Original Article

Anthropometric indices and life style practices of the indigenous Orang Asli adults in Lembah Belum, Grik of Peninsular Malaysia

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A nutritional status survey of Orang Asli (Aboriginal) adults in Lembah Belum, Grik, has been conducted involving a total of 138 subjects. Jahai (58.7%) was the main ethnic group as compared to that of Temiar (41.3%). Based on the Body Mass Index (BMI) characteristics, the majority (63.2%) of the respondents were normal, 26.7% underweight and 10.1% were either overweight or obese. However, by using two different indices of waist circumference and waist-to-hip ratio, 1.6% and 10.8% of the total respondents revealed abdominal obesity, respectively. Measurement of mid upper arm muscle circumference (MUAMC) indicated that about 40% showed nutritional insufficiency whereas 0.8% showed over-nutrition. Body fat classification revealed that 53.4% of the respondents were thin, 45.8% at normal level and only 0.8% were obese. Student's t-test revealed a significant difference in anthropometric indices of body weight, height, MUAMC, triceps, biceps, MUAC, sub-scapular, supra-iliac and body fat according to gender. Meanwhile, analysis of variance showed significant differences in body weight, waist circumference, WHR and body fat according to different age categories. It was also found that those who smoked had lower BMI compared with non-smokers. Alcohol consumption was associated with higher BMI and WHR among the respondents. Pearson correlation test between anthropometric measurements and socio-economic and demographic factors showed that ethnic group was the strongest variable.

Key Words: anthropometry, Aborigines, adult, lifestyle, Malaysia

Introduction
Indigenous community increasingly find themselves in the state of nutritional transition between hunter-gatherer practices, subsistence agriculture and wider food chain. The Aboriginal people of Peninsular Malaysia, known as Orang Asli, are in this situation and require thorough documentation of their food habits, physical activity, body composition and health status on a regular basis.

Medical conditions associated with body weight status, either obesity or severe undernourishment, are becoming more common in society.[1] Nutrition is also increasingly used as an indicator of standard of living, and anthropometric measurements represent an important component of nutritional assessment. Furthermore, malnutrition in a population requires an appropriate nutrition intervention to improve health and nutritional status. Low levels of BMI have been shown to be associated with impaired physiological functions such as poor pregnancy outcomes and reduced work capacity. However, it is also an important issue for consideration that the models postulated for anthropometric indices are likely to influence the interpretation of the empirical results.[2] In addition, socio-economic

transition over the years in Malaysia has brought important implications in current nutritional status, and hence also affects strategies involved in the control of chronic diseases.[3,4,5] However, the current nutritional status of certain of the indigenous Orang Asli peoples in Malaysia is not known. Therefore, the aim of the present study was to assess the nutritional status of Orang Asli adult in the Lembah Belum region of Malaysia and to identify relationships of nutritional status with life style practices.

Materials and methods
A cross-sectional study was conducted from July to August 2002 in ten Aboriginal villages, 45 km from Grik,

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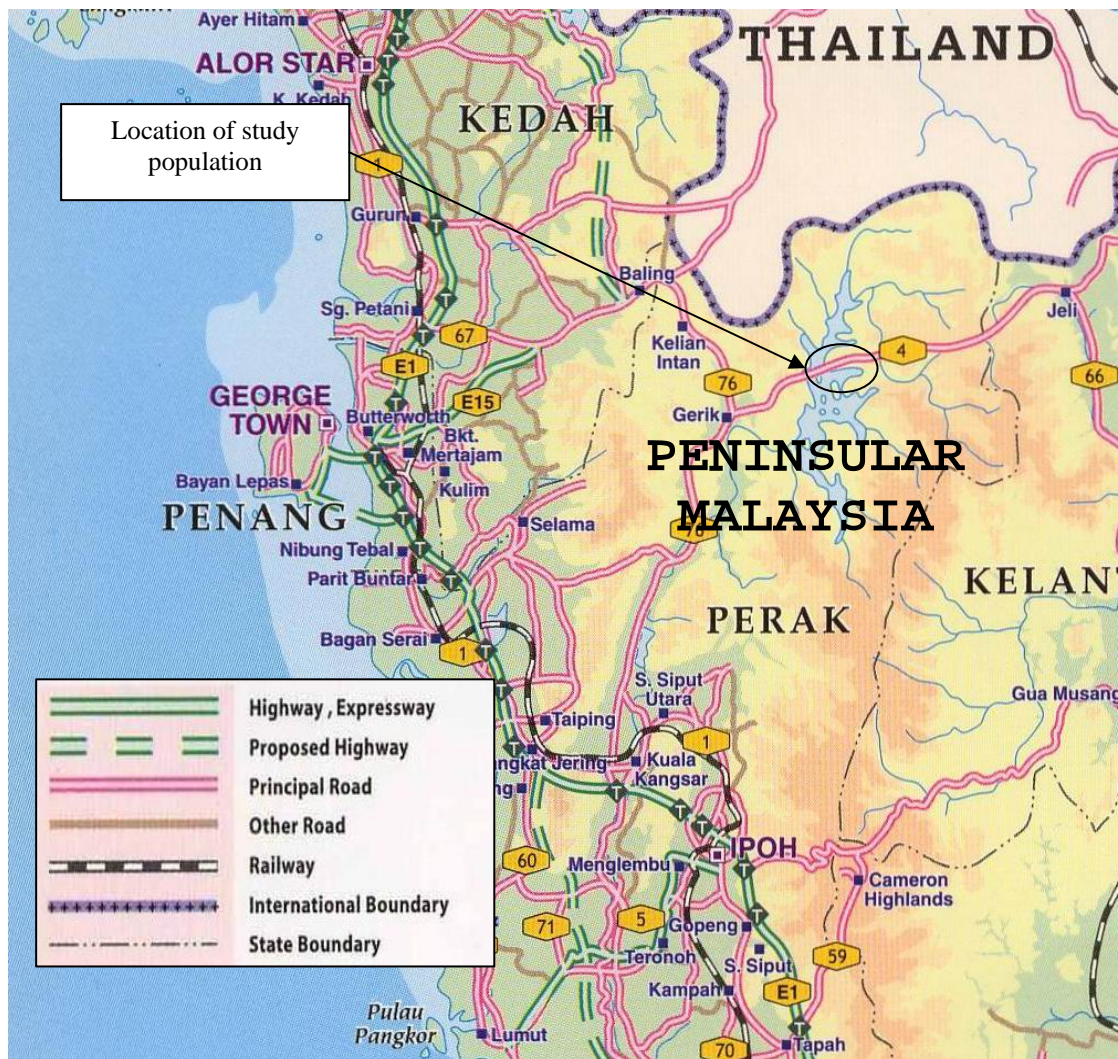Email: hayatimy@kustem.edu.my

Figure1. Location of study population in Orang Asli relocation area, Gerik

Perak. The villages are either located on hilly land (Titi-wangsa Dividing Range) accessed by log track, or islands of the Temenggor Dam, accessed by boat. Figure 1 shows the map of the location of study population.

Subjects
In 2002, there were approximately 1410 Orang Asli in Lembah Belum, which can be divided into the North and South territories. This study only covers the Southern area. Convenience sampling of adults in the age group of 16 to 70 years old was used. Most of figures for ages stated in this report were based on estimates but it can be confidently claimed that any errors in estimation would be less than 2 years between the ages of 16 and 40, and no more than 5 years over the age of 40. An attempt was made to involve all the inhabitants since their traditional lifestyle meant that some of them were absent from their villages, hunting and collecting jungle resources. They are divided into two main ethnic groups, namely Negrito and Senoi. Jahai is the largest sub-ethnic group of Neg-rito whereas Temiar belongs to the Senoi ethnic group.

All of the respondents involved in this study live in the villages which was relocated to the jungle fringe 20 years ago in order to facilitate the construction of hydroelectric Temenggor Dam. Prior to this study, the Tok Batin (the

headman of each village) was approached to get better cooperation from his people. The Department of Aboriginal Affairs was the most important party in the success of this study. This study obtained ethical approval from the Research Committee of Kolej Universiti Sains dan Teknologi Malaysia. For the respondents who are illiterate, consent form was given by using fingerprints. Assurance was given that the collected data would be used for study purposes only.

Data collection
Socio-economic, demographic profile and life style practices data were collected using a set of questionnaires. Waist, hip and mid-upper-arm circumference (MUAC) were measured by using measuring tape. Waist circumference was measured at the level of the umbilicus, subject was standing in position with abdomen relaxed, arms at the sides and feet together. The measurement of hip circumference was taken at the level of maximal gluteal protrusion, also in standing position with abdomen relaxed, arms at the sides and with feet together. MUAC was obtained with the subject in standing position, arms relaxed and without sleeves. The mid point of the left upper arm was determined by measuring the length from the tip of the shoulder to the tip of the elbow and the

length was then divided by two. Skinfold thickness obtained were biceps, triceps, sub-scapular and supra-iliac, by using a Harpenden skinfold caliper and measuring tape. From these measurements, the percentage of body fat can be calculated using empirical equations which relate fat content to body density. [6,7] Height was measured in a standing position without shoes to the nearest 0.1 cm, by using a measuring tape attached to a wall, and a ruler was used to apply to the top of the head, while weight was taken using a portable bathroom scale. BMI was then calculated using the formula of weight (kg)/height (m^2). Life style practices studied were smoking habits, alcoholic consumption patterns and frequent daily physical activity.

Statistical analysis

Student's t-test was used to compare outcomes between genders. Analysis of variance (ANOVA) was used to compare outcomes across different age categories. Pearson's and Spearman's correlation tests were used to investigate the association between anthropometric measurements and socio-economic and demographic factors. In all cases a value for $p < 0.05$ was taken to indicate statistical significance.

Results

Sociodemographic characteristics

Complete data were available for 138 adults. Age ranged from 16 to 70 years with a mean of 29.2 (SD ±12) years. The average family size was 4.9 ± 1.7, and ranged from 3 to 11 members. Among the different tribes, Jahai (58.7%) was the largest group followed by Temiar (41.3%). Over 62% of the Aborigines were illiterate, 32.6% had received primary education and only 5.1% attended secondary education. Most of the respondents (79%) were married. Table 1 shows the demographic characteristics of the respondents.

Physical activities

Half of the respondents (55.1%) reported that they were smokers; 57.9% smoking at the rate of 1-5 cigarettes/day, 17.1% at 6-10 cigarettes/day and 25% more than 10 cigarettes/day. However, only 34.8% of the respondents consumed alcoholic drinks. The most frequent daily physical activities of the male subjects were farming (78.6%) and catching fish (67.8%), whilst for females these were washing clothes and cooking (98.1%). About 73% of the respondents perceived their health as good and 14.6% were not concerned about their health status. The frequency of daily physical activity was recorded in Table 2. About 41% of the respondents reported consumption of supplemental foods, such as Tongkat Ali, cinnamon and honey. In addition 50% claimed that these supplements improved their sense of well being (i.e. perception of their energy and health).

Anthropometric measurements

Table 3 describes the anthropometric indices of the respondents. The mean weight was 48.5 ± 10.1 kg, whereas mean body weights for male and female subjects were 52.4 ± 8.9 kg and 46.0 ± 9.9 kg, respectively. Student's t-test showed a significant difference between gender (t =

3.57, $p < 0.05$). For height measurement, the mean was 152.6 ± 7.5 cm with 159.5 ± 5.4 cm and 148.2 ± 4.9 cm for male and female subjects, respectively.

The mean of BMI was 20.8 ± 4.1 kg/m^2 and no significant difference was reported between male and female respondents; 20.5 ± 2.9 kg/m^2 and 21.0 ± 4.8 kg/m^2, respectively. Using the WHO classification,[8] 26.7% of the respondents could be considered undernourished whereas 10.1% of males and females were either overweight or obese. However, when compared with the percentage of body fat,[9] 53.4% of respondents were classified as lean (body fat < 18%), 45.8% were normal (18-32%) and only 0.8% were obese (> 33%). Figure 2 represents the different results of body weight status by using BMI classification and body fat percentage.

Based on WHO criteria for waist circumference, only 0.8% (for both males and females) exhibited central obesity (>102 cm for males and > 88 cm for females). However, by using WHR interpretation, about 10.8% of the respondents (all females) showed abdominal or android obesity (WHR > 0.85). In addition, by using Gray &

Table 1. Demographic and socioeconomic characteristics of the respondents

Characteristics	Number of respondents (n=138)	Percentage (%)
Gender		
Male	49	35.5
Female	89	64.5
Ethnic		
Jahai	81	58.7
Temiar	57	41.3
Age (y)		
16.0-19.9	34	24.6
20.0-29.9	50	36.2
30.0-39.9	30	21.7
40.0-49.9	14	10.1
≥50.0	10	7.2
Range: 16.0-70.0		
Mean: 29.2 ± 12.0		
Educational level		
Not attending school	86	62.3
Primary school	45	32.6
Secondary school	7	5.1
Household size		
1-3	28	20.3
4-6	70	50.7
7-10	31	22.5
≥10	9	6.5
Range: 3-11		
Mean: 4.9 ± 1.7		
Occupational status		
Work by self	64	46.4
Work with people	4	2.9
Housewife	60	43.5
Not working	10	7.2
Marital status		
Single	26	18.8
Married	109	79.0
Widow	3	2.2

Table 2. Daily physical activity of the respondents

Activity	Everyday (%)	1-3x/wk (%)	>3x/wk (%)	Seldom (%)	Never (%)
Cooking					
Male	7.1	-	-	-	92.9
Female	98.1	-	-	-	1.9
Washing clothes					
Male	7.1	-	-	-	92.9
Female	98.1	-	-	-	1.9
Fetching water					
Male	25.0	-	-	-	75.0
Female	62.3	-	-	1.9	35.8
Farming					
Male	78.6	14.3	-	-	7.1
Female	47.2	11.3	-	7.6	33.9
Collecting jungle resources					
Male	35.7	21.4	3.6	14.3	25.0
Female	5.7	9.4	1.9	-	83.0
Fishing					
Male	67.9	10.7	-	7.1	14.3
Female	18.9	7.6	-	5.6	67.9
Hunting					
Male	10.7	17.9	-	10.7	60.7
Female	-	1.9	-	-	98.1

Table 3. Anthropometric indices of the respondents

Anthropometric measurements	Gender		Average (n=120)	t value
	Male (n=47)	Female (n=73)		
Weight (kg)	52.4 ± 8.94	46.0 ± 9.91	48.5 ± 10.00	3.57*
Height (cm)	160 ± 5.40	148 ± 4.91	153 ± 7.54	11.9*
BMI (kg/m^2)	20.5 ± 2.90	21.0 ± 4.77	20.8 ± 4.13	-0.61
Waist circumference (cm)	72.5 ± 8.26	70.2 ± 6.86	71.1 ± 7.50	1.69
Hip circumference (cm)	88.3 ± 5.83	88.4 ± 6.81	88.4 ± 6.42	-0.09
MUAC (cm)	27.3 ± 3.01	24.9 ± 3.32	25.8 ± 3.41	4.11*
•MUAMC (cm)	24.7 ± 2.46	20.6 ± 2.89	22.2 ± 3.38	8.00*
Biceps (mm)	8.27 ± 5.04	13.1 ± 7.14	11.2 ± 6.80	-4.00*
Triceps (mm)	8.31 ± 3.89	13.5 ± 5.19	11.5 ± 5.35	-5.88*
Subscapular (mm)	11.2 ± 4.19	14.5 ± 6.47	13.2 ± 5.89	-3.09*
Suprailiac (mm)	8.63 ± 3.13	11.4 ± 5.42	10.3 ± 4.84	-3.20*
Body fat (%)[+]	15.9 ± 5.78	19.8 ± 5.77	18.3 ± 6.06	-3.62*
Fat mass (kg)	8.64 ± 4.60	9.29 ± 3.78	9.03 ± 4.13	-0.84
Fat-free mass (kg)	43.7 ± 5.61	36.7 ± 7.45	39.5 ± 7.59	5.53*

* - Significantly different between gender, $p< 0.05$; •- MUAMC = MUAC- (3.14 x triceps); Body fat (%)[+] = {4.95/D – 4.50} x 100%; D = c-m x long skinfold (Durnin & Womersley 1974); Fat mass (kg) = {body weight (kg) x % body fat}/100; Fat-free mass (kg) = body weight (kg) – body fat (kg); Data are mean ± SD

Gray's standard (1979),[10] where MUAMC below 10th percentile is classified as severe malnutrition, 24.2% of the respondents were categorized as having severe malnutrition, 15.9% moderate malnutrition, 59.1% being satisfactory and 0.8% displaying over-nutrition (Table 3).

In all subjects, the t-test showed that the only significant difference between smokers and non-smokers was in the body fat percentage. Nonetheless, smoking subjects had lower mean BMI (20.3 ± 3.8 kg/m2) compared with the non-smokers (21.5 ± 4.5 kg/m^2). The mean value of WHR among smokers was slightly higher compared with the non-smokers group: 0.81 and 0.79, respectively.
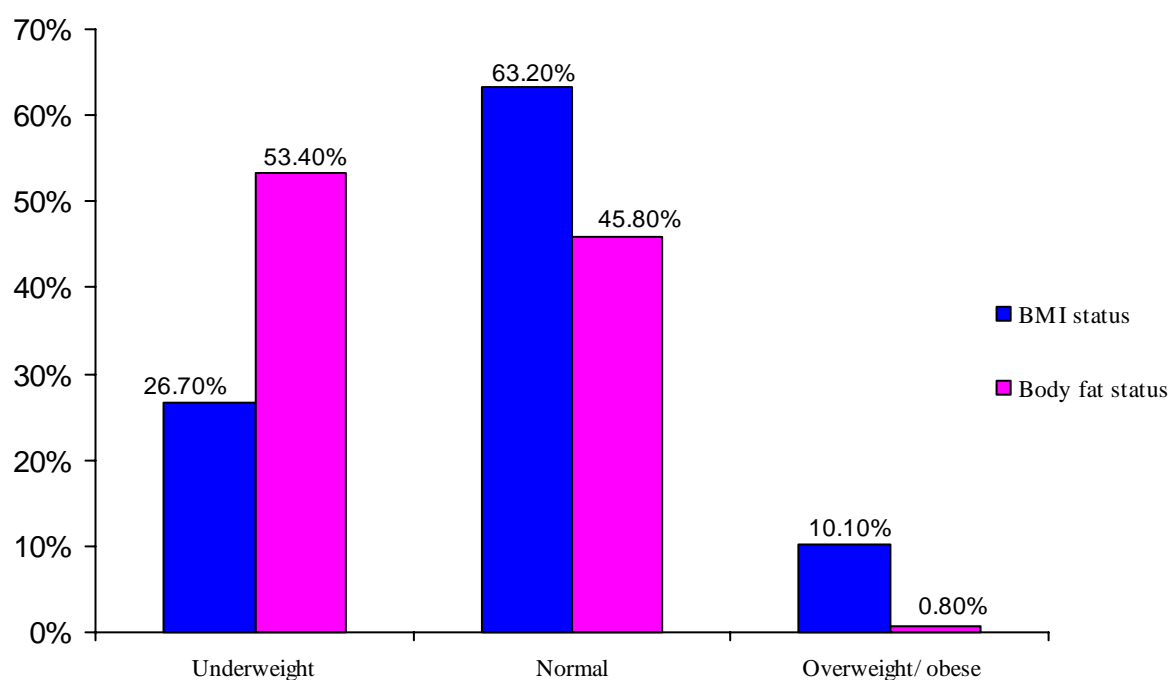
Figure 2. Body weight status using BMI classification and body fat percentage

BMI classification: underweight <18.5kg/m², normal 18.5-24.9 kg/m², overweight/obese >25 kg/m². For body fat classification: underweight= 10-15% (M), 20-25% (F); normal = 15-20% (M), 25-30% (F); overweight/obese = >20% (M), >30% (F). M = male, F = female

However, respondents who consumed alcoholic drinks had higher mean values for BMI and WHR and their body fat percentage was slightly higher but not significant. Spearman correlation revealed that age was positively correlated with BMI (r = 0.19, p<0.05), waist circumference (r = 0.34, p< 0.001), supra-iliac (r = 0.27, p<0.01) and body fat percentage (r = 0.43, p< 0.01). Therefore, these variables appeared to increase with age.

Discussion

Anthropometric measurements are widely used as a tool for assessing nutritional status. These measurements are easily performed with appropriate training, do not require sophisticated equipment, can be performed in field settings and are inexpensive, yet still play an important role in clinical practice. Body mass index (BMI) is often used to reflect total body fat, while the waist circumference and WHR are used as surrogates for body fat centralization. Therefore, our study was able to compare the two different criteria for the classification of body status, which were BMI and body fat content.

This study found a higher percentage of smokers among the Orang Asli adults of Lembah Belum (50%) compared with a previous study in Orang Asli people living in Kuala Pongsoon[11] where it was reported to be only 33%. However, Sua (1992)[12] reported that smoking is common among males and in the elderly in Orang Asli living in Pahang. Alcohol consumption is traditionally practiced during special ceremonies and after the harvesting season.[11] In terms of physical activity, most time was spent engaged in manual agricultural work and collecting jungle resources for survival. Therefore, these activities are the main daily physical activities for males, whereas females are involved in routine family responsibilities

such as cooking and washing clothes. In addition, females also help their family in farming (47.2%) but hunting is usually performed by males as a headman of the family. The results show the same pattern as reported by Chong (2000).[13]

This study demonstrated that mean body weights in both genders were lower compared with the general Malaysian population (55 kg for males and 50 kg for females) as reported by Teoh (1975).[14] Aboriginal people are lighter as compared to the Malaysian population in general, whereby their mean body weight were 52 kg and 46 kg for males and females, respectively. These results were also consistent with general knowledge that men, in comparison with women, had higher mean body weight.

Using a cut-off point of <18.5 kg/m² as the criterion for chronic energy deficiency,[15] 26.7% of the respondents were found to suffer from various degrees of this. Some of the reasons for underweight among tribal people could be poor dietary intake, poor education, early marriage and high morbidity caused by unhygienic practices, environmental and economic factors.[16] Undernutrition of adults, with special regard to mothers, may be carried over to their children. Hence, there is a need to pay special attention to this isolated group to improve their overall nutritional status.

The relationship between BMI and age within this Orang Asli population is similar to that observed in most studies in this field.[17,18] From this study, there was a significant difference in body weight status determined according to BMI or to body fat classification. Undernutrition was reported to be much higher when body fat percentage was used as the criterion (53.4%) than when BMI was used (26.7%). However, BMI show a higher prevalence of normal and overweight/obese subjects than body

fat percentage. BMI is unable to differentiate between body fat and fat-free mass.[19] Thus, the reason for the difference in the percentage of overweight/obese subjects determined using different criteria may be that the study population has a high lean body mass relative to their height. This might be due to a high level of physical activity. It was reported that individuals with the same BMI can be significantly different at 10-30% of body mass due to different bone composition and fat-free mass.[20]

It was found that height significantly decreased with age (F = 4.56, $p < 0.05$). Shuran & Nelson (1986)[21] and WHO (1995)[8] documented that individual height will decrease with age. Moreover, contrary to height, however, it is well known that means of waist circumference and fat percentage increase with age.

In terms of skinfold thickness, all the four indices of biceps, triceps, sub-scapular and supra-iliac were higher in females than males with significant differences between the genders for triceps (t = -5.58, $p < 0.05$), biceps (t = -4.00, $p < 0.001$), sub-scapular (t = -3.09, $p < 0.05$), supra-iliac (t = 3.20, $P < 0.05$), MUAC (t = 4.11, $p < 0.005$) and MUAMC (t = 8.00, $p < 0.001$). Skinfold thickness is shown to be accurate for subcutaneous fat determination. Thus, these findings were also consistent with the idea that females accumulate fat subcutaneously whereas males do not [15,16], whereas age factor specifically determined the linear correlation with BMI, waist circumference, supra-iliac and body fat percentage.

An insufficient food supply can contribute to poor dietary intake, besides food taboos and also bad attitudes.[22] High incidence of smoking, low educational rate and a physically active lifestyle were found to associate with BMI < 18.5 kg/m^2. A previous study[23] showed a significant relationship between BMI and smoking, education and physical activity.

In conclusion, the relationship between under-nutrition and socio-demographic factors is well understood in determining the nutritional status of Aboriginal adults. However, in the current study no consistent association was found between different anthropometric indices and body fat status. Therefore, an extensive study should be carried out using a greater number of subjects. It was noted that a high prevalence of chronic energy deficiency occurred in this isolated community, although BMI suggested some overweight/obese villagers. While it may be too early for dynamic transitional processes to substantially alter nutritional status indictors, it is nonetheless important to document the current prevalence of overweight and obesity among the Aboriginal adults in Lembah Belum, Grik, Malaysia.

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馬來西亞半島 Grik，Lembah Belum, Orang Asli 原住民成年人體位測量指數及生活型態的實行

一個營養狀況調查在 Grik，Lembah Belum 的 Orang Asli(原住民)成年人執行，共調查 138 名研究對象。與 Temiar(41.3%)相比，Jahai(58.7%)為主要的氏族。根據 BMI 的特質，大多數的回應者為正常體位(63.2%)、26.7%過輕及 10.1%過重或肥胖。然而，使用腰圍及腰臀圍比兩種不同的指數，分別有 1.6%及 10.8%的回應者有腹部肥胖的情形。上臂肌肉圍 (MUAMC) 測量指出約有 40%顯示出營養不足，反之有 0.8%顯示營養過剩。體脂肪分組顯示出有 53.4%的回應者過瘦、45.8%正常，只有 0.8%的人是肥胖。Student's t 檢定顯示男女性在體重、身高、MUAMC、三頭肌、二頭肌、MUAC、肩胛下、腸骨上及體脂肪的體位測量指數分佈均有顯著差異。同時，變異數分析顯示在不同年齡組別的體重、腰圍、WHR 及體脂肪有顯著差異。而抽菸者比起非抽菸者有較低的 BMI。在回應者間，酒精攝取量與較高的 BMI 及 WHR 相關。以皮爾遜積差相關檢定體位測量及社經及人口學因子，指出氏族是最強的變項。

關鍵字：體位測量、原住民、成年人、生活型態、馬來西亞。