

Comparisons of Anthropometric Measures, Dietary Intakes, and Lifestyle Factors of Young Adult Indonesian Muslims during Ramadan Fasting and in Regular Days

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ABSTRACT

Every year, millions of Muslims fast during the Ramadan month. The objective of the study was to compare anthropometric measures, dietary intake, and lifestyle factors of Indonesian Muslim young adults during regular days and during Ramadan fasting. The total sample sizes of this study were 49 subjects filled out anthropometric and lifestyles questionnaires before and after Ramadan, and 39 subjects provided 2-day dietary records during regular days and during Ramadan. Before Ramadan, the body weight and BMI were 55±10.8 kg and 22±3 kg/m², respectively. After Ramadan, the body weight and BMI were 55±11 kg and 22±3 kg/m², respectively. The differences between the subjects' body weight as well as their BMI reported before and after Ramadan were significant (n=49; p=0.008; and p=0.012, respectively). Energy, protein, fat, n-6 PUFA, and phosphorus reduced significantly from regular to Ramadan days (n=39; 1688±434 kcal to 1521±364 kcal, p=0.004; 65±21 g to 55±16 g, p=0.001; 62±21 g to 49±17 g, p<0.0001; 14±7 g to 9±4 g, p<0.0001; 839±234 mg to 736±216 mg, p=0.005, respectively). Of the lifestyles, exercise durations and daily food expenses in daily decreased significantly (n=49; 27±27 min to 16±19 min, p=0.002; 435956±27645 IDR to 36549±29937 IDR, p=0.02, respectively). The frequency of exercise significantly changed during Ramadan (n=49, p=0.002). The body weight, BMI; intake of energy, protein, fat, n-6 PUFA, phosphorus; lifestyles of food expenses, exercise durations, and frequency of exercise of young adult Indonesian Muslims decreased significantly during Ramadan fasting when compared those in regular days.

KEYWORDS: anthropometric measure; dietary intakes; lifestyles; Ramadan fasting

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INTRODUCTION

Ramadan is the holiest month for Muslim, accordingly, the following of its practices is mandatory for all Muslims. As it is obligatory, people who are under condition of pregnancy, breastfeeding, travelling, or acute or chronic diseases qualify for exemption from fasting due its risk to altered health effect¹. Ramadan fasting includes daily "time-restricted"

Eating period for one full month of 9th lunar month (*Hijri*). Muslim people abstain from food and drink from dawn (*suhor*) until sunset (*iftar*) during Ramadan month². The duration of fasting varies from 10 to 20 h/day according to the geographical location and season¹. During fasting, all Muslims are forbidden to take any meal or drink³, thus might change their usual eating habit including the mealschedule and frequency⁴.

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The common practice is to eat two meals, one before dawn and one after sunset, rather than three meals. Accordance with previous review study, since the pattern of food intake had been changed, the overall amount and type of each meal consumed were changed⁴. By changing food intake pattern, the composition of the foods is expected to be changed accordingly. A cross sectional study involving 173 Saudis living in urban area reported increased consumption of carbohydrate- and fat-rich foods⁵. Moreover, prior intervention study conducting in 84 Malay women suggested that during Ramadan, protein intake was elevated, while carbohydrate intake was decreased (all $p=0.000$)⁶.

Fasting during Ramadan has been found to affect nutritional status changes due limited of total food intake, which often leads to reduced energy intake and weight loss⁷. A previous prospective observational study, which performed during Ramadan (September, 2008) in adult Iranians, reported that Ramadan fasting leads to weight loss and fat-free mass reductions. However, body composition changes vary depending on age and sex⁸. Furthermore, as Ramadan fasting has been practiced in different ways in different populations, it is necessary to investigate how fasting during Ramadan might affect health-related variables in certain population². In previous intervention study involving 10 healthy, lean Danish men aged between 18 and 35 years showed no change in body mass index (BMI) (Δ mean=0.2 kg/m², 95 percent of CI, -2 to 0.5)⁹. In contrast, an observational study performed in 160 healthy Iranian men aged between 21 to 63 years reported significant decreased of BMI ($t=20.38$, $p<0.001$) and decreased body fat ($t=7.21$, $p<0.001$)¹⁰.

In recent years, several studies investigated the role of fasting during Ramadan on lifestyle factor, such as physical activity and sleep habit^{11,12}. A cross-sectional study conducted from April to July 2019 in 1118 hypertensive patients found observed significant reduction of sleeping duration ($p<0.001$)¹¹. Another study including 36 Saudi individuals with type 2 diabetes mellitus (T2DM) indicated a significant shorter total sleep time and night-time sleeping hours during Ramadan ($p=0.007$ and $p=0.005$, respectively), however this study did not find any significant result regarding physical activity¹³. On the other hand, an experimental study performed in 9 male students suggested that an acute intense exercise is modified by day time fasting and modifications in sleep schedule during Ramadan increase significantly the concentration of IL-12 after the exercise during and after Ramadan¹⁴. Due to the unique nature of Ramadan fasting, there has been a resurgence of interest in observing the association between fasting and lifestyle factors. However, no study has been reported in the literature regarding nutrients intake and lifestyles, i.e. sleep habit, food access, food expenses, and exercise durations in young adult Indonesian Muslims during Ramadan. Therefore, this study aimed to investigate the comparison of body weight, dietary intakes,

and lifestyles of Young Adults Indonesian Muslims in Regular days and During Ramadan Fasting.

METHODS

Subjects and study design

Research design was conducted by observational study. The subjects were voluntary recruited. The inclusion criteria of the subjects were: Indonesian male and female healthy-means not in bed rest condition or having severe illness, Muslims who did fasting during Ramadan 2013 (30 days), young adults aged 20-30 years old, regularly using internet and having email account. The exclusion criteria of subjects were: those who did not meet inclusion criteria should be excluded, if they will not fast in Ramadan more than 15 days, pregnant women and women breast-feeding their children, suddenly getting severe illness during Ramadan. The total sample sizes of this study were 165 subjects provided information only before Ramadan, but only 49 subjects filled out anthropometric and lifestyles questionnaires before and after Ramadan, and 39 subjects provided dietary records during regular days and during Ramadan.

This research conducted to young adult Indonesian Muslims because they are in a productive age. People who embraced Islam are very large in Indonesia, which are about 13 percent of the total Muslim world. Therefore, Indonesia is the country with the largest Muslim adherents. In 2010, followers of Islam in Indonesia are were around 205 million people, or 88 percent of the population¹⁵.

This study had no a conflict with ethical issues because this study was conducted through online questionnaires. Of the recruitments of subjects by voluntary, they could withdraw anytime during the filling the next questionnaires. There were no treatments or interventions for the subjects. Furthermore, no sensitive questions were put in the questionnaires.

Research tool

All of the participants were requested to complete the questionnaires by self-reported. The consent were given before filling the questionnaire. Validity of the questionnaires had been approved by expert's panel from 1 Professor from Nutrition college of Taipei Medical University (TMU), 1 professor from Public health college of TMU, and 1 Professor from Public Health department of National Taiwan Normal University. The subjects filled out the form of questionnaire by using Google Docs and Google drive through social media, such as Facebook groups, Twitter, Google Plus, and mailing list in Yahoo and Gmail. By using online questionnaires, we could save the time, paper, budget, and also human resources. However, the disadvantage of online questionnaires was we can't control subject directly to fill the follow up questionnaires. We kept reminding them to fill it by sending email one by one.

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The questionnaires had been presented in four parts by following the links:

- Questionnaire 1, which done before Ramadan:
https://docs.google.com/forms/d/1QPAPMhsO9x6i_RbFQKMF8ER28j0QBEqtlh2-fUr0WAK/viewform
- Questionnaire 2, which done at the end of Ramadan:
https://docs.google.com/forms/d/17rY6nTQ90Ct_FpO5onkgywDwaXp4nGvsSFgQjkM-ILY/viewform
- Dietary records 1, which done in the middle of Ramadan:
https://docs.google.com/spreadsheets/ccc?key=0ApB_jJRawyRVdHBfSnRuLUdQZEtUfUGh6Y2Nma0Z4akE&usp=drive_web#gid=2
- Dietary records 2, which done in regular days (after Ramadan):
https://docs.google.com/spreadsheets/ccc?key=0ApB_jJRawyRVdHBfSnRuLUdQZEtUfUGh6Y2Nma0Z4akE&usp=drive_web#gid=4

Data collection

The schedule to collecting all of data was started from July 5, 2013 until September, 2013. Collecting data from participants were using the questionnaires. We were collecting the data twice to compare during regular days and during Ramadan. The data requests of questionnaires included: Basic information: name, sex, age, domicile, Facebook username, email, marital status, occupation, and highest educational level; Anthropometric measures: body weight, height, BMI; Dietary intakes: energy, macronutrient, and micronutrient; Lifestyle factors: health status, disease occurrences, food expenses, food access, sleep quality, sleep durations, exercise durations, frequency of exercise.

The weight change was defined if the subjects should be both losing weight and gaining weight at least 0.225 kg for 15 to 30 days unintentionally. Based on, the definition of involuntary weight loss is as 5 percent or greater weight loss occurring within 6 to 12 months¹⁶. According WHO Asia-Pacific guideline for Asian adults, BMI criteria are used to screen for weight categories: underweight (BMI values < 18.5), normal or desirable weight (BMI values 18.5-22.9), overweight (BMI values 23.0-24.9), and obese (BMI values \geq 25.0)¹⁷.

For knowing the intake of each meal, we performed 4-day dietary records, 2-day during Ramadan (one day in weekdays and one day in weekend) and 2-day during regular days (one day in weekdays and one day in weekend). Thus, we could compare the energy intake in regular days and during fasting, and then measured the percentage of energy intake reduction. Dietary data which we measure are energy intake and nutrients intake (protein, carbohydrate, fat, fiber, vitamin, and mineral). The method for collecting dietary

intake were using spreadsheet and attaching the pictures of food into it.

Statistical analysis

All of the data in questionnaires were included in the analysis by SPSS 19.0. Moreover, dietary intakes from meals were analyzed using NutriSurvey's 2007 software. Data were checked for normality before analysis by the Kolmogorov-Smirnov test and by examining normality plots. A paired t-test was used for comparison between two sets of data for normally distributed data and the Wilcoxon signed ranks test was used for nonparametric data. Percentage changes from baseline in males and females were compared using the Mann-Whitney U-test for not-normally distributed data. In addition, McNemar's test was used for the analysis of paired dichotomous, categorical variables in much the same way that the paired t-test is designed for paired quantitative data. We determine mean \pm SD and median with significant difference was $p < 0.05$.

RESULTS

Socio demographic and anthropometric characteristics

Of the socio demographic data in total sample, 63 percent of the subjects ($n=165$) were female; 86.7 percent were unmarried; 67.3 percent lived in Indonesia; 50.9 percent had bachelor degree; and 60 percent were college students. The average age of subjects was 24.3 ± 2.6 years old. Almost one out of four subjects were overweight (9.1%) or obese (15.2%) while more than one out ten subjects was underweight (12.7%) according their BMI (See Table 1).

Of the socio demographic characteristics of subsample ($n=49$), 34 were female (69%); 43 were unmarried ($n=43$, 88%); 28 participants (57%) lived in Indonesia, 25 participants (51%) had bachelor degree; and 33 participants (67%) were college students. Mean of age in subsample was 24.3 ± 2.2 years old, the same as that of total sample subjects. Thirteen subjects were overweight ($n=3$, 6%) or obese ($n=10$, 20%), and six participants (12%) were underweight (See Table 2).

Anthropometric measures

Before Ramadan, the body weight and BMI was 56 ± 11 kg and 22 ± 3 kg/m², respectively. After Ramadan, the body weight and BMI were 55 ± 11 kg and 22 ± 3 kg/m², respectively. For statistical analysis with a nonparametric test (Wilcoxon Signed Rank test), we found significant differences between the subjects' body weight as well as their BMI reported before and after Ramadan ($n=49$, $p=0.008$; and $p=0.012$, respectively) (Table 3). Nevertheless, we separated the change of body weight from 0.225 kg, then the results of Wilcoxon Signed Rank test showed still significance ($p=0.027$) as well as BMI was $p=0.03$.

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Dietary Intakes

A parametric test (Paired t-test) was used for analyzing energy, protein, fat and phosphorus (n=39). Energy significantly reduced from 1688±434 kcal to 1521±364 kcal (p=0.004). Protein significantly decreased from 65±21 g to 55±16 g (p=0.001). Fat decreased significantly from 62±21 g to 49±17 g (p<0.0001). However, carbohydrate did not significantly reduce during Ramadan fasting. In the other hand, micronutrients which were only n-6 PUFA and phosphorus reduced significantly during Ramadan fasting (13.8±7.4 g to 8.9±4.3 g, p<0.0001; 839.1±233.5 mg to 839.1±233.5 mg, p=0.005, respectively). As well as others (fiber, cholesterol, vitamin A, carotene, vitamin E, vitamin B1, vitamin B2, vitamin B6, folic acid, vitamin C, sodium, potassium, calcium, magnesium, iron, and zinc), there were no significant difference between Ramadan fasting and regular days (Table 4).

Lifestyle factors

Of the lifestyle factors, exercise durations, and food expenses in daily decreased significantly during Ramadan fasting (n=49; 27.3±26.9 minutes to 16.1±18.9 minutes, p=0.002; 43595.9±27645.2 IDR to 36548.9±29937.2 IDR, p=0.02, respectively). However, sleep durations and disease occurrences did not change significantly during Ramadan fasting compared to during last 3 months before Ramadan (Table 5).

Using McNemar's test, only frequency of exercise significantly changed during Ramadan (n=49, p=0.002). However, no significant tendency was found for subjects related their sleep quality, health status, and food access (n=49; p= 0.454; p=0.227; p=0.070, respectively). See Table 6.

DISCUSSIONS

Current study participants had similar characteristics of socio demographic variables in either total sample or sub-sample subjects. Most of the participants were aged 24 years old, female, unmarried, and normal weight status. Our participants were mostly college students, including undergraduate and postgraduate. However, referring Statistics Indonesia or known in Indonesia as BPS (Badan Pusat Statistik, the Central Bureau of Statistics), for population aged ≥15 year, only 6.73 percent completed university degree¹⁸. According to living places, our study participants lived not only in Indonesia, but also in Taiwan, South Korea, Thailand, and other countries.

Our study observed a significant reduction of body weight and BMI during Ramadan fasting in sub-sample analysis. Most of the participant domicile under summer conditions, so the body may be easy to loss water and energy. Similar to our finding, a previous prospective observational study in Iran reported that mean weight status was lower during Ramadan fasting compared to mean weight after Ramadan fasting in men (75.1 kg vs. 76.8 kg) and in female

(59.1 kg vs. 59.9 kg)⁸. This previous study also found a significant reduction of BMI status during Ramadan in both male and female (p<0.001)⁸. Moreover, a study performed in 202 British who fasted throughout Ramadan reported a significant weight decrease (-0.84 kg, 95% CI, -0.6 to -1, p<0.0001)¹⁹. During Ramadan, our study participants showed involuntary weight loss by 1 kg. Accordingly, a previous study reveals that there is a significant weight loss during Ramadan in Jordan (p<0.005)²⁰. A significant reduction in mean body weight and BMI after 28 day compared with baseline values during Ramadan. The body weight loss slowed down during the latter part of Ramadan⁷.

The study showed significant decrease in energy, protein, fat, n-6 PUFA, and phosphorus, but no change in carbohydrate intake. According to dietary pattern of the current study, our participants mostly chose carbohydrate-rich foods during breakfasting period. This condition may might explain the insignificant difference of carbohydrate intake in our study during and before Ramadan. In current study, protein intake decreased significantly compare with intake in regular days. During the fasting days of Ramadan glucose homeostasis is maintained by meals taken before dawn and by liver glycogen stores³. Interestingly, if glycogen stores and blood glucose are compromised by such a fast, there is also evidence of an increased metabolism of protein²¹. There is a typically an increased fractional ingestion of protein with a small reduction in overall energy intake, and this may lead to small reductions of body and lean tissue mass. This in turn could lead to increased gluconeogenesis²². Nevertheless, other study in Iran shows dietary intake is similar before and during Ramadan, except in males whose protein intake fall during Ramadan⁸. In men and women less than 35 years, there is a significant increase in intake of energy and macronutrients, as of high consumption of carbohydrate during this month²³.

The distribution of energy for carbohydrate, protein, and fat were almost similar with RDA, which was 55 percent, 15 percent, and 30 percent, respectively. Based on RDA in Indonesia, the percentage of intakes of protein, n-6 PUFA, and phosphorus showed approaching RDA in both female and male, but not energy, carbohydrate and fat. The percentage of intakes of energy, carbohydrate and fat were less than 90 percent RDA in both female and male as well as in other micronutrients. However, it did not mean the intakes of those are inadequate. Study in Indonesia found that the energy intake in adults was less than RDA, which was 1423.9 kcal, and fat was 31.9 percent of energy, PUFA was 3.5 percent of energy²⁴. For micronutrients, only vitamin A was more than 110 percent RDA in both male and female. It may happen as Indonesian commonly consume internal organ, such as liver, cooking with oil or coconut milk. The study also showed vitamin B9 and calcium intake were less than 90 percent of RDA both in male and female. According to previous cross sectional study included 750 adults aged 20 to 75 years in

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Turkey, calcium intake was the most likely to have insufficient amount consumed during Ramadan²⁵.

Our study showed significant decreased of exercise duration, exercise frequency, and daily food expenses during Ramadan fasting. Sleep durations and disease occurrences did not change significantly during Ramadan fasting compared to during last 3 months before Ramadan. In contrast, previous There was negative effect on Ramadan for Ramadan on duration and regulatory of sleeping. However, there was a significant reduction in total sleep time for Muslims^{26, 27}. Result from previous investigation suggested that Ramadan fasting might be a significant barrier to achieve sufficient sleep time for many Muslims¹¹. Normally, fasting devotees consume pre-dawn meal prior to the fast, which leads to a delay in the onset of sleep²⁸. Thus, regular sleep habits can be disturbed, especially the rapid movement of the eye (REM)¹¹.

The suggestions for further studies are to increase more subjects are delivering the questionnaires to the subjects by face to face, so we can control the subjects directly. Moreover, there is needed further research about dietary pattern in different countries during Ramadan.

CONCLUSIONS

Current study showed most of them were aged 24 years old, female, unmarried, college students, and not only lived in Indonesia, but also in Taiwan, South Korea, Thailand, and other countries. The conclusions of this study are the body weight, BMI; intake of energy, protein, fat, n-6 PUFA, phosphorus; lifestyle factors of food expenses, exercise durations and frequency of young adult Indonesian Muslims decreased significantly during Ramadan fasting when compared those in regular days.

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Table 1. Socio demographic and anthropometric characteristics of Young Adult Indonesian Muslims in total sample (n=165)

Characteristics	n (%)
Sex	
Male	61 (37)
Female	104 (63)
BMI (kg/m²)	
Underweight < 18.5 kg/m ²	21 (12.7)
Normal 18.5 – 22.9 kg/m ²	104 (63.0)
Overweight 23 – 24.9 kg/m ²	15 (9.1)
Obese ≥ 25 kg/m ²	25 (15.2)
Marital status	
Married	22 (13.3)
Unmarried	143 (86.7)
Domicile	
Indonesia	111 (67.3)
Taiwan	34 (20.6)
South Korea	12 (7.3)
Other countries ^a	8 (4.8)
Highest Educational level	
Junior High School	1 (0.6)
Senior High School	42 (25.5)
Diploma	9 (5.5)

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Bachelor	84 (50.9)
Master	29 (17.6)
Occupation	
College Students ^b	99 (60.0)
Employee ^c	62 (37.6)
Unemployed	4 (2.4)
^a Other countries: Thailand n=3, Australia n=1, Tunisia n=1, Italy n=1, Singapore n=1, Timor Leste n=1	
^b College Students: Undergraduate student n=38, Postgraduate student n=61	
^c Employee: Physician n=3, Nutritionist n=1, Scriptwriter n=1, Surveyor n=1, Entrepreneur n=4, Labor n=3, Lecturer n=2, Assistant of Lecturer n=3, Teacher n=3	

Table 2. Socio demographic and anthropometric characteristics of Young Adult Indonesian Muslims in sub-sample (n=49)

Characteristics	n (%)
Sex	
Male	15 (31)
Female	34 (69)
BMI (kg/m²)	
Underweight < 18.5 kg/m ²	6 (12)
Normal 18.5 – 22.9 kg/m ²	30 (62)
Overweight 23 – 24.9 kg/m ²	3 (6)
Obese ≥ 25 kg/m ²	10 (20)
Marital status	
Married	6 (12)
Unmarried	43 (88)
Domicile	
Indonesia	28 (57)
Taiwan	15 (31)
South Korea	2 (4)
Other countries ^a	4 (8)
Highest Educational level	
Senior High School	10 (20)
Diploma	3 (6)
Bachelor	25 (51)
Master	11 (23)
Occupation	
College Students ^b	33 (67)
Employee ^c	15 (31)
Unemployed	1 (2)
^a Other countries: Thailand n=3, Australia n=1, Tunisia n=1, Italy n=1	
^b College Students: Undergraduate student n=9, Postgraduate student n=24	
^c Employee: Physician n=1, Scriptwriter n=1, Labor n=2	

Table 3. The comparisons of body weight and BMI before and after Ramadan fasting (n=49)

Measures	Before		After		p
	Mean±SD	Median	Mean±SD	Median	
Body weight (kg)	56±11	52	55±11	52	0.008*
BMI (kg/m ²)	22±3	22	22±3	21	0.012*
Analysis using Nonparametric test: Wilcoxon Signed Rank test.					
*The significant difference was p<0.05.					

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Table 4. The comparison of dietary intakes of young adult Indonesian Muslims during regular days and Ramadan fasting (n=39)

Intakes	Regular days		Ramadan fasting		p
	Mean±SD	Median	Mean±SD	Median	
Energi [#] (kcal)	1688±434	1751	1521±364	1563	0.004*
Carbohydrate (g)	233±113	227	216±60	219	0.856
Protein [#] (g)	65±21	67	55±16	56	0.001*
Fat [#] (g)	62±21	61	49±17	49	<0.0001*
Fiber (g)	10±4	10	11±4	10	0.690
n-6 PUFA (g)	14±7	14	9±4	8	<0.0001*
Cholesterol (mg)	305±189	276	237±135	212	0.052
Vitamin A (µg)	1022±1086	589	857±937	615	0.494
Carotene (mg)	0.8±0.9	0.4	1±1	0.6	0.185
Vitamin E (mg)	5±3	4	4±2	4	0.208
Vitamin B1 (mg)	0.6±0.3	0.6	0.5±0.2	0.5	0.325
Vitamin B2 (mg)	0.9±0.4	0.9	0.9±0.4	0.8	0.177
Vitamin B6 (mg)	1±0.4	1	1±0.4	0.9	0.668
Folic acid (µg)	164±76	150	156±90	128	0.426
Vitamin C (mg)	38±23	35	44±35	34	0.696
Sodium (mg)	952±861	754	1008±869	752	0.357
Potassium (mg)	1694±908	1492	1569±798	1325	0.577
Calcium (mg)	331±201	305	324±228	244	0.748
Magnesium (mg)	239±103	214	211±85	190	0.143
Phosphorus [#] (mg)	839±234	871	736±216	761	0.005*
Iron (mg)	9±3	9	8±2	8	0.190
Zink (mg)	7.6±2.5	7.5	6.8±1.9	6.6	0.666

Analysis using Nonparametric test: Wilcoxon Signed Rank test.
[#]For other nutrient intakes, analysis using Parametric test: Paired T-test.
 *The Significant difference was p<0.05.

Table 5. The comparisons of exercise durations, food expenses, sleep durations, and disease occurrences of young adult Indonesian Muslims during regular days and Ramadan fasting (n=49)

Characteristics	Regular days (in the last 3 month before Ramadan)		Ramadan fasting		p
	Mean±SD	Median	Mean±SD	Median	
Exercise durations (minutes)	27±27	20	16±19	10	0.002*
Food expenses daily (IDR**)	43596±27645	35000	36549±29937	30000	0.020*
Sleep durations (hours)	6±1	6	6±1	6	0.793
Disease occurrences (the number of types)	0.9±0.9	1	0.9±1.1	0	0.865

Analysis using Nonparametric test: Wilcoxon Signed Rank test
 *The significant difference was p<0.05
 **IDR 11420 = USD 1

Comparisons of Anthropometric Measures, Dietary Intakes, and Lifestyle Factors of Young Adult Indonesian Muslims during Ramadan Fasting and in Regular Days

Table 6. The comparisons of frequency of exercise, sleep quality, health status, and food access of young adult Indonesian Muslims during regular days and Ramadan fasting (n=49)

Characteristics	<i>Regular days (in the last 3 months before Ramadan)</i>		Ramadan fasting		p
	n (%)	n (%)	n (%)	n (%)	
	No Exercise	Frequently Exercise	No Exercise	Frequently Exercise	
Frequency of exercise	6 (12)	43 (88)	19 (39)	30 (61)	0.002*
	Poor	Good	Poor	Good	
Sleep quality	18 (37)	31 (63)	14 (29)	35 (71)	0.454
Health status	11 (22)	38 (78)	6 (12)	43 (88)	0.227
Food access	13 (27)	36 (74)	7 (14)	42 (88)	0.070
<i>Analysis using McNemar's test. Binomial distribution used.</i>					
<i>*The significant difference was $p < 0.05$</i>					