

ASSESSMENT OF DIET QUALITY AND ITS ASSOCIATION WITH NUTRITIONAL STATUS AMONG FISHERMEN'S CHILDREN IN TERENGGANU

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ABSTRACT

The aim of this study was to assess diet quality and its association with nutritional status among 7 to 12 years old fishermen's children in Terengganu. The dietary intake data and nutritional status of 100 fishermen's children were obtained using two-day 24 hours dietary recall and Body Mass Index. Diet quality of the subjects was assessed using the Healthy Eating Index. 61% of subjects had normal BMI, 22% had a BMI below the normal range, and 17% had their BMI above the normal range. The diet quality of subjects was poor, with mean total HEI score of 50.45±5.27 out of 100 points. The low median scores of the five food groups, particularly for the vegetable (0.83), fruit (0.00) and dairy (0.00) components, indicates the poor compliance of the fishermen's children with the dietary guidelines. No significant association was found between total HEI score and BMI of the subjects ($\chi^2=0.051$, $p=0.821$). Thus, BMI did not reflect the diet quality of the fishermen's children in this study. The findings of this study provide additional information on the diet quality and nutritional status of fishermen's children in Terengganu, on the East Coast of Peninsular Malaysia.

Key words: Diet quality, fishermen's children, Healthy Eating Index, nutritional status

INTRODUCTION

In Malaysia, childhood malnutrition persists, especially in rural communities. It has become a major public concern (Wong *et al.*, 2014). Unhealthy dietary intake and practice that established during childhood may develop impacts on their health and track until adulthood and therefore the assessment of children diet quality is important. Good quality diet reflects the sufficient nutrient intake required by the children to enhance their growth and development in term of physical, cognitive and psychosocial (Cheng & Buyken, 2013). The few studies on the diet quality assessment of Malaysian children have concluded that diet quality of these children was poor (Chua *et al.*, 2012; Zalilah *et al.*, 2005). However, none of the studies were focusing on fishermen's children. This is important because previous studies have shown that fishermen in Malaysia are poor in several dimensions, including health, insurance and education based on the multidimensional poverty index (Solaymani & Kari,

2014). Unlike the labors from the other sectors, fishermen do not have monthly fixed income. Their income is primarily determined by the amount of fish catch through their fishing effort. However, unpredictable fishing return due to environmental and seasonal climate change threatened their livelihood. These cumulative pressures could produce significant consequences on household food security and susceptibility of the fishermen families especially the children to malnutrition.

Studies have found that fishermen's children are vulnerable group which have high susceptibility to poor nutritional status. In Malaysia, Khor and Tee (1997) reported that children below 18 years old from the fishing community in peninsular Malaysia showed higher prevalence of underweight (33% boys and 24.6% girls) than those from the estates (29.5% boy, 24.6% girl) and coconut community (22.2% boys, 19.1% girls). Foo *et al.* (2006) reported that the mean intake of energy and most nutrients (carbohydrate, fat, calcium, iron and thiamine) of the adolescents in a rural fishing community in Tuaran, Sabah were below the Malaysia recommended nutrient intake (RNI) level. Several studies have

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been done on diet quality of children and reveal its association with nutritional status outcome (Vitolo *et al.*, 2010; Abbott, 2015; Jennings *et al.*, 2011). However, the extent to which the nutritional status of fishermen's children may be influenced by their diet quality is unknown.

There has been a lack of study on the diet quality of middle childhood children from fishing communities, especially those on the East Coast of Peninsular Malaysia. Therefore, the objective of this study was to assess the nutritional status and diet quality as well as to determine the association between these two variables among fishermen's children in Terengganu.

MATERIALS AND METHODS

This was a cross-sectional study conducted in two districts of Terengganu, namely Kuala Nerus and Kuala Terengganu. The sample size involved in this study was calculated using the formula developed by Cochran (1963). After acquiring 10% attrition into account, the final desired sample size of this study was 100. In this study, a total of 100 fishermen's children aged seven to 12 year old were recruited through snowball sampling. Verbal and written informed consent was obtained from the mother or caregiver of fishermen's children before involving them in this study. The application of ethical review of this study was submitted to the Human Ethic Board of Committees of Universiti Malaysia Terengganu and was approved with reference number: UMT/JKEPM/2017/4.

The research instrument used in this study was an interviewer-administered survey questionnaire. The survey questionnaire used in this study consists of three sections. The first sections comprised of seven questions regarding respondent's profile and socio-demographics information namely, gender, race, date of birth, number of members in the household, highest education level of parents, monthly household income and status of financial support. The second part of the questionnaire required the body height and weight of the children to be measured using non-stretchable measuring tape and weight scale. The subjects' body weight and height were used to calculate their body mass index (BMI). The BMI-for-age (5-19 years old) from WHO growth reference (2007) was used to determine the nutritional status of fishermen's children. The third part was a two-day 24-hours dietary recall intake form. Subjects were asked to recall the food and beverages they had consumed in a normal weekday and a weekend. Pictures were used to illustrate household measurements such as cup, tablespoon, scoop, and teaspoon in order to help the subjects in estimating the quantity of food and

beverages they had consumed. Dietary intake data obtained was analyzed in terms of total energy, macronutrients (carbohydrate, fat and protein) and also selected micronutrient intake (iron, calcium, niacin, vitamin C and vitamin A) using Nutritionist Pro™ software.

The Healthy Eating Index (HEI) (Kennedy *et al.*, 1995) was used to measure the diet quality of fishermen's children after adjusting some of the scoring criteria based on the Malaysian Dietary Guidelines for Children and Adolescents (2014). HEI consists of 10 components (grains, vegetables, fruits, dairy, meat, total fat, saturated fat, cholesterol, sodium and variety) and the number of recommended servings depends upon an individual's energy requirement. The possible composite HEI score range from a minimum score of 0 to maximum score of 100. A total score of above 80 is classified as good, scores between 51 and 80 indicated the needs of improvement, and scores of less than 51 is considered poor.

The data collected was analyzed using the Statistical Package for Social Sciences (SPSS) version 20. All data was examined for normality with the Kolmogorov Smirnov test. Descriptive statistical analysis, including frequency, percentage, mean score (SD) or median score (IQR) was used to describe the distribution of the data. One sample t-test or Wilcoxon Signed-Rank test was used to determine whether the total energy, macronutrient and micronutrient intake were statistically different from the Recommended Nutrient Intake (RNI). The association between total HEI scores and BMI was assessed using a Chi-square test. In all analysis, the results were considered significant at $p < 0.05$.

RESULTS AND DISCUSSION

Socio-demographic characteristics

The socio-demographic characteristics of the fishermen's children are shown in Table 1 below. Of the 100 subjects participated in this study, 56.0% were female and 44.0% were male. All of the subjects were Malay. Over half of the subjects (61.0%) were 10-12 years old while the remaining 39.0% were 7-9 years old. In the present study, majority of the subjects (65.0%) came from fishermen's families with 5 to 8 household members. It is discovered that the highest education level of 52.0% of the subject's parents was until lower secondary school attainment. Approximately 44.0% of subjects came from families with estimated monthly household incomes of between RM 441 to RM750, which were considered as poor households based on the definition of categories of low income groups by PEMANDU (2010). Of the 100 subjects took part in the present study, only about one fifth

of the subject's families (21.0%) received financial support. The finding of this study was in line with study by Yaakob and Chau (2005) who reported that the mean monthly income of fishermen in Each Coast State of Malaysia range from RM 419 to RM 1461 during normal period. The decreased income level of fishermen increases the household vulnerability towards food insecurity (Makame *et al.*, 2015). Low income level of fishermen constrained their purchasing power, decreases their household access to healthy and nutritious food and also increases their susceptibility to food insecurity. Findings from several studies have showed an inverse relationship between household income and malnutrition in the fishing community (Foo *et al.*, 2006; Pal *et al.*, 2011).

Table 1. Socio-demographic characteristics of subjects (n=100)

Characteristics	Frequency (%)	Median (IQR)
Gender		
Male	44 (44.0)	
Female	56 (56.0)	
Race		
Malay	100 (100.0)	
Age		10.00 (4)
7-9 years old	39 (39.0%)	
10-12 years old	61 (61.0%)	
Highest education level of parents		
Primary school	22 (22.0)	
Lower secondary school	52 (52.0)	
Upper secondary school	24 (24.0)	
Other	2 (2.0)	
Number of member in household		
1-4 persons	10 (10.0)	
5-8 persons	65 (65.0)	
≥ 9 persons	25 (25.0)	
Estimated monthly household income		
RM 440 and below	2 (2.0)	
RM 441–RM 750	44 (44.0)	
RM 751–RM 999	39 (39.0)	
RM 1000–1999	15 (15.0)	
Financial support receiver		
No	79 (79.0)	
Yes	21 (21.0)	
Have you started having your period?		
*Additional question for female subjects (n=56)		
Yes	10 (17.9)	
No	46 (82.1)	

Interestingly, in this study, a majority of the subjects came from households with a high number of household members and low level of estimated monthly household income. However, most of them reported that they did not receive any financial supports. This is something interesting to be pondered upon on how they cope with little expense to sustain their daily food intake. From the economic point of view, they are a particularly vulnerable group and suffer from higher susceptibility to food insecurity.

Body mass index

As shown in Figure 1, 61.0% of the subjects possessed normal BMI. In the present study, even though the majority of subjects came from low income households and did not receive financial support, most of them still had their BMI within the normal range. One of the plausible reasons, maybe these subjects are participants of nutrition programs implemented by the Ministry of Health, such as the *Rancangan Makanan Tambahan* (RMT) which targets primary school children from low income families. The additional food provided to the poor schoolchildren through RMT helps to improve their nutritional status and overcome various problems in terms of growth and lack of energy.

A previous study by Foo *et al.* (2006) reported that 19.6% of the adolescents in a rural fishing community in Tuaran District, Sabah who were involved in that study were classified as thin and 4.5% were at risk of overweight. A similar pattern was observed in this current study, subjects with BMI below the normal range (22.0%) were more than those with BMI above normal range (17.0%). In Malaysia, even though food is produced in abundance, household food accessibility remains the main challenge in this country. As food prices have risen, the purchasing power of poor households has decreased, resulting in the poor composition of their diet and lower intake of food and energy. Study by Wong *et al.* (2014) identified that fishermen is one of the most common occupations among the fathers of malnourished children in Terengganu probably due to the low income level.

Total energy, macronutrient and selected micro-nutrient intake

It can be seen from Tables 2 and 3 that the average intake for energy, carbohydrate, and fat among the fishermen's children in this study were significantly lower than the recommended nutrient intake but not for the level of protein. Protein intake among these fishermen's children was significantly higher than the recommendation in both age groups ($p=0.000$). The findings were consistent with several previous studies among children and adolescents in fishing communities (Foo *et al.*, 2006; Hanazaki

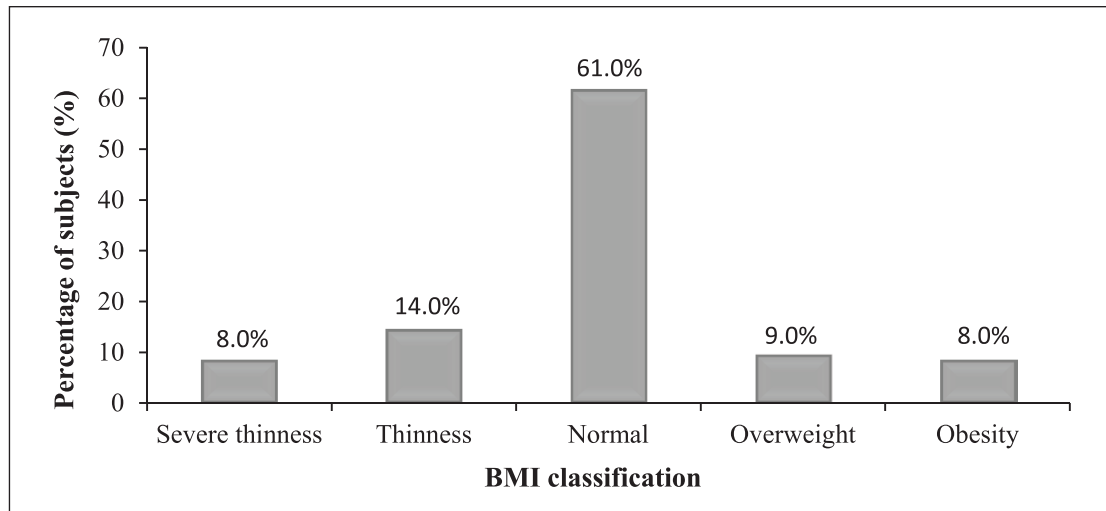


Fig. 1. Body Mass Index (BMI) classification of 100 subjects.

Table 2. Average total energy, macronutrient and selected micronutrient intake of 7-9 years old subject (n=39)

Nutrient	Boy (n=11)			Girl (n=28)		
	RNI	Average Intake	P-value	RNI	Average Intake	P-value
Energy (kcal)	1750	1260.93±377.87 ^{a*}	0.002	1610	1076.88±232.44 ^{a*}	0.000
Carbohydrate (g)	219-284	164.50±54.88 ^{a*}	0.008	201-262	146.59±40.81 ^{a*}	0.000
Protein (g)	23	53.45±13.56 ^{a*}	0.000	23	42.84±10.18 ^{a*}	0.000
Fat (g)	49-68	42.76±15.41 ^a	0.209	48-63	34.96±8.83 ^{a*}	0.000
Calcium (mg)	1000	371.31±204.04 ^{a*}	0.000	1000	278.09±103.72 ^{a*}	0.000
Iron (mg)	9	15.32±6.17 ^{a*}	0.007	9	14.36±7.30 ^{a*}	0.001
Niacin (mg NE)	12	15.82 (15.29) ^{b*}	0.006	12	17.09±8.57 ^{a*}	0.004
Vitamin C (mg)	35	66.06±41.09 ^{a*}	0.031	35	49.12±29.79 ^{a*}	0.018
Vitamin A (µg RE)	500	1303.15±615.85 ^{a*}	0.002	500	1063.68±501.83 ^{a*}	0.000

Data are presented in mean± SD or median (IQR).

^a One sample t-test was used.

^b Wilcoxon Signed-Rank test was used.

*Significantly different at p<0.05.

Table 3. Average total energy, macronutrient and selected micronutrient intake of 10-12 years old subjects (n=61)

Nutrient	Boy (n=33)			Girl (n=28)		
	RNI	Average Intake	P-value	RNI	Average Intake	P-value
Energy (kcal)	1930	1220.75±310.32 ^{a*}	0.000	1710	1259.16 (447.44) ^{b*}	0.000
Carbohydrate (g)	241-314	168.52±44.56 ^{a*}	0.000	214-278	175.44±49.95 ^{a*}	0.000
Protein (g)	30	48.76±15.00 ^{a*}	0.000	31	50.95±15.92 ^{a*}	0.000
Fat (g)	54-75	38.74±13.97 ^{a*}	0.000	48-67	41.24±15.15 ^{a*}	0.026
Calcium (mg)	1300	288.69±113.22 ^{a*}	0.000	1300	265.82 (238.06) ^{b*}	0.000
Iron (mg)	15	12.04 (10.88)	0.296	14 (nm) 33 (m)	16.95±7.82 ^a 18.53±9.00 ^{a*}	0.128 0.001
Niacin (mg NE)	16	16.24±7.89 ^a	0.864	16	15.19 (8.79) ^b	0.585
Vitamin C (mg)	65	49.00±31.63 ^{a*}	0.007	65	50.42 (42.08) ^{b*}	0.032
Vitamin A (ug RE)	600	1069.78±472.27 ^{a*}	0.000	600	906.51 (618.43) ^{b*}	0.000

Data are presented in mean± SD or median (IQR).

^a One sample t-test was used.

^b Wilcoxon Signed-Rank test was used.

*Significantly different at p<0.05.

nm: non-menstruating.

m: menstruating.

& Begossimeets, 2010; Bando & Kenu, 2017). The high level of protein intake may indicate high consumption of fish and seafood that are more accessible among the fishing community. This was further supported by the sufficient intake of niacin among the subjects, as niacin is a micronutrient that is found in abundance in fish and shellfish.

From Table 2 and 3, the average intake for calcium among the fishermen's children in this study was significantly lower than the RNI for both age groups ($p=0.000$). The result was in line with a study by Foo *et al.* (2006) which revealed a low RNI level achieved for calcium intake (33.4%) among adolescents from rural fishing communities in Sabah. The low calcium intake among the children could be also due to low consumption of milk products (Du *et al.*, 2002).

It was discovered that the iron intake of subjects aged 7-9 years old was significantly higher than the recommended nutrient intake in both boys ($p=0.007$) and girls ($p=0.001$). However, for female subjects aged 10-12 years old who have started their menstruation, their average iron intake was significantly low compared to the recommendation ($p=0.001$). The findings of the present study have been found to match with those of Poh *et al.* (2013), which observed an increased rate of iron deficiency with age among Malaysian children aged 6 months to 12 years old. Iron deficiency anaemia (IDA) is the most prevalent nutritional deficiency affecting millions of children and adolescents worldwide, particularly in developing countries (Viteri *et al.*, 2002). There is a need to provide an iron supplement for female adolescents in order to increase the body iron level, replace the loss and thus reduce the prevalence of IDA in this vulnerable group.

For the vitamin intake, the average intake for vitamin C among fishermen's children aged 7-9 years old was significantly higher when compared to recommended vitamin C intake. However, the vitamin C intake among 10-12 year old fishermen's children in this study were significantly lower than the recommendation for their age. This result was in line with that of Poh *et al.* (2013) in which the percentage of vitamin C intake was much lower than the recommended nutrient intake as the subject's age increased. Based on the dietary intake data obtained, sources of vitamin C intake among the fishermen's children included cabbage, carrots and cucumbers.

Table 2 and 3 showed that the average intakes for vitamin A among subjects in both age groups were significantly higher than the recommended vitamin A intake ($p=0.000$). This finding was in agreement with Foo *et al.* (2006) who reported high level of vitamin A intake among adolescent in a rural fishing community in Tuaran District, Sabah. The high vitamin A intake level could be due to the

year-round availability of high vitamin tuber crops, vegetables and poultry in the fishermen's village. Based on the dietary intake data collected, sources of vitamin A intake among these fishermen's children included carrots, chicken eggs, chicken, sweet potatoes and Indian Mackerel (*Ikan Kembung*).

Healthy eating index score

As shown in Table 4, the mean total HEI score for the fishermen's children in the present study was 50.45 ± 5.27 which falls into the category of poor diet quality. These findings indicate that the compliance of the fishermen's children with the dietary guidelines is generally poor.

The low median scores of the five food groups, particularly for the vegetable (0.83), fruit (0.00) and dairy (0.00) components, indicates low consumption levels of these food groups among the subjects compared to the recommended serving in Malaysia Dietary Guideline for Children and Adolescents (2014). The results seem to be consistent with those of Koo *et al.* (2016), who observed that the dietary intake of Malaysian children for six food groups, namely cereals/grains, legumes, fruits, vegetables, fish, and dairy products, fall short of the recommended levels in Malaysia Dietary Guidelines.

The possible reason of low fruit and vegetable intake among the fishermen's children could be the swift increase in fruit and vegetable prices in Malaysia over recent years (Department of Statistics, 2017). The low incomes of fishermen may limit them to purchase only essential food sources which provide energy and macronutrients, while restricting their access to other food groups such as fruits and vegetables. Other plausible factors of low fruit and vegetable consumption among children include preference, attitude, and parent intake (Rameussen *et al.*, 2006).

The low consumption of dairy products among the subjects was found to match with their significantly lower calcium intake when compared to RNI. The low accessibility of milk products among the poor might be the cause of low milk and dairy product intake among the fishermen's children. Previous study by Khor *et al.* (2015) showed that the milk consumed by children from low income households was significantly lower than those from high income households. This was further supported by Babolian Hendijani and Ab Karim (2010) who found that availability of milk products at home is the only factor that had a significant effect on intention to consume milk in the rural areas of Selangor. The rise in the price of food and non-alcoholic beverages over the past several years has denied access of low income groups to milk and dairy products and subsequently deprived poor children of the essential nutrients in milk.

From Table 4, the subjects achieved high scores for the component of total fat, saturated fat, cholesterol and sodium with 10.00(1.77), 10.00(0.00), 10.00(0.00) and 8.96(8.07), respectively. This indicates that the intakes of these nutrients among the subjects are within the recommendations and did not go beyond the requirement. However, for the last component in HEI, namely food variety, the median score was only 1.00(2.00). Study by Lin (2005) reported that the variety score in HEI among school age children from low income families is lower than those from high income families. Due to the limited financial resources, low-income families rely on a limited number of different foods to raise their children (Knol *et al.*, 2004). A low-variety diet may limit the chance of consuming different nutrients that the body needs.

Association between total HEI score and BMI among fishermen's children

As shown in Table 5, no significant association was found between total Healthy Eating Index score and Body Mass Index (BMI) among the fishermen's children ($\chi^2 = 0.051$, $p=0.821$).

It is apparent from this study that even though over 60% of subjects had normal BMI that does not indicate that they had a better diet quality. BMI is a measure of relative weight, and does not reflect the quality of diet and adequacy of nutrients. A person with normal or high BMI could be due to the high calorie intake, but this does not imply that his/her diet quality in term of diet variety and micronutrient adequacy is also better. A study by Ross and Janiszewski (2008) indicated that BMI does not necessarily reflected the healthy lifestyle and balanced diet and recommended to look beyond changes in body mass index in determining a patient's nutritional status. Several studies have been done among the paediatric population and showed no significant relationship between HEI and BMI (Angelopoulos *et al.*, 2009; Kourlaba *et al.*, 2009; Manios *et al.*, 2009). Furthermore, the lack of association between the Healthy Eating Index and Body Mass Index (BMI) may be due to the profound effect of genetics as well as physiological, lifestyle, and family factors on body mass index among the children.

Table 4. Average score of each component and total HEI score

HEI Components	Possible range of score	HEI scoring criteria		Average score
		Requirement for minimum score of 0 (serving per day)	Requirement for maximum score of 10 (serving per day)	
Grain	0-10	0	5-7	4.63 (1.96)
Vegetable	0-10	0	3	0.83 (1.67)
Fruit	0-10	0	2	0.00 (2.50)
Dairy	0-10	0	2	0.00 (0.00)
Meat	0-10	0	2.5-3.5	5.47 (3.64)
Total fat	0-10	≥ 45% energy	≤ 30% energy	10.00 (1.77)
Saturated fat	0-10	≥ 15% energy	≤ 10% energy	10.00 (0.00)
Cholesterol	0-10	≥ 450 mg	≤ 300 mg	10.00 (0.00)
Sodium	0-10	≥ 2200 mg	≤ 1200 mg	8.96 (8.07)
Food variety	0-10	≤ 3 items	≥ 8 items	1.00 (2.00)
Total HEI score	0-100	–	–	50.45±5.27

Data are presented in mean± SD or median (IQR).

Table 5. Association between total Healthy Eating Index score and BMI

Variable	Total HEI score				Pearson Chi-Square
	Poor		Need improvement		
BMI	n	%	n	%	
Not normal	22	22%	17	17%	$\chi^2 = 0.051$
Normal	33	33%	28	28%	P-value = 0.821 ^a

^a $p > 0.05$ indicated non-significant by Pearson Chi-square when 0 cells (0.0%) have expected count less than 5.

CONCLUSION

The present study provides baseline information about the diet quality and nutritional status of fishermen's children at Terengganu, East Coast of Peninsular Malaysia. The study found that a majority of the fishermen's children participated in this study have normal BMI. The mean total Healthy Eating Index score of the fishermen's children was 50.45, which falls into the category of poor diet quality. The result of Chi-square test revealed that there was no significant association between total HEI scores and BMI among the fishermen's children. Thus, BMI does not reflect the diet quality of the fishermen's children in this study. The findings of the present study indicate the need for nutrition education and intervention among this vulnerable group.

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