NUTRITIONAL STATUS OF THE MALAYSIAN ARMED FORCES

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ABSTRACT

Findings from four major studies on the Malaysian Armed Forces are reviewed: a comprehensive study by the Inter-departmental Committee on Nutrition for National Defence (ICNND) in the early 1960s; a study by this Institute (IMR) in the early 1980s; the 1973 anthropometric survey by the Pusat Sains & Teknologi Pertahanan (PSTP); and a study of the nutritional quality of the Normal Armed Forces Ration Scale (NAFRS). This review re-examines these data, re-organises them for presentation, and highlights some important aspects. Various types of data are considered, including anthropometric, biochemical and dietary. Although data from the different studies are not strictly comparable due to various basic differences, certain general observations may be made.

Nutritional status of the Malaysian Armed Forces appear to have improved over the years. This is evident from anthropometric measurements, as well as various biochemical parameters, particularly with regards to vitamin status. At the same time, nutritional status of these personnel may be said to be better off than the general population, particularly the rural communities. Nevertheless, marginal vitamin deficiencies do exist. There are also indications that the problems of obesity and hyperlipidemia may be increasing amongst members of the Armed Forces.

Although not as comprehensive as it is hoped to be, these data, covering various aspects of the nutritional status of the Malaysian Armed Forces and spanning over two decades, do provide some valuable information. They have given a clearer understanding of the situation, thereby providing some pointers for future attention and emphasis.

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INTRODUCTION

A review of the literature (Tee, 1979; 1984) shows that four major studies on the Malaysian armed forces have been carried out. Two comprehensive studies, employing a variety of techniques, including clinical examinations, anthropometric measurements, biochemical determinations and dietary studies, have been documented. The first is the relatively large scale study by the Interdepartmental Committee on Nutrition for National Defense (ICNND, 1964) in the early 1960s. The second is the more recent, and relatively small scale study by this Institute (IMR) in the early 1980s (Chong et al., 1982). The other two studies were conducted by the Pusat Sains & Teknologi Pertahanan (PSTP) - formerly known as the Defence Research Centre of the Ministry of Defence Malaysia. In 1973, a large scale anthropometric survey was conducted (Khoo et al., 1976), and in 1977, the nutritional quality of the Normal Armed Forces Ration Scale (NAFRS) was examined (Quah, 1977).

This review is based essentially on these four data set. Although not as comprehensive as it is hoped to be, these data, covering various aspects of the nutritional status of the Malaysian armed forces and spanning over two decades, do provide some valuable information. This review re-examines these data, re-organises them for presentation, and highlights some important aspects. It is hoped that a clearer understanding of the nutritional status will emerge, thereby providing some pointers for future attention and emphasis.

NUTRITIONAL STUDIES OF THE MALAYSIAN ARMED FORCES

The ICNND (1964) study was carried out in the then Federation of Malaya between September to October 1962. A total of 1268 military personnel were examined at eight different locations. An abbreviated clinical examination was carried out on the men, and this included obtaining various anthropometric measurements (weight, height, arm skinfold thickness, scapula skinfold thickness). A sub-sample of about 120 subjects was examined for various biochemical parameters. Blood samples were determined for haemoglobin, plasma protein, albumin and globulin values, vitamin A and carotene levels, ascorbic acid, and serum lipids. Urine samples were determined for excretion of thiamine, riboflavin and iodine.

Dietary surveys were conducted at six separate army units. Study was by both the recipe method (calculation of nutrient content based on recipes of foods prepared) and the chemical analysis of composite samples. Information was also gathered on food preparation, messing practices, dietary patterns and mess hall facilities.

In a more recent study carried out by the IMR (Chong et al., 1982), 158 soldiers, drawn from 4 different barracks, were studied. The study emphasized on biochemical assessment of the nutritional status. Protein status of the subjects was examined via serum protein and albumin and globulin fractions. Iron status was studied by determination of haemoglobin (Hb), microhaematocrit, serum iron and iron binding capacity. Nutriture of various vitamins was studied, including vitamin A, thiamine (using transketolase activity and urinary excretion of the vitamin), and riboflavin (urinary excretion). Serum lipid parameters studied were cholesterol, triglycerides, betalipoproteins and high density lipoprotein cholesterol.

Weight and height measurements of the soldiers were also taken. Cooked rations from two of these camps were collected and analysed for nutrient composition in the laboratory.

In 1973, the PSTP of the Ministry of Defence Malaysia conducted a large scale anthropometric survey among 6020 male members of the Armed Forces (Khoo et al., 1976). A total of 56 measurements were taken in this exercise, aimed primarily at obtaining body measurements for application to various practical problems such as in the designing of clothing, equipment, machines and weapons. However, some of the data collected, especially weight and height, would be useful in providing a picture of the nutritional status of the subjects. Analyses of this data for this purpose has been presented by Quah (1977).

Another study by the PSTP was carried out to examine the nutritional quality of the Normal Armed Forces Ration Scale (NAFRS) (Quah, 1977). Nutrient composition of the 1961-64 and 1967-77 scales was computed using a food composition table and compared.

Selected results from these four major studies are summarised below. Although not strictly comparable due to various differences, e.g. in methodologies and subject characteristics, the findings are tabulated for general comparison. The ICNND study, carried out in the 1960s, the anthropometric survey of 1973, and the IMR study of the 1980s gives an indication of the nutritional status of the armed forces over two decades.

A study of Malay rural villages carried out by the IMR (Chong et al., 1984) is also included for discussion. Since the study covered the general population, only those data pertaining to male adults within the age group 18-50 years are included, so as to be more comparable to the armed forces personnel studied.

ANTHROPOMETRIC MEASUREMENTS

Mean weight and height data for the three data set for the armed forces (ICNND, 1964; Khoo et al., 1976; and Chong et al., 1982) (Table I) do not show much differences. Although mean weight and body mass index (BMI) appear to be slightly higher for the 1982 study, it is to be noted that mean age of the group is also higher than the others. On the other hand, mean weight of the civilian rural group is lower than that of the armed forces from all three studies. So is the mean height of the rural group. Thus, BMI for this group is also lower, with a higher prevalence of underweight.

The ICNND (1964) report had noted that there was an upward trend in body weight of older men (Figure 1). There is an increase in the proportion of overweight men (% standard weight by age >110) with increasing age (Figure 2). Quah (1977) had shown that data from the 1973 anthropometric survey (Khoo et al., 1976) showed a similar upward trend (Figure 1). Although a different index of obesity (BMI >23.5) was used in the later study, Figure 3 also clearly shows that in the higher age groups, the proportion of overweight men increased.

Figure 1 also shows that for most age groups, the men in the 1973 study were heavier than those studied a decade earlier in the ICNND (1964) study. The study carried out in the 1980s (Chong et al., 1982), although on a much smaller sample size, shows a slight further increase in weight for most age groups. Therefore, there appears to be a general increase in weight of the personnel over the years.

A concern would of course be the increasing prevalence of obesity among the armed forces. In the ICNND (1964) study, 6.9% of the subjects were considered overweight, using per cent standard by age greater than 110 as the cut-off (Table I). In the other two studies, BMI was used. In the 1973 survey, 22.2% were considered overweight, whereas the 1982 study reported a prevalence of 11% (Table I). The prevalence rate in the former study may be lower since the cut-off used, BMI > 23.5, is probably too high.

IRON AND PROTEIN STATUS

Mean haemoglobin (Hb) concentration and the other haematological parameters (PCV and MCHC) of the two data set for the armed forces appear similar (Table II). Prevalence of anaemia, as defined by a low Hb concentration and PCV was almost nil. However, based on serum iron and transferrin saturation level, some 15% of the men in the 1982 study were found to be of poor iron nutriture. All the mean values of parameters listed in Table II for the rural community were slightly lower than those for the armed forces.

With regards to protein status of men in the two studies of the armed forces (ICNND, 1964 and Chong et al., 1982), serum total protein appear similar. However, albumin status of the latter study was slightly better than the ICNND study, and the rural group reported as well (Table III).

VITAMIN STATUS

Vitamin A status of the army personnel in the IMR report appears to be slightly better than that of the ICNND study, with a slightly higher mean level of the vitamin in the serum and a lower prevalence of hypovitaminosis A (serum vitamin A < 20 ug/dl) (Table IV). Nevertheless, the armed forces in both studies have a lower prevalence of low serum vitamin A level than the rural community.

The other vitamins that have been considered are thamine (vitamin B1) and riboflavin (vitamin B2). Some 30% of the army personnel in the more recent study of IMR may be said to be deficient in thiamine, based on a TPP effect of > 25%, and a urinary thiamine excretion of < 66 ug/g creatinine (Table V).

Thiamine status of this group is thus seen to be better than the earlier study of ICNND, where urinary thamine excretion was found to be low in 64% of the subjects. In contrast to other nutrients thus far discussed, the status of the vitamin in the rural group is seen to be better than that of the armed forces.

Based on urinary riboflavin excretion, subjects in the ICNND study are seen to be poorer in the status for this vitamin compared with the IMR study. This is true both in terms of median level of thiamine excretion, as well as prevalence of subjects with low urinary excretion (Table V).

SERUM LIPIDS

Due to the growing interest in the relationship between blood lipid levels, particularly cholesterol, and coronary heart disease, these have been determined in both studies of the armed forces (ICNND, 1964 and Chong et al., 1982). Mean serum cholesterol levels for the two groups of armed forces studied are higher than that for the rural community (Table VI). They are however lower than the group of urban executives also included in the table. The prevalence of hypercholesterolemia among the armed forces was also considerably lower than that for the urban group.

DIETARY ASPECTS

Intake of nutrients from the ICNND (1964) study by the recipe method have been extracted for discussion. This method of determination was found to be in general agreement with results obtained by the food composite analysis method. This is especially so for calories, calcium, iron, thiamine, and riboflavin. The largest difference was obtained for vitamin A and C, wherein the recipe method gave considerably higher results.

In considering adequacy of the various nutrients in the ICNND study, it was found that daily intake of most of the nutrients were within the "acceptable" levels (Table VII). Only thiamine and riboflavin were found to be below their respective acceptable levels. Thus, dietary findings indicate a satisfactory intake of most nutrients, except for the two B vitamins.

Intake of these nutrients are also compared with parallel figures extracted from the FAO (1980) food balance sheet (FBS) for 1961-65 (Table VII). For most of the nutrients tabulated, the daily intake from the ICNND study are considerably higher than availability figures from FBS. Exceptions are seen for iron and the B vitamins, thiamine, riboflavin and niacin, where differences are marginal.

Proportion of these nutrients from animal sources have also been calculated from the ICNND report and FBS, and given in Table VII (within parentheses). Percentage contribution of these nutrients from animal sources such as meat, eggs, fish and milk, is also higher in the ICNND data for all nutrients, except for fat, thiamine and ascorbic acid. The importance of this is due to the better absorption and utilization of nutrients from animal foods.

Dietary protein and fat energy contents of the ICNND data were also compared with those of the FBS figures. Dietary protein energy was calculated to be

10% of the total energy for the former data, while from the FBS data, the figure was 8%. Percentage of fat energy of the ICNND data, at 29%, was almost twice that of the FBS data (15%).

It is thus seen that the diet of the armed forces was generally considerably better than the average figures given by the FBS for Malaysians.

Another dietary aspect that will be considered is the armed forces ration scales. In the 1977 PSTP examination of the adequacy of the Normal Armed Forces Scale (NAFRC), nutrient content of the 1961-64 scale was compared with those in the 1967-77 scale (Table VIII). The study pointed out the slight increase in energy level in the latter scale, as well as the niacin and riboflavin content. At the same time, the latter scale also has a lower level of thiamine, calcium and vitamin C. Based on various considerations, including findings from the ICNND study, a new NAFRC was proposed (Table VIII). The major changes over the 1967-77 ration scale are a slight decrease in calorie, iron, vitamins A and C and a higher content of thiamine and niacin in the new scale.

CONCLUDING REMARKS

For obvious reasons, strict comparison between the data set presented would not be valid. However, certain general observations may be made between the nutritional status of the army personnel examined by ICNND and those in the more recent studies by the PSTP and the IMR. There also appear to be differences between the nutritional status of the armed forces and that of the general population, particularly the rural communities.

Nutritional status of the Malaysian armed forces appear to have improved over the years. This is evident from anthropometric measurements, as well as various biochemical parameters, particularly with regards to vitamin status. At the same time, nutritional status of these personnel may be said to be better off than the general population, particularly the rural communities. There are indications that the problems of obesity and hyperlipidemia, already known to be affecting more and more Malaysians, particularly the urban executives, may be increasing amongst members of the armed forces.

Findings from these studies have shown that several aspects of the nutritional status of the Malaysian armed forces may be considered important for particular attention in the future. There is a need to keep track of the marginal vitamin deficiencies that appear to be prevalent among the armed forces. On the other hand, there is also a need to monitor the prevalence of obesity and hyperlipidemia.

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Table 1. Weight, height and Body Mass Index (mean ± S.D.)

	ICNND, 1964 (n = 1268)	Khoo et al., 1976 (n = 6012)	Chong et al., 1982 (n = 158)	Chong et al., 1984* (n = 522)
Age (years)	25.8	N.A.	28.6 ± 5.3	N.A.
Weight (kg)	57.9	58.6 ± 7.9	60.5 ± 7.7	52.4
Height (cm)	162.9	164.3 ± 3.1	165.0 ± 4.9	159.8
Body Mass Index (kg/m^2)	21.8	21.7	22.2	20.4
% > 25.0	N.A.	N.A.	11	5
% < 20.0	N.A.	N.A.	15	45
% > 23.5	N.A.	22.2	N.A.	N.A
% Standard weight by age				
% > 110	6.9	N.A.	N.A.	N.A

N.A. = not available
* only included men, 18 - 45.9 years

Table II. Iron status

	ICCND, 1964	Chong et al., 1982	Chong et al., 1984*
Haemoglobin			
Mean ± S.D. (g/dl)	15.7 ± 1.6	15.8 ± 1.1	15.3 ± 1.8
% < 12.0 g/dl	0.8	0	7
n	125	158	210
Packed cell volume			
Mean ± S.D. (per cent)	45 ± 3.2	48 ± 2.6	not done
% < 36 per cent	0	0	
n	122	158	
Mean corpuscular haemoglobin concentration			
Mean ± S.A. (per cent)	35 ± 2.8	33	not done
% < 28 per cent	1.6	N.A.	
n	122	158	
Serum iron			
Mean ± S.D. (ug/dl)	not done	88 ± 30	76 ± 31
% < 60 ug/dl		16	N.A.
n		156	138
Transferrin saturation			
Mean ± S.D. (per cent)	not done	30 ± 10.6	29 ± 11
% < 20 percent		15	9
n		156	138

N.A. = not available
* only included men, 18 - 45.9 years

Table III. Protein status

	ICNND, 1964	Chong et al., 1982	Chong et al., 1984*
Serum protein			
Mean ± S.D. (g/dl)	7.3 ± 0.55	7.5 ± 0.38	not done
% < 6.0 g/dl	0	0	
n	123	158	
Albumin			
Mean ± S.D. (g/dl)	4.0 ± 0.44	4.8 ± 0.38	4.3 ± 0.40
% < 3.5 g/dl	8.9	0	3
n	123	158	294

*only included men, 18-45.9 years

Table IV. Vitamin A and C status

	ICNND, 1964	Chong et al., 1982	Chong et al., 1984*
Serum vitamin A			
Mean ± S.D. (ug/dl)	45 ± 13	53 ± 14	46 ± 19
% < 20 ug/dl	3.3	0.6	7
n	120	158	152
Serum carotene			
Mean ± S.D. (ug/dl)	97 ± 33	not done	not done
% < 40 ug/dl	0		
n	121		
Serum ascorbic acid			
Mean ± S.D. (mg/dl)	0.42 ± 0.22	not done	not done
% < 0.2 mg/dl	12.8		
n	117		

*only included men, 18-45.9 years

Table V. Thiamine and riboflavin status

	ICNND, 1964	Chong et al., 1982	Chong et al., 1984*
Thiamine status			
RBC transketolase activity			
Mean ± S.D. (IU/dl)	not done	57 ± 13	not done
n		158	
TPP effect			
Mean ± S.D. (%)	not done	19 ± 20	not done
% > 25 % TPP effect		29	
n		158	
Urinary thiamine			
Median (ug/g creatinine)	52	70	142
% < 66 ug/g creatinine	64	30	20
n	106	158	107
Riboflavin status			
Urinary riboflavin			
Median (ug/g creatinine)	32	77	not done
% < 80 ug/g creatinine	83	51	
n	118	158	

* only included men, 18-45.9 years

Table VI. Serum lipids

	ICNND, 1964	Chong et al., 1982	Chong et al., 1984*	Chong, 1986
Cholesterol				
Mean ± S.D. (mg/dl)	180 ± 44	199 ± 40	175 ± 38	231 ± 45
% > 260 mg/dl	N.A.	6	3	24
n	121	158	246	251
Triglyceride (non-fasting)				
Mean ± S.D. (mg/dl)	not done	168 ± 80	141 ± 71	N.A
n		158	246	
HDL-Cholesterol				
Mean ± S.D. (mg/dl)	not done	45 ± 11	not done	N.A.
n		158		
B-Lipoprotein				
Mean ± S.D. (mg/dl)	not done	523 ± 234	not done	N.A.
n		158		

* only included men, 18-45.9 years

Table VII. Adequacy of daily nutrient intake (ICNND, 1964)

	ICNND Recipe Method*	ICNND "acceptable" levels	FBS** 1961-1965
Calories, Kcal	3,041 (17)+	2,800 - 3,000	2,352 (10)+
Protein, g	79 (48)	60 - 90	48.2 (30)
Fat, g	99 (38)	-	41.2 (40)
Calcium, mg	476 (53)	400 - 600	277 (40)
Iron, mg	19 (31)	9 - 12	13 (17)
Vitamin A, ug	2,033 (68)	1,050 - 1,500	453 (25)
Thiamine, mg	0.78 (20)	1.0 - 1.5	0.83 (18)
Riboflavin, mg	1.08 (66)	1.2 - 1.5	0.65 (40)
Niacin, mg	11.5 (38)	10 - 15	13.1 (24)
Vitamin C, mg	76 (2)	30 - 50	52 (0)

* Average of 6 locations, 840 men/2 days (includes corrections for cooking losses)
** FBS = Food Balance Sheet, extracted from FAO (1980)
* Percent from animal sources within parentheses

Table VIII. Nutrient level in various army ration scales

	1961-64 ration scale	1967-77 ration scale	Proposed new NAFRS
Calories, Kcal	3,992	4,096	3,900
Protein, g	99.8	98.7	98
Fat, g	123	138	-
Calcium, mg	733	645	650
Iron, mg	29.8	29.1	20
Vitamin A, ug	1,646	1,648	950
Thiamine, mg	1.24	1.06	2.5
Riboflavin, mg	2.22	2.25	2.3
Niacin, mg	18.0	18.9	29.5
Ascorbic acid, mg	171	161	90

Source: Quah, 1977

Figure 1
Weight by Age of Military Personnel, Malaysia

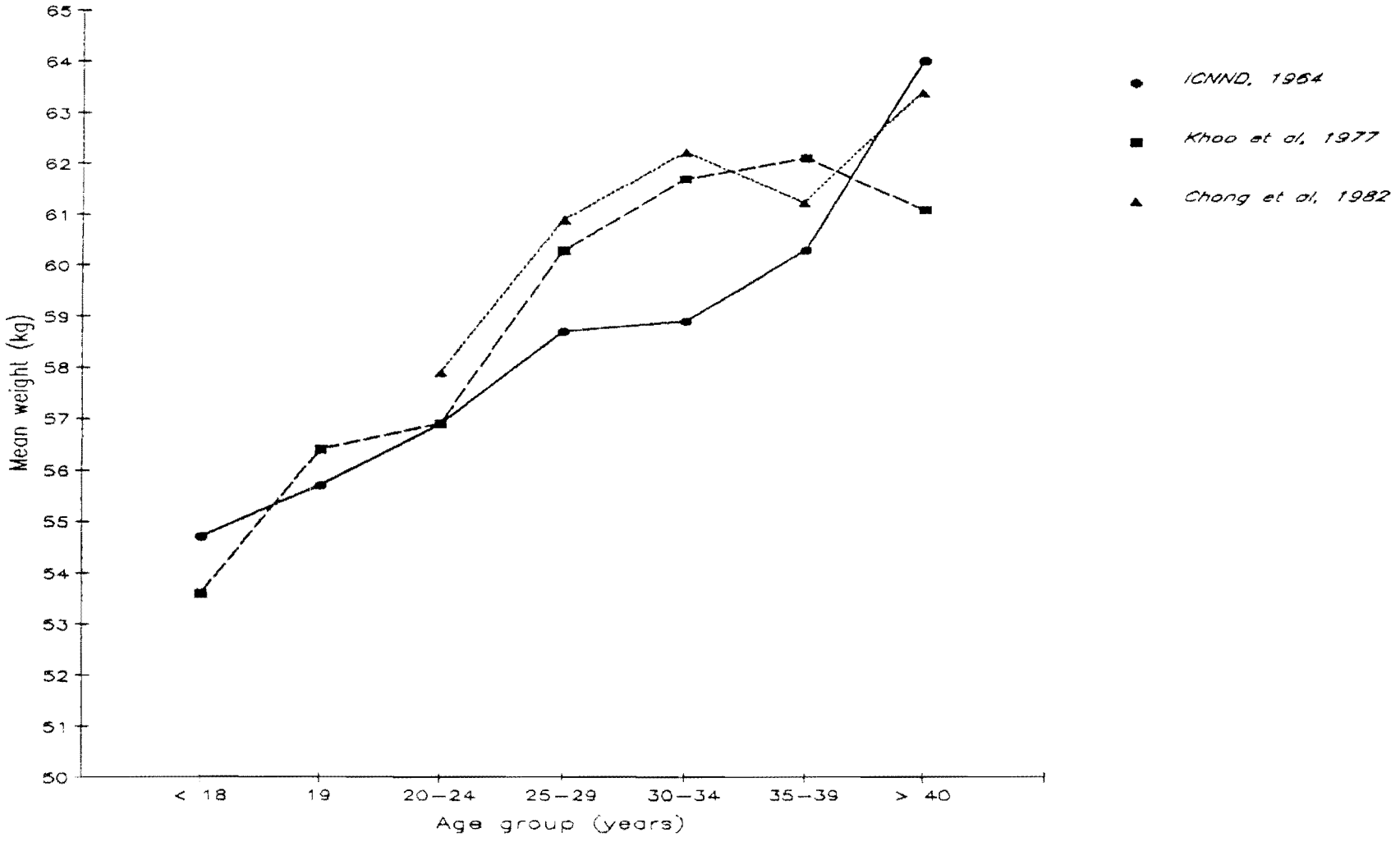
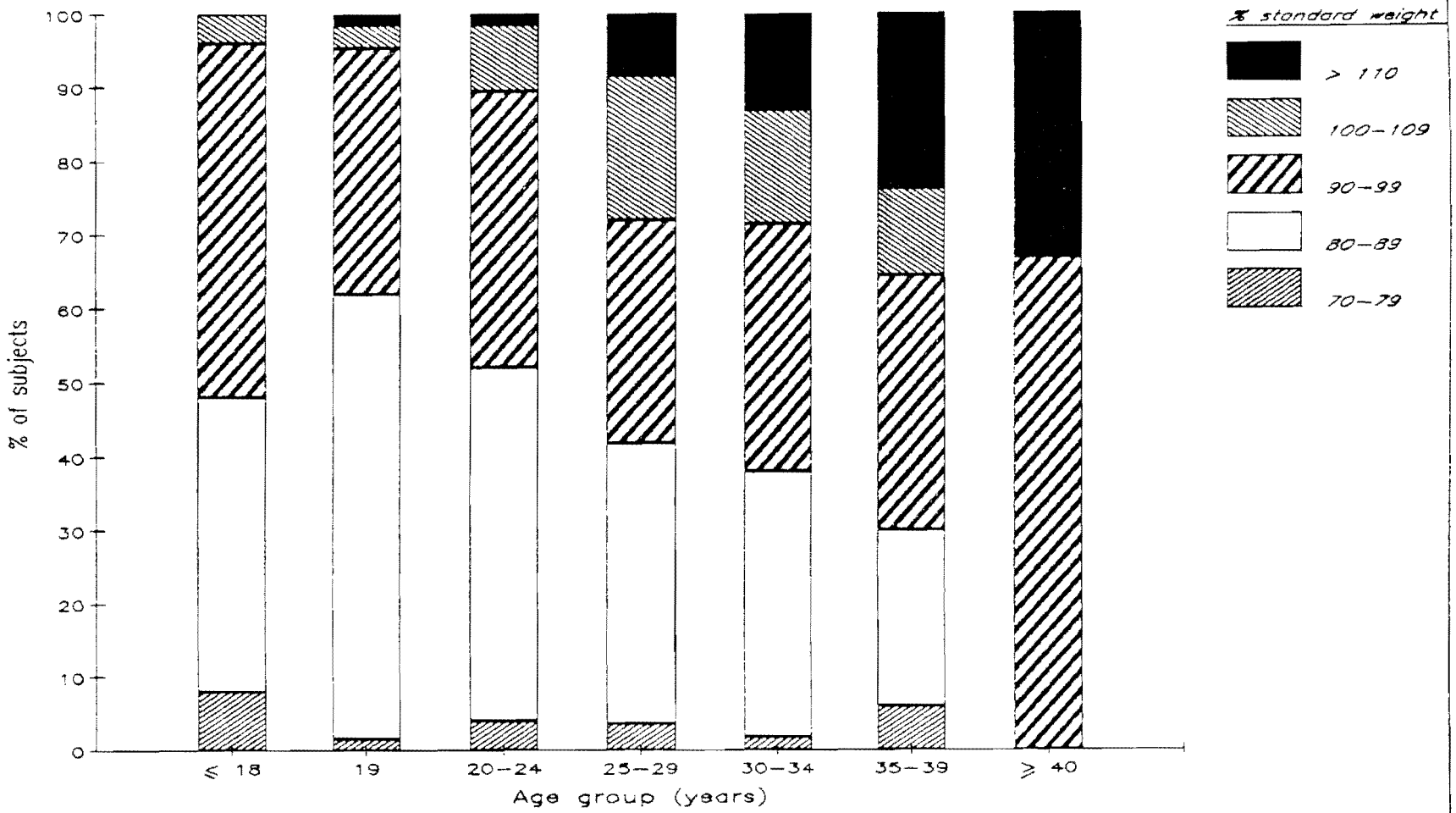
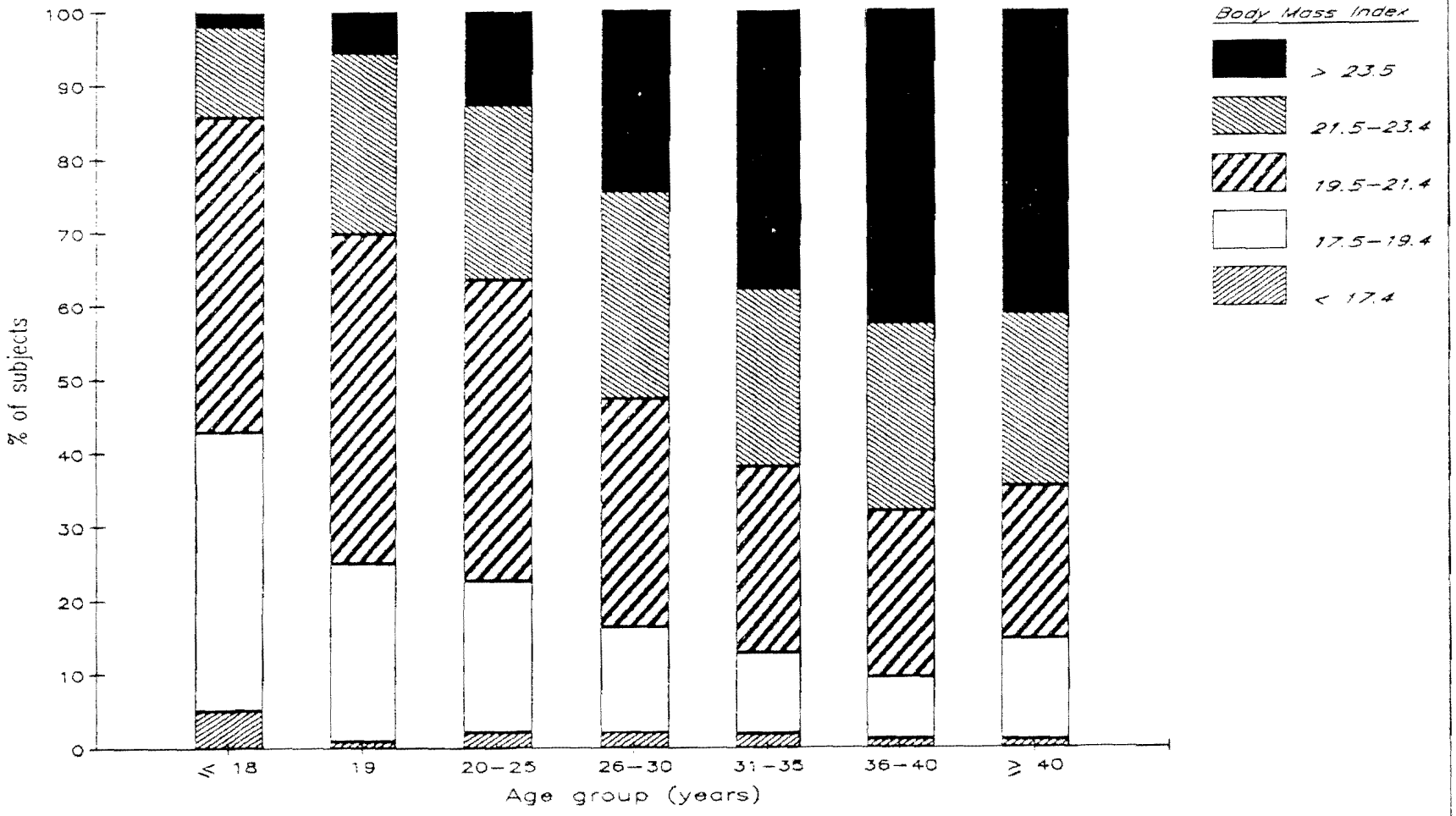


Figure 2
Distribution of percent "Standard Weight by Age" according to age groups
(ICNND, 1964; n = 1268)



Plotted from data in ICNND (1964)

Figure 3
Distribution of Body Mass Index according to age groups
(1973 anthropometric survey, n = 6017)



Plotted from data in Quah (1977)