Food consumption patterns and nutrient intake among Nepalese living in the southern rural Terai region

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The dietary nutrient intake of persons aged 10-68 years (55 males and 54 females) living in the Chitwan district, Nepal, was investigated using the 24-hour recall method. The mean daily consumption of food for males and females averaged 483±92 and 433±115 g of cereals, 179±126 and 167±126 g of coloured vegetables, 91±177 and 111±206 g of milk and dairy products, 67±91 and 53±82 g of potatoes, respectively. These items constituted more than three-fourths of the total food weight, whereas the amounts and frequency of the consumption of meats, fish and eggs were very low. Males (464±80 g) consumed a larger amount of rice than females (408±105 g, $p<0.01$). The level of rice consumption was strongly related to the level of energy intake ($r= 0.60$), protein ($r= 0.44$), carbohydrate ($r= 0.66$), vitamin B_1 ($r= 0.77$), niacin ($r= 0.53$) and vitamin E ($r= 0.54$), ($p<0.001$). The mean amount of total energy intake for males (2340±526 kcal) was higher than that of females (1930±457 kcal, $p<0.01$). The daily mean intakes of protein, fat, Ca, vitamin B_1 and B_2 were 51.9±13.0 g, 23.0±9.8 g, 412±228 mg, 1.88±0.33 mg and 0.73±0.27 mg for males and 47.4±12.5 g, 26.1±13.8 g, 395±237 mg, 1.72±0.39 mg and 0.68±0.31 mg for females, respectively. The intake levels of Fe and vitamin E for males (8.5±3.4 and 4.4±1.5 mg) were higher than those of females (6.7±1.9 and 3.7±1.2 mg, $p<0.01$, respectively). The mean intake of vitamin A, mostly of carotene (about 90% of vitamin A), was 1614±1003 and 1561±1031 IU for males and females, respectively. The consumption of coloured vegetables was correlated with the intake of vitamin A ($r= 0.96$), B_2 ($r= 0.37$) and C ($r= 0.85$), ($p<0.001$, respectively).

Key words: food consumption, nutrient intake, Nepal, Terai region, Chitwan district, Khargual Village, rural, Itahari district, BMI (body mass index), blood pressure

Introduction

Malnutrition is still a public health problem in many developing countries[1-3]. We have been interested in the nutritional status in Nepal where little survey work has been done. Brown *et al*[4] carried out a dietary survey of 19 villages throughout Nepal in 1965 and reported that the Nepalese diet was generally superior to that reported by FAO for the Far East as a whole.

We have conducted dietary surveys in a mountain area in 1975[5] and in an industrial region (Itahari district, Terai region) in 1987[6] to obtain actual data on food consumption of the Nepalese. Although their dietary patterns were found to be very simple and similar, the main cereals consumed in the former case were foxtail millet, Japanese barnyard millet and wheat, whereas in the latter case, much more rice was consumed. Besides cereals, the residents in the Itahari district consumed more vegetables and milk and dairy products than those in the mountain area. The reason for the variation in findings between the surveys was not clear, but it could have been related to changes over time, the season of the survey, income or regional differences. Therefore, for comparison with our previous findings, we surveyed the dietary intake of Nepalese living in the Chitwan district of the southern agricultural Terai region where residents were self-supporting but lived on a low income. We found some nutrient deficiencies and discuss the nutritional status of the people living in this rural region of Nepal.

Subjects and methods

The subjects were a random sampling from among the general populace who came to a medical camp for a routine health check and consisted of over 50% of the population of a village in Khargual of the Chitwan district, an agricultural Terai region of Nepal. The study was conducted on 55 males and 54 females of ages ranging from 10 to 68 years (average 28.8±12.7 years).

The average life-span of the Nepalese is 53-54 years. The majority of the residents in this district were engaged in agriculture and were peasants. Most of them were Hindu believers.

Height and body weight were measured for all subjects, and body mass index (BMI) was calculated as weight/height^2 (kg/m^2). Systolic (SBP) and diastolic blood pressure (DBP) were measured for 108 subjects (55 males and 53 females).

The dietary survey was carried out in December, 1989 by the 24-hr dietary recall method. Food models were used to obtain descriptions of the amounts of food consumed. In addition, information was obtained from local residents on the usual dietary habits and the consumption of minor food groups such as seasoning and local foods. The data were analysed and nutrient intake was calculated from food tables of India and Japan. Foods not listed in the tables were substituted with similar items.

All results are expressed as mean ± SD. Student's unpaired t test was used to assess the statistical significance of difference. Pearson's correlation coefficients were computed to examine the relationship between the variables. Statistical analysis was performed by using STAX statistical software (Microcomputers in Medicine, Nakayama Shoten, Tokyo).

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Table 1. Physical characteristics[a] of subjects.

Sex		Subject	Height	Weight	BMI	Blood pressure [b]	
						SBP	DBP
	(age)	(n)	(cm)	(kg)	(kg/m^2)	(mmHg)	
Male	10-14	0					
	15-19	14	159±7	43.9±5.7	17.2±1.2	125.0±9.1	80.0±7.7
	20-29	18	161±16	51.7±5.8	18.7±1.4	135.0±17.1	84.6±8.5
	30-39	12	165±6	50.7±5.9	18.6±1.2	129.8±13.0	85.8±6.9
	40-49	5	163±8	49.1±1.7	18.5±1.5	113.0±8.4	77.2±6.4
	50-59	4	164±4	55.6±6.6	20.8±3.2	123.0±4.8	80.0±7.5
	60-68	2	159±2	48.5±2.1	19.3±1.4	150.0±0	83.0±9.9
	All [c]	55	162±10**	49.3±6.4**	18.5±1.7	129.4±14.1*	82.6±7.9**
Female	10-14	3	139±11	28.7±6.1	14.7±1.1	109.3±1.2	64.7±5.0
	15-19	11	152±6	42.5±5.0	18.8±2.2	118.5±5.8	73.1±5.9
	20-29	19	154±5	44.1±4.8	18.6±1.4	128.3±22.7	79.9±10.0
	30-39	9	151±5	38.2±3.7	16.7±0.9	120.2±10.1	78.9±7.8
	40-49	8	147±5	39.8±2.6	18.3±1.2	127.0±11.6	79.8±7.7
	50-59	4	152±7	42.0±4.0	18.3±1.4	130.0±0	84.0±4.3
	60-68	0					
	All [c]	54	151±6**	41.1±5.6**	18.0±1.8	123.8±15.5*	77.7±8.9**

[a] Mean ± SD; [b] Total number of subjects : 55 males and 53 females; [c] Significant differences between the sexes, *p<0.05, **p<0.01.

Results

The physical characteristics of the subjects are summarised in Table 1. The mean values of height and body weight for males were significantly higher than those for females (p<0.01, respectively). However, the mean level of BMI was almost the same for both sexes (18.5±1.7 for males and 18.0±1.8 for females), showing that they were rather lean. SBP and DBP were 129.4±14.1 and 82.6±7.9 mmHg for males and 123.8±15.5 and 77.7±8.9 mmHg for females, respectively (p<0.05 for SBP, p<0.01 for DBP). These values were not influenced by age.

Table 2. Average daily food group consumption[a] of subjects.

Food group (g/day)	All (n=109)	Male[b] (n=55)	Female[b] (n=54)
Cereals	458±107	483±92*	433±115*
Rice	436±97	464±80**	408±105**
Wheat	5±22	3±14	7±28
Potatoes	60±86	67±91	53±82
Sugar & sweetenings	4±6	5±8*	2±4*
Fats & oils	8±6	7±5	9±7
Pulses	8±15	9±17	7±12
Fruits	2±12	3±17	0
Vegetable: coloured	173±127	179±126	167±129
other	82±128	71±99	94±151
Seasoning	5±3	5±3*	4±2*
Alcohol [c]	86±193	153±252**	18±43**
Fish	13±32	13±31	13±33
Meats	19±43	14±41	24±45
Eggs	2±14	2±16	2±11
Milk & dairy products	101±191	91±177	111±206
Total food weight	1034±344	1120±348**	946±320**

[a] Mean ± SD. [b] Significant difference between the sexes, *p<0.05, **p<0.01 [c] alcoholic beverage, not ethanol, principally fermented liquor or whisky.

Table 2 shows the average daily food intake of the subjects. Considerable variation was found among individuals for the amount of food consumption, although the mean number of food items, excluding seasoning and alcohol, was 7.2±2.4 per day. All of the subjects consumed rice, seasoning and vegetable oil. Vegetables, potatoes and milk and dairy products were frequently consumed. The proportion of consumption of rice, coloured vegetables and milk and dairy products was 65.6 and 72.5% of the total weight of the food intake for males and females, respectively. The average amounts of rice consumed for males and females were 464±80 and 408±105 g per day, respectively, which constituted almost half of the total weight of the food intake, and the males consumed more rice than the females (p<0.01). The males also consumed much more alcohol (13.7% of the total weight of the food intake), but no significant difference was observed with age. A significant positive correlation was found between age (subjects 20-30 years old vs. teenagers and those over 40 years old vs. those 20-30 years old) and the amount of milk and dairy product intake (r = 0.28, p<0.01) while there was a negative correlation between age and the amount of rice intake (r= -0.25, p<0.01). The amounts and frequency of meat, fish or egg consumption were very low for both sexes, which meant that milk and dairy products were almost the sole food source of animal origin.

The nutrient composition of diets is shown in Table 3. Age was negatively correlated with the average intakes of protein (r= -0.18, p<0.05), carbohydrate (r= -0.19, p<0.05), vitamin B_1 (r= -0.23, p<0.05), and niacin (r= -0.23, p<0.05). Energy and intake of carbohydrate, Fe and vitamin E were higher for males than for females (p<0.01). The average intakes of animal protein and fat were slightly higher for females, but did not differ significantly between males and females. The daily mean intakes of Ca, K, vitamin A, B_2 and C were almost the same for both sexes.

Table 3. Daily average nutrient intake[a] of subjects.

Nutrient	All (n=109)	Male (n=55)[b]	Female (n=54)[b]
Energy (kcal)	2137±532	2340±526**	1930±457**
Protein (g)	49.6±12.9	51.9±13.0	47.4±12.5
animal protein (g)	8.8±9.3	7.6±9.6	9.9±8.9
Fat (g)	24.5±12.0	23.0±9.8	26.1±13.8
animal fat (g)	7.9±9.7	6.2±7.7	9.6±11.1
Carbohydrate (g)	404±100	449±96**	359±81**
Dietary fibre (g)	15.9±8.7	15.9±5.2	15.8±11.3
Ca (mg)	404±232	412±228	395±237
P (mg)	1160±283	1214±241*	1104±312*
Fe (mg)	7.6±2.9	8.5±3.4**	6.7±1.9**
K (mg)	2010±731	2080±774	1939±685
Vitamin A (IU)	1588±1013	1614±1003	1561±1031
Vitamin B_1 (mg)	1.80±0.37	1.88±0.33*	1.72±0.39*
Vitamin B_2 (mg)	0.71±0.29	0.73±0.27	0.68±0.31
Niacin (mg)	14.9±3.7	15.6±3.8*	14.2±3.5*
Vitamin C (mg)	117±61	120±59	114±63
Vitamin E (mg)	4.0±1.4	4.4±1.5**	3.7±1.2**

[a]Mean±SD; [b]Significant difference between the sexes, *p<0.05, **p<0.01.

As shown in Table 4, the proportion of energy intake from protein and fat was higher for females (p<0.01, respectively) and

that of carbohydrate was higher for males ($p<0.01$). Rice appeared to contribute most to the total energy intake in both sexes, which constituted of about 74% of the total energy intake.

Table 4. Contribution of nutrients and rice to total energy intake[a]

Subject	N	Sources of energy (%)			
		Protein	Fat	Carbohydrate	Rice
All	109	9.8±1.6	10.8±4.4	79.4±5.1	74.0±14.2
Males	55	9.4±1.1**	9.3±3.2**	81.3±3.9**	72.5±15.4
Females	54	10.3±1.8**	12.2±5.0**	77.5±5.5**	75.6±12.8

[a] Mean±SD. **Significant difference between the sexes, $p<0.01$.

Table 5. Correlation among food consumption and nutrient intake.

Nutrient	Rice	Fish	Meats	Milk & dairy products	Coloured vegetables
Energy	0.60***	0.15	0.21*	0.12	-0.07
Protein	0.44***	0.31***	0.43***	0.19*	0.05
Fat	0.23*	-0.03	0.46***	0.42***	0.02
Carbohydrate	0.66***	0.12	0.06	0.07	-0.10
Ca	0.01	-0.22*	-0.01	0.63***	0.63***
Fe	0.13	0.23*	0.39***	-0.08	0.14
Vitamin A	--	-0.21*	0.17	0.11	0.96***
Vitamin B_1	0.77***	0.24**	0.07	0.19	--
Vitamin B_2	0.14	-0.06	0.24**	0.63***	0.37***
Niacin	0.53***	0.04	0.63***	0.02	0.15
Vitamin C	-0.05	-0.19*	0.12	0.12	0.85***
Vitamin E	0.54***	0.33***	0.04	--	-0.11

*$p<0.05$, **$p<0.01$, ***$p<0.001$

The results of correlation analysis among major food items and nutrient intake for all subjects are presented in Table 5. Rice correlated most strongly with energy intake ($r = 0.60$, $p<0.001$), protein ($r = 0.44$, $p<0.001$), carbohydrate ($r = 0.66$, $p<0.001$), vitamin B_1 ($r = 0.77$, $p<0.001$), niacin ($r = 0.53$, $p<0.001$) and vitamin E ($r = 0.54$, $p<0.001$). Coloured vegetables showed correlations with Ca ($r = 0.63$, $p<0.001$), vitamin A ($r = 0.96$, $p<0.001$), B_2 ($r = 0.37$, $p<0.001$) and C ($r = 0.85$, $p<0.001$). Milk and dairy products were correlated with fat ($r = 0.42$, $p<0.001$), Ca ($r = 0.63$, $p<0.001$) and vitamin B_2 ($r = 0.63$, $p<0.001$). However, Fe was only correlated with meats ($r = 0.39$, $p<0.001$). Ca, vitamin A and C were not correlated with energy. Several other food groups were correlated with only a few dependent variables (not presented in the table).

Discussion

The mean height of the subjects in this study was almost the same as that given in the previous report[6], but that of body weight was lower, resulting in lower BMI values. This might be explained by greater energy expenditure for the subjects compared with energy intake and also by the difference in the daily activities between the two areas (subjects in this study were peasants while those in the previous one were factory workers). The blood pressure levels (DBP and SBP) for the subjects were within the normal ranges by Japanese standards. The mean values of DBP of males and females were about the same as those of Nepalese in the Itahari district[6] and African Americans[7] reported by Melby *et al*, while those of SBP were higher than those reported previously.

Milk and dairy products were almost the sole food source of animal origin, as found for the Itahari district[6]. Food habits such as having milk tea or boiled rice with milk led to the subjects consuming fairly large amounts of milk. The average daily consumption of rice and coloured vegetables in this study was higher than those of Japanese[8] and Nepalese in the Itahari district[6]; the intake of coloured vegetables was about 3.5 times higher than in the Itahari district[6]. This might be explained by the facts that it was just after the rice harvest and that the land was also good for cultivating vegetables throughout the seasons compared with mountain or industrial areas in Nepal.

The dietary pattern was very simple in this area and similar to that reported previously[5,6]. An average of seven food items was consumed in this area, which was fewer than the average of 22 for the Japanese[8] and 18 for the Nepalese in the Itahari district[6]. This showed that food availability and cash income greatly influenced food intake. Due to the large amounts of rice intake, its proportion in the total energy intake of Nepalese in this study was higher than those in the mountain area[9] and in the Itahari district[6]. The energy percentage of carbohydrates for Nepalese in this study was almost the same as those for South Africans[9], Polynesians[10] and other Nepalese[4-6,11], but was higher than those in developed countries[12,13] and among vegetarians[7,14]. The average intake of protein was about the same level as that reported elsewhere for Nepalese[4-6,11] and that of fat was the same as for the Nepalese in the 19 villages reported earlier[4] and in Kathmandu[11] but was lower than that in the Itahari district[6]. Rice intake contributed to the intake of protein, fat, vitamin B_1, niacin and vitamin E, however, compared with a previously studied vegetarian diet of 2200 kcal[14], the intake of protein and fat was less and that of Ca, vitamin E, niacin and Fe was considerably less than the vegetarians. Ca intake mainly came from consumption of milk and dairy products and coloured vegetables which was higher than those in the 19 villages[4], in the mountain area[5] and in the Itahari district[6]. However, the consumption of milk and dairy products was lower in this study than that in the Itahari district[6].

Fe intake was related to meat consumption, but this was very low in amount and frequency in this study, as found with the diets of vegetarian adults[15]. Fe intake in this study was only 56 to 65% of that in the Itahari district[6]. We found that the dietary Fe was not related to the serum Fe concentration and that the average percent saturation of serum transferrin was around 20-25% in this area (to be published in a separate paper), which tended to be lower than that of the normal range (20-55%)[16]. Thus, there seems to be a latent iron deficiency. Black gram, a kind of pulse commonly eaten in Nepal, contains about 15 mg/100 g of Fe (unpublished data). The average intake of pulses for Nepalese in this area was below one-fifth of that in the Itahari district[6]. We do not have precise information on the kind of pulses consumed in the Itahari district, but the difference in the amount of pulse consumption between these two areas might be the reason for the lower Fe intake found in this study because the amount of animal origin food intake did not differ much between the two areas.

Dietary fibre is known to play an important role in human health[17,18] but increasing its amount can disturb the absorption of nutrients such as protein, fat and minerals[19,20]. This would be a problem for children and pregnant or lactating women in developing countries because of the lower bioavailability of important nutrients. The average intake values for dietary fibre by males and females in this study were 15.9±5.2 and 15.8±11.3g, respectively, which were about the same as those in the Netherlands (18g)[13] and the United States (15.4±8g)[21] and among the elderly in Norwich, Great Britain (20.9g for males and 17.4g for females)[22], but they were about half of that of vegetarians (30-40g)[7,14]. Thus, although the amount of dietary fibre intake in this area was not considerably higher, the net amounts of bioavailability of those nutrients might be affected due to the overall low nutrient intake.

Examining the average intakes of the various nutrients showed that the level for vitamin A was within the range of the other reports[4-6,11] and was lower than that of the Japanese[8]. About 90% of vitamin A was from carotene, which agreed with the lesser consumption of animal origin food. Carotene is readily available from vegetables from the people's gardens throughout the year.

The average intake of vitamin B_1 was higher than those of Japanese[8] and Americans[12], but was lower than those in the 19 villages[4] and in the Itahari district[6]. The average intake of vitamin B_2 was the same level as those of the 19 villages[4] and in the mountain area[5] but was lower than those in the Itahari district[6] and for Japanese[8] and Canadian students[23]. Niacin intake for this study was the same level as that in the Itahari district[6] but was lower than that in the 19 villages in Nepal[4] and among Canadian students[23]. The main source of both nutrients, vitamin B_1 and niacin, was apparently rice. The residents eat more nutritive half-polished rice than the all-polished type. The average intake of

vitamin C, which showed good correlation with the consumption of coloured vegetables, was the same as those in the Itahari district[6] and in Japan[8], was lower than that in the mountain area[5] and was higher than that in the 19 villages[4]. The average intake of vitamin E was the same level as that of 7-11-year-olds in Britain found by Nathan *et al* (4.4-5.6 mg)[24]. Horwitt *et al*[25,26] reported that the vitamin E requirement was 4mg of α-D-tocopherol per day for persons whose polyunsaturated fatty acid (PUFA) intake was very low. For the Japanese, 8-10mg of vitamin E is considered to be adequate[27]. Judging from the food consumption of Nepalese in this study, 6-8mg of vitamin E might be sufficient because their PUFA intake was much lower than that for the Japanese.

In general, the nutritional status of Nepalese in this study was almost the same as that reported previously. They were apparently healthy, despite the fact that there may be a latent deficiency of protein, Ca, Fe, vitamins A and B_2 and a lack of high quality amino acids because of lesser intake of animal origin food groups such as meats, fish, or eggs. The status of food consumption was greatly influenced by food habits, food availability, and socioeconomic conditions. The residents can grow some agricultural products throughout the year because they live in a southern arable farm village but the variety of food is limited due to their low income. The usual diet in the research area consists of plenty of boiled rice, thin soup of pulses and cooked vegetables. Although it is very difficult to change food habits and it takes time to improve the nutritional status, we would suggest the consumption of thicker soups of pulses, more variety of vegetables, and animal origin foods. The quality of the diet rather than its quantity should be improved to raise the nutritional status as a whole.

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住在南部农村Terai区的尼泊尔人的食物模式和营养素摄取

摘要

作者在尼泊爾Chitwan區，用24小時回憶法研究10－68歲（男55人，女54人）人群的膳食營養素攝取. 男性和女性的每日平均食物的食人量分別是谷類483±92和433±115克; 青菜179±126克和167±126克; 乳及乳制品91±177克和111±206克; 馬鈴薯67±91克和53±82克. 上述食物的食人量超過¾的食物總攝人量，而肉類，魚類和蛋類食人量很低. 男性米的食人量（464±80克）大于女性（408±105克 P>0.001）米的消耗量與總能量（r=0.60）; 蛋白質（r=0.44）; 碳水化合物（r=0.66）; 維生素B1（r=0.77）; 菸鹼酸（r=0.53）和維生素E（r=0.54）高度相關（P<0.01）. 男性的總能量攝人（2340±526千卡）較女性爲高（1930±457千卡 P<0.01）. 男性每日平均攝取蛋白質，脂肪，鈣，維生素B1和B2分別爲51.9±13.0克; 23.0±9.8克; 412±228毫克; 1.88±0.33毫克和0.73±0.27毫克. 女性每日平均攝取爲47.4±12.5克; 26.1±13.8克; 395±237毫克; 1.72±0.39毫克和0.68±0.31毫克. 男性鐵和維生素E的攝取（8.5±3.4和4.4±1.5毫克）較女性爲高（6.7±1.9和3.7±1.2毫克 P<0.01）. 維生素A絶大多數來自胡蘿卜素（約90%），男女攝取量分別爲1614±1003和1561±1031國際單位. 有色青菜的攝取分別與維生素A（r=0.96）; B2（r=0.37）和維生素C（r=0.85）的攝取有關.

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(日本語要旨)

ネパール、チトワン地域に住む 10-68 歳の男子 55 名、女子 54 名を対象に前日 1 日分の食事内容を聞き取る方法で食物摂取状況調査を実施した。1 日の平均摂取量は男女それぞれ穀類 483±92、433±115 g、緑黄色野菜 179±126、167±29 g、乳・乳製品 91±177、111±206 g 芋類 67±91、53±82 g で、これらの食品で総摂取量の 3/4 以上を占め、肉、魚、卵類の摂取量がきわめて少なかった。米の摂取量 (男子 464±80 g、女子 408±105 g) は多く、米とエネルギー (r= 0.60)、タンパク質 (r= 0.44)、糖質 (r= 0.66)、ビタミン B_1 (r= 0.77)、ナイアシン (r= 0.53)、ビタミン E (r= 0.54) と高い相関を示した (いずれも $p<0.001$)。総エネルギーの平均摂取量は男子 2340±526 kcal で女子 (1930±457 kcal) よりも多かった ($p<0.01$)。タンパク質、脂肪の平均摂取量はそれぞれ男子 51.9±13.0、23.0±9.8 g、女子 47.4±12.5、26.1±13.8 g であった。Ca の平均摂取量は男女それぞれ 412±228、395±237 mg であった。Fe とビタミン E の平均摂取量は男子は 8.5±3.4、4.4±1.5 mg で女子 (それぞれ 6.7±1.9、3.7±1.2 mg) よりも多かった ($p<0.01$)。ビタミン A の平均摂取量は男子 1614±1003、女子 1561±1031 IU で、その 90 %はカロチンであった。ビタミン B_1、B_2 はそれぞれ男子 1.88±0.33、0.73±0.27 mg、女子 1.72±0.39、0.68±0.31 mg であった。緑黄色野菜は Ca (r= 0.63), ビタミン A (r= 0.96)、B_2 (r= 0.37)、C (r= 0.85) と高い相関を示した (いずれも $P<0.001$)。

References

1. Chen LC, Chowdhury AKMA, Huffman SA. Anthropometric assess-ment of energy-protein malnutrition and subsequent risk of mortality among preschool aged children. Am J Clin Nutr 1980; 33:1836-1845.
2. Ramalingaswami V. New global perspectives on overcoming malnutrition. Am J Clin Nutr 1995; 61: 259-263.
3. Forman MR, Hundt GL, Berendes HW, Abu-Saad K, Zangwill L, Chang D, Bellmaker I, Abu-Saad I, Graubard B. Undernutrition among Bedouin Arab children: a follow-up of the Bedouin infant feeding study. Am J Clin Nutr 1995; 61: 495-500.
4. Brown ML, Worth RM, Shar NK. Food habits and food intake in Nepal. Trop Geogr Med 1968; 20: 217-224.
5. Hirai K, Okuda T, Fukuwatari T. Observation of living of the Sherpa tribe in Nepal and their dietary survey. Rep Sci Living Osaka City Univ 1975; 23: 27-34.
6. Hirai K, Nakayama J, Sonoda M, Ohno Y, Okuno Y, Nagata K, Tamura T, Sakya HN, Shrestha, MP. Food consumption and nutrient intake and their relationship among Nepalese. Nutr Res 1993; 13: 987-994.
7. Melby CL, Toohey ML, Cebrick J. Blood pressure and blood lipids among vegetarian, semivegetarian, and nonvegetarian African Americans. Am J Clin Nutr 1994; 59: 103-109.
8. National Nutrition Survey: 1994. Section of Nutrition, Bureau of Public Health Ministry of Health and Welfare. Daiichi Publishing Co, Tokyo.
9. Vorster HH, Silvis N, Venter CS, van Ryssen JJ. Huisman H, van Eeden TS, Walker ARP. Serum cholesterol, lipoproteins, and plasma coagulation factors in South African blacks on a high-egg but low-fat intake. Am J Clin Nutr 1987; 46: 52-57.
10. Prior IA, Davidson F, Salmond CE, Czochanska Z. Cholesterol, coconuts, and diet on Polynesian atolls: a natural experiment the Pukapuka and Tokelau island studies. Am J Clin Nutr 1981; 34: 1552-1561.
11. Reynolds RD, Moser PB, Acharya S, McConnell W, Andon MB, Howard MP. Nutrition and medical status of lactating women and their infants in the Kathmandu valley of Nepal. Am J Clin Nutr 1988; 47: 722-728.
12. Nichols AB, Ravenscroft C, Lamphiear DE, Ostrander LD. Daily nutritional intake and serum lipid levels. the Tecumseh study. Am J Clin Nutr 1976; 29: 1384-1392.
13. Baecke JAH, van Staveren WA, Burema J. Food consumption, habitual physical activity, and body fatness in young Dutch adults. Am J Clin Nutr 1983; 37: 278-286.
14. Haddad E. Development of a vegetarian food guide. Am J Clin Nutr 1994; 59: 1248S-1254S.
15. Surapistchat T, Tanphaichitr V. Iron status in omnivorous and vegetarian adults. J Clin Biochem Nutr 1988; 4: 235-240.
16. Yoshino Y, Hisayasu, S. Recent research and information on iron metabolism. Jpn J Nutr 1987; 45: 155-164.
17. Retzlaff BM, Dowdy AA, Walden CE, McCann BS, Gey G, Cooper M, Knopp RH. Changes in vitamin and mineral intakes and serum concentrations among free-living men on cholesterol-lowering diets: The dietary alternations study. Am J Clin Nutr 1991; 53: 890-898.
18. Anderson JW, Smith BM, Gustafson NJ. Health benefits and practical aspects of high-fibre diets. Am J Clin Nutr 1994;59:1242S-47S.
19. Cummings JH. Nutritional implication of dietary fibre. Am J Clin Nutr 1978; 31: S21-S29.
20. Kritchevsky D. Fibre, lipids, and atherosclerosis. Am J Clin Nutr 1978; 31: S65-S74.
21. Marlett JA, Bokram RL. Relationship between calculated dietary and crude fibre intakes of 200 college students. Am J Clin Nutr 1981; 34: 335-342.
22. Maisey S. Loughridge J, Southon S, Fulcher R. Variation in food group and nutrient intake with day of the week in an elderly population. Bri J Nutr 1995; 73: 359-373.
23. Barr SI. Secular trends in nutrient intakes of female nutrition students, 1986-1991. Nutr Res 1993; 13: 1099-1103.
24. Nathan I, Hackett AF, Kirby S. The dietary intake of a group of vegetarian children aged 7-11 years compared with matched omnivores. Bri J Nutr 1996; 75: 533-544.
25. Horwitt MK. Status of human requirements for vitamin E. Am J Clin Nutr 1974; 27: 1182-1193.
26. Horwitt MK. Vitamin E: a reexamination. Am J Clin Nutr 1976; 29: 569-578.
27. Recommended Dietary Allowances for Japanese, 5th edition: Section of Health Promotion and Nutrition. Bureau of Health Service, Ministry of Health and Welfare 1994; Daiichi Publishing Co, Tokyo.