)	11(100)	0.033 |||
	Complete Undergrad	17(60.7)	11(39.3)	28(100)	
	Complete Masters	5(100)	0(0)	5(100)	
	Complete Doctoral	1(100)	0(0)	1(100)	
Working Hours	Part-Timer	14(48.3)	15(51.7)	29(100)	0.082 |||
	Office Hours	8(88.9)	1(11.1)	9(100)	
	By shift	1(33.3)	2(66.7)	3(100)	
	Not Set/flexible	3(100)	0(0)	3(100)	
	Unemployed	0(0)	1(100)	1(100)	

*Age is significantly associated with having a higher protein diet (p=0.046). Education level is also significantly associated with consumption of a high protein

diet (p=0.033). The prevalence of high protein diets is highest among males (55%), those aged 18-30 years (51.5%), of Malay ethnicity (44.4%), those who have completed up to secondary education (72.7%), and those who are unemployed (100%).

†A high protein diet is defined as consuming ≥1.6 g protein/kg body weight, which is double the recommended daily protein intake.

‡ One respondent is excluded due to missing data.

§ P-value for association between gender and high protein diet were calculated using Pearson chi-square.

|| P-values for association of other sociodemographic factors were calculated using Fisher's exact test by categorising the top outcome against the other outcomes in each sociodemographic factor to form a 2x2 table.

Table 5 : Association between High Protein Diet and Abdominal Obesity*

High Protein Diet†	**Abdominal Obesity** ‡		**Total n (%)**	**Chi square (df)**	**p-value**§
	Yes n (%)	**No n (%)**			
Yes	2(10.5)||	17(89.5)	19(100)	5.811 (1)	0.016
No	11(44)	14(56)	25(100)		

* 89.5% of respondents who consume a high-protein diet were not abdominally obese, while 44% of respondents who did not consume a high-protein diet did have abdominal obesity. There is a significant association between a high-protein diet and abdominal obesity among the gym goers in Cyberjaya (p=0.016).

† High protein diet defined as >1.6 g protein/kg body weight/day.

‡ Abdominal obesity is defined according to Asian values, with ≥90 cm for males, and ≥80 cm for females.

§ P-value was calculated using Pearson chi-square

|| Expected value for this cell is 5.6, thus fulfilling the criteria for chi-square test of association.

Table 6 : Association* between High Protein Diet and Body Fat Percentage

High Protein Diet†	Body fat Percentage‡		Total n (%)	p-value§
	Normal n (%)	High Body Fat n (%)		
Yes	18(94.7)	1(5.3)||	19(100)	0.027
No	16(64)	9(36)	25(100)	

***** 94.7% of those who consume a high-protein diet had a normal body fat percentage, while 36% of those who did not consume a high-protein diet had a high body fat percentage. There is a significant association between high-protein diet and having a high body fat percentage among gym goers in Cyberjaya (p=0.027).

† High protein diet defined as >1.6 g protein/kg body weight/day.

‡ High body fat percentage is defined as body fat >23% of body weight for males and body fat >35% of body weight for females.

§ P-value was calculated using Fisher's exact test.

|| Expected value for this cell is 5.2, thus fulfilling the criteria for chi-square test of association.