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Carbohydrate Intakes and Preferences among Endurance Athletes in Universiti Teknologi MARA Selangor

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Abstract. Endurance sport have risen and expanded over the year and nutrient particularly carbohydrate are believed to be the key factor to achieve the optimum performance. Limited information are available in Malaysia regarding the nutrition status of this particular athletes especially those among the students. The aim of this study is to determine the dietary intake and carbohydrate preferences of the athletes and to compare with the establish sport nutrition guideline. A total of 40 endurance athletes from Universiti Teknologi MARA Selangor were recruited in this study. Dietary intake of the athletes were assessed using Food Frequency Questionnaire and 3-days diet record. Overall, carbohydrate intake per day was 464.79 ± 155.39 g and 386.31 ± 93.12 g for male and female athletes, respectively. Report on carbohydrate intake as per sport nutrition guidelines showed that male and female athlete have a mean carbohydrate intake of 6.06 ± 2.07 g/kg body weight and 5.73 ± 1.99 g/kg body weight, respectively, which were in the minimum range of recommendation. The main source of carbohydrate of the athletes derive from white rice. Meanwhile, the intake of protein and fat for male were 1.77 ± 0.94 g/kg body weight and 61.78 ± 32.64 g, respectively. Meanwhile, the protein and fat intake in female athlete were 1.94 ± 0.82 g/kg body weight and 74.51 ± 36.92 g, respectively. Remarkably, the intake of fat and fluid were recorded lower than recommendation. It is proven that the nutrient intake of the athletes does not meet the optimum sport nutrition recommendation

1. Introduction

Endurance sports have risen in favor over the year and athletes at all levels are seeking for ways to optimize their athletic performance by training and nutrition [1]. Endurance athletes engage in long training hours, making the body stresses for extreme caloric demand and depends greatly on carbohydrates as the major key energy sources [2]. Adequate carbohydrate intake are required to maintain body weight, replenishes glycogen stores, prevent carbohydrate depletion that contribute to fatigue besides depletion in strength and endurance due to loss of lean mass tissue [1], [3]. Endurance athletes are said to consume more carbohydrate during daily training and competition compared to their non-endurance peers in order to meet their training and energy requirement [4]-[6].

Several guidelines have been published in order to navigate the endurance athletes to meet their nutrient recommendation particularly on carbohydrates (CHO) intake. However, for most athletes, the carbohydrate intake was lower than generally recommended in the existing consensus guidelines on sport nutrition even



at group level [7]-[9] considering the limited information available in Malaysia. This study was conducted (1) to determine the nutrition status of endurance athletes in UiTM Selangor, (2) to determine the current dietary carbohydrate intakes and preferences among endurance athletes in UiTM Selangor and (3) to compare the carbohydrate intake among endurance athletes in UiTM Selangor with the establish sport nutrition guideline carbohydrate recommendation.

2. Methodology

This was a cross-sectional study design that was conducted from June 2017 to October 2017 in UiTM Selangor. The approval for the study was obtained from Universiti Teknologi MARA (UiTM) Research Ethics Committee. The study used the method of convenient sampling. All the athletes are UiTM's Selangor Students athletes that have competed and represent UiTM at the national level. A list name of the active endurance athletes which comprises of athletes that are still involved in the sports was obtained from UiTM Sports Centre. The athlete that was included in the study was given consent form. The sample size was calculated by using the Raosoft sample size calculator. The sample size obtain is 56 using the values: 5% margin of error, 90% confidence level, and 65 sample population. However, throughout this study only 40 were recruited due involuntary to participate in the study. Among the inclusion criteria were athletes that are active endurance ones and have involved in endurance sport in duration more than 6 months. The exclusion criteria were athletes that are not an endurance athletes or have involved in the endurance sport in duration less than 6 month. The athletes were all previously informed on the aim of the study.

2.1 Sociodemographic and Anthropometric

A set of questionnaire was developed and self-administered by the athlete to identify their age, gender, races, semester of study, name of endurance sports involve, duration of the sports involvement (years), frequency of training (day per week) and duration of training (minutes per day). Anthropometric measurement for weight and height was done based on CDC anthropometry procedure manual [10]. BMI was calculated and tabulated based on BMI Asian Adult [11]. Fat measurement was done using the Bioelectrical impedance analysis (BIA) method and was tabulated in percentage.

2.2 Dietary Assessment

Food frequency questionnaire (FFQ) and 3-day food and exercise record was used to assess the dietary intake. FFQ was used to determine the nutrition status and 3-day food and exercise records was used to assess the carbohydrate intake based on sport nutrition guidelines. For FFQ, there are a total of 128 food items list in the FFQ that are divided into 15 different groups. The item list on the FFQ comprises the food that can be found in Malaysia. This is to ensure the accuracy of food intake frequency since the study takes into account by of the demographic factor. The athletes were asked on their habitual food intake by indicating the number of frequency intake of each types of food listed according to the options: 'per day', 'per week', 'per month' and 'never'. The athletes were required to choose only one option. The athletes were also asked on their number of serving size for each time they consume the food. A set of household measurement was provided as a reference to facilitate them. Each food item listed was given a standard serving size based on the Atlas Makanan: Saiz Pertukaran & Porsi (Edisi Ketiga) [12] that contained a picture of various food, their respective portion size and weight in grams in household measures. The serving size was based on the medium size and were using the serving size for one quantity (one piece, one whole fruit, one matchbox, one cups, one spoon and other). For the food item that wasn't available, a reference food item of the same characteristics was used to determine the weight. Conversion factor [13] was used to estimate amount of food intake based on the frequency of food intake. In order to determine the total food intake per day, the amount of weight (in gram) of each food items estimated from the formula was then calculated by using the Dietary Plus Software developed by Ng [14] which displays the total dietary, macronutrient and micronutrient intake.

Athletes was required to record their dietary intake using the 3-day food and exercise record provided which comprises of 2 weekday and 1 weekend. By taking into account the weekend which the food intake

are substantially modified due to eating out or family gathering, it enables a better accuracy in estimating the usual dietary intake. All the athletes received a detailed verbal and written explanation regarding the food record. Athletes were asked to eat normally and remain as close as their usual food intake. Athletes were also asked to record the data as accurate as possible and taking into account the method of preparation. All confusion or question regarding the food intake are resolved through a direct interview by the researcher. Athletes were also required to record their exercise concurrently with the food record. The food and exercise record were conducted during usual training session to ensure the data provided could represent the usual intake. Underreporting were checked by using the formula (Energy intake (EI) /Total energy expenditure (TEE)). TEE was calculated by using the equation [15] for total energy expenditure (TEE= Basal metabolic rate (BMR) X physical activity level (PAL)). BMR was calculated by using the formula [16] that are suitable for population in tropic environment and the PAL use are 1.8 (Active population). Under-reporting was check by using the ratio of 0.82 [17] whereby, the ratio of EI/TTE < 0.82 was said to be underreported and was excluded from analyzing process.

The total food intake per day was estimated by using the using the Dietary Plus Software developed by Ng [14] which displays the total dietary, macronutrient and micronutrient intake. The quantity for each food item were determined by referring to Atlas Makanan: Saiz Pertukaran & Porsi (Edisi Ketiga) [12]. For each of the food item that reported in the food diary but not listed in the Diet PLUS, the food items will be broken down to ingredients and will be calculated based on the ingredients [18].

2.3 Statistical Analysis

All of the data are analyze by using the Statistical Analysis Software Package (SPSS) Version 21. The data collected are analyze on descriptive statistic aspects that comprises of mean, frequencies, standard deviation and percentage. Chi-Square test were used to check on the relationship between carbohydrate intake and gender.

3. Result and Discussion

Figure 1 shows a total of 40 participants which equal to response rate 61.5% have agreed to volunteer for the study. The remaining 25 athletes didn't give their consent to participate in the study because they are not interested and thus, are excluded from the study. For the data analysis process, all FFQ (n=40) was analyzed but for food diary, only 23 was analyzed. The remaining 17 was excluded as it is underreported.

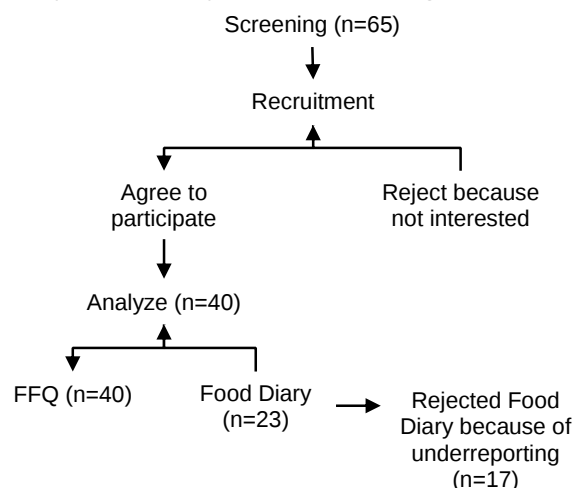


Figure 1. Enrollment of endurance athletes

Based on the result obtained in Table 1, it could be seen that the male endurance athletes have a mean age of 22.24 ± 1.67 years old, a year older than the female athletes at 21.13 ± 1.64 years old. Most of the male athletes are in semester 7 while the majority of female athletes are in their semester 2 and semester 3

of study. Almost majority of the male athletes that participate in the study are two-sports athletes which means they specialized in two endurance sports whereas almost majority of the female athletes that participate in the study is cyclist.

In regards to training days in a week, female athletes had more frequent training day of mean value almost 5 days per week as compared to male athletes that trained for mean value 4 days per week only. The majority of male athletes train for 4 to 5 days whereas almost the majority of female athletes train for 6 days per week. The female athletes are proven to have longer training duration with mean value of 124.6 ± 83.07 minutes as compared to the male athletes that have a mean value of 83.0 ± 41.88 minutes of training per day. Both male and female athletes have overall involved in their respective endurance sports for about 1 to 5 years.

Table 1. The sociodemographic data of endurance athletes in Universiti Teknologi MARA, Selangor

Characteristics	Total (n=40)	Male (n = 25)		Female (n = 15)	
	Mean $\pm$ SD	Mean $\pm$ SD	Frequency (%)	Mean $\pm$ SD	Frequency (%)
Age	21.83 $\pm$ 1.72	22.24 $\pm$ 1.67		21.13 $\pm$ 1.64	
Semester in study					
Semester 2			3 (12)		4 (26.7)
Semester 3			1 (4)		4 (26.7)
Semester 5			3 (12)		3 (20.0)
Semester 6			6 (24)		1 (6.7)
Semester 7			12 (48)		3 (20.0)
Type of endurance sport involved					
Cyclist			5 (20)		7 (46.7)
Biathletes			10 (40)		3 (20.0)
Long Distance			9 (36)		4 (26.7)
Runner					
Swimmer			1 (4)		1 (6.7)
Training (day per week)	4.38 $\pm$ 1.63	4.20 $\pm$ 1.26		4.67 $\pm$ 2.13	
1 – 3 days			7 (28)		5 (33.3)
4 – 5 days			14 (56)		4 (26.7)
6 – 7 days			4 (16)		6 (40.0)
Training duration (minutes per day)	98.6 $\pm$ 63.03	83.0 $\pm$ 41.88		124.6 $\pm$ 83.07	
Involvement in Sports (Years)					
1 – 5 years			15 (60.0)		9 (60.0)
6 – 10 years			8 (32.0)		4 (26.7)
More than 10 years			2 (8.0)		2 (13.3)

Table 2 shows subject anthropometric measurement, male athlete have higher body mass of 60.79 ± 7.79 kg as compared to female athletes that have a mean body mass of 50.79 ± 10.21 kg. Male athletes also appeared to be taller than their female counterpart with mean height of 167.44 ± 4.64 cm.

Table 2. The anthropometric measurement of endurance athlete in Universiti Teknologi MARA, Selangor

	Male (n = 25)		Female (n = 15)	
	Mean $\pm$ SD	Frequency (%)	Mean $\pm$ SD	Frequency (%)
Weight (kg)	60.79 $\pm$ 7.79		50.79 $\pm$ 10.21	
Height (cm)	167.44 $\pm$ 4.64		156.03 $\pm$ 5.76	
BMI (kg/m ²)	21.67 $\pm$ 2.42		20.89 $\pm$ 4.06	
Underweight (< 18.5 kg/m ²)		3 (12.0)		6 (40.0)
Normal (18.5 kg/m ² – 22.9)		14 (56.0)		4 (26.7)

kg/m ²) Overweight (> 23.0 kg/m ²) Body fat (%)	17.78 ± 4.31	8 (32.0)	25.9 ± 6.57	5 (33.3)
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The mean height and weight of both gender appear to be lower than those study conducted among student athlete in France [17] with mean age of 19.2 ± 1.9 years old whereby their mean weight and height is 67.8 ± 9.2 kg, 179.9 ± 6.1 cm and 59.9 ± 7.9 kg, 167.9 ± 5.7 cm for male and female respectively. However, This result is expected as Asian have smaller stature. In relative to BMI value, male athletes have a higher BMI value of 21.67 ± 2.42 kg/m² as compared to the female athletes that have a mean BMI of 20.89 ± 4.06 kg/m². The mean BMI for both gender are found to be lower than previous study [19]. Even so, the mean BMI of both gender of current study appeared to be in the normal BMI range of 18.5 kg/m² – 22.9 kg/m² according to Asian Adult BMI classification [11]. The frequency data shows that eight male athletes and five female athletes are classified as overweight. The misclassification of athletes to overweight or obese are prone to happen as athlete have a higher lean body mass that impart their body weight [20]. Thus, BMI should be use carefully when determining higher body proportion in college athlete [21].

Some other method to measure body fatness include BIA [10] which the result will be presented in percentage. Female athletes have a higher percentage body fat with mean value 25.9 ± 6.57 % as compared to their male counterpart that have a body fat percentage of 17.78 ± 4.31 %. This result is similar to the previous study conducted among Lithuanian high performance endurance athlete [22]. This might due to the fact that, female have more body fat especially in their hip and chest part as compared to the male. Male also are said to have a higher proportion of lean body mass as compared to female. The good proportion of body fat percentage for male and female age 20 to 29 years old is 14.8% - 18.6% and 19.4% - 22.7% respectively [23]. Comparing to the body fat percentage range, current study male athletes resides themselves within the good proportion range of body fat whereas the case are vice versa for the female athletes that have a mean body fat higher than the good proportion range. However, previous study reported a body fat percentage lower than the current study [24]-[26].

Nature of the sports may play a significant role to the body fat percentage. Lower body fat in runners is associated with faster running speed in training as the body feels lighter [27]. Training volume also associated with body fat percentage. High training volume may resulted in lower body fat [25]. Previous study involved high level athlete that usually have high training volume, which resulted in lower body fat.

As the previous study involved mainly runners, thus the result are expected to be varied. Another possible explanation is current study involved student athlete which is a part time athlete that representing their university only. It is differed from previous study that involved nation's athletes. This is because, nation's athletes usually have their own sports dietitian that monitors their body composition progress, but that couldn't be said for university students' athletes.

Table 3 shows Nutrition intake of endurance athlete in Universiti Teknologi MARA Selangor based on Food Frequency Questionnaire (FFQ). For energy intake, the mean value obtain are 2865.13 ± 1058.29 kcal/day for male and 2628.27 ± 839.62 kcal/day for female. The energy intake of UiTM endurance athlete are lower than the study conducted among Dutch elite and sub-elite endurance athlete [7] and the study conducted in Lithuanian endurance [22]. The difference might be due to the status of the athletes whereby current study involved the student athlete that have the duration of exercise of 83 minutes per day for male and 124.6 minutes for day for the female with both gender training 4 to 5 days per week. Dutch study consisted of elite athletes who trained a minimum of 9 hour per week and are the top athlete of their age group and the Lithuanian involved the highest performance endurance athlete in Lithuania. The levels of athletes also plays a role in energy intake. Dutch study comprises of elite and sub-elite athletes which by definition, are those that hold a record or competing in international competition [28]. Thus, their energy intake are proved to be higher in accordance to their higher exercise intensity.

Appropriate energy intake will help in obtaining optimal body function, and help in manipulation of body composition. Adequate energy intake are important for endurance athlete in order to achieve positive energy balance and weight stability [29]. It is proved to be a challenge among endurance athlete to achieved positive energy balance because energy expenditure that is higher than energy intake will result in loss of body weight

significantly as what had happen among endurance athlete in Greece [30]. However, when compare with the study among endurance student athlete in France [17], the energy intake of the UiTM athlete appeared to be higher. Percentage (%) that meets RNI was calculated for endurance athlete of both gender by comparing it with the RNI [31] energy for 19-29 years old individuals at PAL 1.8 (active individuals).

Table 3. Nutrition intake of endurance athlete in Universiti Teknologi MARA Selangor based on Food Frequency Questionnaire (FFQ)

	Male (n=25)		Female (n=15)		RNI 2017 ^a
	Mean $\pm$ SD	Percentage (%)	Mean $\pm$ SD	Percentage (%)	
Energy (kcal/day)	2865.13 $\pm$		2628.27 $\pm$ 839.62		2520 ^b
% meet RNI	1058.29	114		126	2080 ^c
Carbohydrate (g/day)	464.79 $\pm$ 155.39		386.31 $\pm$ 93.12		50-65 %
% TEI	65.84 $\pm$ 6.76		60.33 $\pm$ 6.81		
% meet RNI		114		105	
Protein (g/kg BW)	1.77 $\pm$ 0.94		1.94 $\pm$ 0.82		1.0 -1.5
% TEI	14.68 $\pm$ 2.94		14.53 $\pm$ 2.77		g/kg/day
% meet RNI		141		155	
Fat (g/day)	61.78 $\pm$ 32.64		74.51 $\pm$ 36.92		
% TEI	18.80 $\pm$ 5.64		24.47 $\pm$ 5.57		25-30%
% meet RNI		68		89	
Fibre (g/day)	20.52 $\pm$ 9.74		20.16 $\pm$ 7.34		20g-30g
% meet RNI		82		81	
Fluid (ml/day)	1320 $\pm$ 381.88		1506.67 $\pm$ 418.27		2520 ^d
% meet RNI		52		72	2080 ^e
GI	63.92 $\pm$ 3.00		60.40 $\pm$ 3.25		
GL	297.08 $\pm$ 98.95		234.13 $\pm$ 61.78		

It shows that, the male and female endurance athletes meet the RNI by 114 % and 126 % respectively. Thus, both male and female meet and exceed the energy requirement according to RNI by 14% and 26% respectively.

Current study found that the intake of carbohydrate in male are higher than female. Male have a mean total carbohydrate intake of 464.79 $\pm$ 155.39 g with % of carbohydrate to total energy intake (% TEI) is 65.84 $\pm$ 6.76 % which is higher than female that have a mean intake of 386.31 $\pm$ 93.12 g and % TEI of 60.33 $\pm$ 6.81 %. When compared the total carbohydrate intake per day with previous study, it shows that the intake of carbohydrate among endurance athlete in UiTM Selangor are far higher [32]. The result shows the same pattern in the aspects of % TEI value [17], [32].

Calculated % of carbohydrate that meets RNI shows that both male and female meets and exceeded the average amount % TEI by 14% and 5% respectively. This finding is opposite to the previous study among Lithuanian endurance athlete which shows that, majority of the athletes of both gender consume carbohydrate less than their recommended daily intake (RDI) [22]. Carbohydrate are preferable energy source for the body as it provide the most readily available form of energy which is important in endurance sport as the body depend on the muscle glycogen greatly [33]. Inadequate carbohydrate intake will result in muscle glycogen depletion that subsequently will induced fatigue among athlete [1], [34].

For the protein intake, the mean protein in regards to g/kg body weight (BW) is 1.77 $\pm$ 0.94 g with % TEI of 14.68 $\pm$ 2.94 % and 1.94 $\pm$ 0.82 g with % of TEI of 14.53 $\pm$ 2.77 % for male and female athletes respectively. The result obtained were differed from the previous study in US that reported the mean intake of protein is 1.85 g/kg BW for both gender [32]. In the aspect of % TEI, the result obtained appeared to be similar to the previous study among swimmers age 18 to 24 [30]. However, some study have reported a higher mean % TEI than current study which is 17.38 $\pm$ 5.43 % [7], [32]. The calculated percentage that meets RNI shows that athlete from current study met and exceeded the average requirement of RNI for protein by 41% and 55% respectively for both male and female. This is in accordance to previous study among male endurance athlete in Lithuania, whereby more than half of the athletes exceeded the RDI.

However, the case is different among female athletes. Findings showed that almost half of the female Lithuanian endurance athletes failed to meet the RDI for protein [22].

Protein are important for the body due to its diverse role. Protein act as the structural protein, enzymes, hormones, transport protein and immunoproteins for body defense mechanism [31]. For endurance athletes, optimal protein intake are suggested to be taken after exercise. This is to support the process of muscle repair and recovery that happen after exercise [35]. Adequate protein among adult athletes is important to maintain positive protein balance, facilitate protein synthesis and support growth. However, among adolescent and young adult athlete, sufficient protein are vital to facilitate proper development and maturation [36]. Current study finding showed that, athletes were able to meet and exceed the average amount of protein as per recommendation. This is partly believed due to the facts that protein are abundant in Malaysian diet and can be found in variety of food.

Regarding fat intake, the mean total fat intake per day obtained from current study was 61.78 ± 32.64 g and 74.51 ± 36.92 g for male and female respectively. The results were less than the previous study [7], [32]. The same pattern are observed for % TEI which showed that, current study population with % TEI of 18.8 ± 5.64 % for male and 24.47 ± 5.57 % for female, is lower than the finding from previous study [17], [19], [32]. In regards to the calculated percentage that meet the RNI, current study reported 68% and 89% which signifies that the intake are less than the average recommended RNI amount of 25 – 30% fat. The result were in contrast to the previous study. In the previous study conducted in Greece, the % TEI of fat intake are find to be higher than the recommendation [30]. Previous finding showed the same pattern whereby, the intake of fat among endurance athlete in both gender is exceeding the RDI [22]. Lower fat intake are usually associated with nutrition knowledge. College students who have a higher nutrition knowledge usually consumed lesser fat than their peers in their daily intake [37]. Among athletes, endurance athlete are reported to have a lower fat intake than other athletes [2]. Low fat intake was reported to be due to susceptibility of the subjects toward social desirability bias – a condition which research subject give a response that are thought to be socially accepted rather than the response that reflective of oneself [38]. Previous study reported that self-reported fruit and vegetables intake using FFQ or 24-hour diet recall were susceptible to socially accepted bias [39]. Thus, the same cases of socially accepted bias may happen in self-report dietary fat intake as endurance athlete usually were perceived to have a low fat intake than other athletes. Underreporting of dietary fat intake due to insufficient information on fat content of food [40] may also explain the low fat intake reported..

For fibre intake, the mean value obtained for total fibre intake per day is 20.52 ± 9.74 g for male and 20.16 ± 7.34 g per day for female respectively. The results were compared with previous study [7] that showed the mean fibre intake was higher than the current study. Calculated % that meets RNI give out 82 % for male and 81% or female which showed that the fibre was not consumed in recommended amount by the study population. Previous study reported a similar finding for fibre intake among female athlete but different for male athletes [22]. This problem doesn't revolve around study population only. More than half of Malaysian consumed lower than the recommended amount of dietary fibre [41]. Fibre are normally associated with wholegrain, fruits and vegetables. Low fibre intake among study population could be caused by low intake of food-containing fibre. As in the case among young male long distance runner in Swiss that consumed whole grain cereal product and vegetables including raw vegetables less frequent than the recommendation [42].

Mean fluid intake obtained for male population in current study was 1320 ± 381.88 ml/day while female population produced a mean intake of 1506.67 ± 418.27 ml/day which is higher than the male population. However, both resulted showed a mean intake less than the reported previous study [7]. Malaysia Dietary Guideline recommended fluid consumption of 1 ml per 1 kcal per day [43]. Comparing the recommendation of MDG and RNI [31] gives out the fluid requirement for male is 2520 ml/day while female is 2080 ml/day. Calculated percentage that meets RNI for male and female was 47% and 65% respectively. Thus, suggesting that the population study did not meets the RNI for fluid. This finding is similar with previous finding among Ethiopian runners that concluded that Ethiopian runners doesn't meet the fluid recommendation [44].

Fluid are vital for athlete in order to prevent dehydration that may affect the performance significantly [45]. Thus, athletes should train themselves to greater water uptake during training period and to ensure more fluid consumption during hot or humid environments [46]. Fluid consumption are usually related to ability to perceived thirst. However, in some cases, it is said that athletes do not drink spontaneously following thirst stimulation for rehydration during exercise and further resulted in low fluid uptake [47].

Glycemix index (GI) could be defined as the physiological classification of carbohydrate-containing food based on their ability in raising the post-prandial blood glucose as compared to the reference value while glycemix load (GL) is the combination of quality and quantity of carbohydrate [48]. Mean glycemix index (GI) value for male was 63.92 ± 3.0 while female was 60.40 ± 3.25 . Both gender's GI value were in the intermediate group (GI value 55-70). This is in accordance to the recommendation that athletes were recommended to consume complex carbohydrate from low to moderate glycemix index [46]. The same pattern were observed in glycemix load (GL) in male, 297.08 ± 98.95 while in female, 234.13 ± 61.78 .

Table 4 shows the result of frequency of carbohydrates preferences among endurance athletes in UiTM Selangor that was obtained from FFQ. The highest carbohydrates source that was preferred by the endurance athletes was rice particularly white rice (35%). This result is expected as rice have act as the half of the world's population staple food including Malaysia [49] that contributed to more than 21% of their total calorie requirement and about 76% in South East Asian populations [49], [50].

Table 4. Frequency of carbohydrates food source preferences among the participants

CHO SOURCES	Frequency (%)
Rice	35
White	35
Brown/Basmati	0
Noodles	12
Wheat-Based Varieties	7
Rice-Based Varieties	3
Pasta	2
Bread	5
White	4
Wholemeal/Wholegrain	1
Starchy Vegetables	1
Low GI Varieties	0
Other Varieties	1
Fruit	9
Low GI Varieties	3
Other GI Varieties	6
Breakfast Cereal	3
Low GI Varieties	0
High GI Varieties	3
Total Dough	5
High GI Varieties	5
Low GI Varieties	0
Beverages	19
Low GI Varieties	7
Other Varieties	12
Kuih	1
Wheat – Based Kuih	1
Biscuits	4
Milk/Dairy	2
Miscellaneous	4
Total	100

Furthermore, white rice are recognized as the commonly consumed rice among Malaysian. It is said that younger generation age 20 to 25 years old consumed rice twice a day [51]. Thus, as current study athlete are Malaysian within the previous study age range, they are expected to show the same preferences [51].

For carbohydrates sources that comes from noodles, athletes preferred to choose wheat-based varieties such as yellow mee (mee kuning) as compared to rice-based varieties (mee hoon and kuey teow) and pasta (spaghetti). In terms of carbohydrates sources from bread, endurance athletes from both gender were inclined to choose white bread as compared to wholemeal/wholegrain bread. Current study athletes preferred fruit from other glycemix index (GI) varieties (6%) that consist of fruits from intermediate and high GI group such as papaya, pineapple and canned fruit. Meanwhile, Low glycemix index (GI) fruits varieties (3%) that were normally consumed by athletes were banana, apple and pear. Total dough from high GI varieties represent a frequency of 5%. An example of the food from total dough food group that are often choose by the athletes was Roti Canai. For beverages, athletes were prone to consume high GI beverages such as sports drink and carbonated drink as their carbohydrates sources. Athletes chose to consume sports drinks with the aim to replenish the water and electrolytes lost after activity and for recovery [52]

Table 5 shows the carbohydrates intake as recommended by sport nutrition guideline between male and female endurance athlete based on 3-day food record. The mean carbohydrate intake obtained for male and female was 6.06 ± 2.07 g/kg body weight (BW) and female was 5.73 ± 1.99 g/kg BW, respectively. The result of mean carbohydrate intake from current study was slightly higher than the result reported from previous study [19], [22]. However, there are some studies that reported on the intake which is slightly higher than the current study [53]. It could be seen that the intake of current study and previous study are somewhat in the area of minimum recommended amount or near to the lower range of the optimum recommendation by sport nutrition guidelines.

Table 5. Carbohydrates intake as in recommendation by sport nutrition guideline between male and female endurance athletes based on 3-day food record

	Male (n= 14)		Female (n=9)		*P-value
	Mean $\pm$ SD	Frequency (%)	Mean $\pm$ SD	Frequency (%)	
Carbohydrate (g/kg/bw)	6.06 ± 2.07	8 (57)	5.73 ± 1.99	6 (67)	0.693
≤ 5 g/kg BW		5 (36)		3 (33)	
6 – 10 g/kg BW		1 (7)		0	

*Statistical analysis is significant at $p < 0.05$ using Chi-square test (X²)

Result of the chi-square test (Pearson chi-square) for the research sample shows that there is no significant difference between carbohydrates intakes in regards to gender (p -value = 0.693). For both gender, more than half meets the minimum recommendation by sport nutrition guideline which is 5 g/kg BW. When comparing the percentage of frequency of carbohydrate intake that are lower and equal to the minimum recommended amount (≤ 5 g/kg BW) between gender, it shows that female endurance athlete shows that female endurance athlete reported a higher percentage of 67% as compared to male endurance athlete (57%). The finding from current study and majority of previous study concluded that endurance athlete had failed to meet the general recommended value of carbohydrate based on sport nutrition guidelines [7], [19], [22], [30].

The problem however did not arise among endurance athlete only as 24-hour diet recall conducted at Delhi 2010 Commonwealth Games shows that athletes from varying sports may not consume enough carbohydrates to meet current recommendations for performance [54]. This is supported by the study conducted among Canadian high-performance athlete that found that Canadian high-performance athletes do not consume adequate energy or carbohydrates as both genders are reported to consume it below the recommended level [55].

4. Conclusion

In conclusion, calculated percentage (%) that meets recommendation shows that male and female endurance athletes meet the average RNI recommendation for energy, carbohydrate and protein but didn't achieved 100% RNI for fat, fibre and water. Endurance athlete in current study have adequate intake of energy,

carbohydrate and protein according to RNI. However, they have failed to meet the general recommended amount for fat and fluid.

Frequency of carbohydrate preferences shows that UiTM endurance athlete have a high preference for rice particularly white rice. While report on carbohydrate intake as per sport nutrition guidelines shows that male and female athletes have a mean carbohydrate intake of 6.06 ± 2.07 g/kg BW and 5.73 ± 1.99 g/kg BW which exceed the minimum amount of carbohydrate but still considered to be low than the generally recommended amount. This should be a concern as endurance athlete relies greatly on carbohydrate amount and reduction in intake may significantly affect their performance.

Conflict of interest

There was no potential conflict of interest in relation to this article reported.

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