MICRONUTRIENT LEVELS AMONG ABORIGINES IN PAHANG AND PERAK

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ABSTRACT

Micronutrients are essential component of human life. Only small amounts are requiredfor normal growth. The objective of this study was to assess micronutrient status among aborigines living in Sg Siput (U), Perak and Kuala Lipis , Pahang. Our study showed that serum selenium, manganese, magnesium and zinc levels for aborigines were 0.517 ± 0.243 µmol/l (n=442), 0.221 ± 0.016µg/l (n=457), 1.178 ± 0.221mmol/l (n=455) and 15.847 ± 1.348µmol/ (n=453) respectively. In general, serum selenium and manganese among aborigines were deficient compared to the levels of other population, whilst their serum magnesium and zinc were normal when compared to others population.

Keywords: *micronutrient, serum levels, aborigines, Malaysia*

INTRODUCTION

Micronutrients are essential vitamins and minerals that are required in small amounts for various physiological functions. Micronutrients are required for growth, maintenance, repair and health of tissues and bones (Grifith 2000). Some of these minerals are ferum, cuprum, cobalt, iodine, zinc, selenium, manganese, molybdenum, cromium, flourine, silicon, nikel and vanadium. Selenium plays an important role as an antioxidant in protecting cells against damaging free radicals. In recent epidemiologic studies it has been found that there is an inverse correlation between selenium and the prevalence of goiter, cancer, aging and cardiovascular dieases (Griffith 2000). Selenium natural sources are bran, broccoli, brown rice, cabbage, chicken. garlic (grown in selenium-rich soil), kidney, liver, milk, mushrooms, nutritional yeast, oatmeal, onions, seafood, tuna and whole-grain products (Griffith 2000).

Manganese stimulates a production of cholesterol by the liver. It is a co-factor in many enzymes and is a key element in antioxidation processes. Manganese deficiency has been observed in many animal species
Evidence of this deficiency among animal species include growth impairment, impaired reproductive functions, impaired glucose tolerance and alterations in carbohydrate and lipid metabolism. Manganese is also neurotoxic if taken in high dosage; excessive exposure to Mn may lead to accumulation of the compound in the brain. Beans, bran, carrots, chestnuts, hazelnuts, oatmeal, peanuts, peas, seaweed, spinach, tea and whole grains are rich on manganeses (Griffith 2000).

Magnesium is important for bone growth, nerves and muscles functions including regulation of normal heart rhythm. Symptoms of deficiency in Mg include convulsions, hypertension and arrhythmias (Mildred 1997). Magnesium is found in abundance in almonds, avocados, bananas, bluefish, carp, cod, halibut, mackerel, herring, swordfish, dairy products, leafy green vegetables, molases, nuts, shrimp, wheatgerm and whole-wheat bread (Griffith 2000).

Zinc is a component of various enzymes in the body and functions in maintaining the structural integrity of proteins and regulation of gene expression. Zinc promotes normal growth and development. It is essential for brain development and helps improve attention span as well as short-term memory. Conversely, zinc deficiency can lead to growth retardation in children, delayed bone maturation, dwarfism and alopecia. Zinc is found in lean beef, chicken heart, egg yolk, herring, lamb, maple syrup, milk, molasses, oysters, pork, sesame seeds, soybeans, sunflower seeds, turkey, wheat bran, wheat germ, whole-grain products and yeast (Griffith 2000).

Micronutrient deficiency cases occur commonly among the disadvantaged populations such as those in remote area (aborigines) and the urban poor. This study will provide useful information on micronutrient status among Malaysians aborigines. In this study, the aborigines were chosen as subjects for the study because they are known to be suffering from protein energy malnutrition (PEM), anemia and

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IDD (Osman 1993). Their micronutrient status will be compared with other population.

METHODOLOGY

Subjects and Sampling

Two villages in Perak, Malaysia namely Legap Post and Perwor Post and three villages in Pahang, Malaysia namely Sinderut Post, Tual Post and Bertang Post were selected as advised by the Department of Aboriginal Affairs. The study was carried out in 1998. All subjects aged between 4 and 70 years old from the selected villages were included in the study. The study population was selected using a cluster sampling procedure. The aborigines from Perak are from the Temiar tribe while the aborigines from Pahang are from the Semai tribe. Most of them can speak the Malay language. For this study, they were asked to attend the clinic for clinical and blood examinations.

Serum Micronutrient Analysis

Venous blood samples were drawn for serum micronutrient analysis by trained personnel. Samples were collected in Vacutainer tubes (without anticoagulant) and then centrifuged at room temperature for 15 minutes at 1500 g. The serum was then transferred to vials and stored at -20°C. The blood samples for aborigines were analyzed for selenium, manganese, magnesium and zinc levels by using graphite furnace Atomic Absorption Spectrophotometer (GFAAS) (GBC-906) at Allied Health Sciences Faculty, Universiti Kebangsaan Malaysia (UKM). All glasswares used for analysis were cleaned; with 10% acid nitric and rinsed with deionised water.

It is important to note that no local reference values for serum selenium, manganese, magnesium and zinc have so far been published in Malaysia. Therefore, normal values from Trace Element Laboratory, Robens Institute, University of Surrey was used as the cut off marker for selenium and manganese. The normal values for selenium are 0.89 – 1.65 μmol/l for adults and 0.57 – 0.9 μ mol/l for children. The normal value for manganese is 0.5 – 1.3 μ g/l. The normal values for magnesium and zinc are 0.8-1.2 mmol/l (Young 1987) and 10.7 – 18.5 μmol/l (Vega 1996) respectively.

Data Analysis

Data was analysed by using one-way analysis of variance (ANOVA) in order to determine the influence of age groups and location on level of serum micronutrients. T-test was used to determine the difference of micronutrient levels between gender. The statistical tests were conducted using SPSS Version 10.0 with $p<0.05$ valued used to indicate statistical significance.

RESULTS

Sample characteristics

The total number of aborigines involved in the study from the two areas was 459. Table 1 summarizes the characteristics of the study subjects. Two hundred and forty three (52.9%) of the subjects were females and the rest were males. The average age of respondents was 21.05 $\pm$ 13.67 years (range 4-70 years). In terms of location, 166 (36.2%) subjects were from Legap, 122 (26.6%) from Perwor, 93 (20.8%) from Sinderut, 42 (9.2%) from Bertang and 36 (7.8%) from Tual.

Table 1: Sample Characteristics Of Study Subjects

Characteristic	Category	Aborigines	
		n	%
Gender	Male	216	47.1
	Female	243	52.9
Age (years)		21.048 $\pm$ 13.67 (n=459)	
Age group	Children (4-10 years old)	96	20.9
	Adolescent (11-19 years old)	163	35.5
	Adult (20-55 years old)	193	42.0
	Elderly (>55 years old)	7	1.5
Location	Perwor	122	26.6
	Legap	166	36.2
	Sinderut	93	20.8
	Tual	36	7.8
	Bertang	42	9.2
Ethnicity	Temiar	288	62.5
	Semai	171	37.5

Serum micronutrients level

In general, the serum levels of selenium and manganese among aborigines were lower when compared with the reference value. Serum selenium and manganese levels for aborigines were 0.517 ± 0.243 μmol/l (n=442) and 0.221 ± 0.016μg/l (n=457) respectively (Table 11). The serum magnesium and zinc concentrations among aborigines were 1.178 ± 0.221mmol/l (n=455) and 15.847 ± 1.348μmol/ (n=453) respectively. Therefore, compared to the reference values, the mean concentrations of zinc and magnesium for aborigines were within normal limit

Table 2: Mean micronutrient Levels In Subjects According To Gender, Age Group and location'

Characterictic		Selenium (μmol/l)	Manganese (μg/l)	Magnesium (mmol/l)	Zinc (pmol/l)
Gender	Male	0.531 ± 0.249 (209)	0.219 ± 0.016 [a] (215)	1.179 ± 0.233 (213)	15.973 ± 1.32 (211)
	Female	0.504 ± 0.238 (233)	0.222 ± 0.017 (242)	1.176 ± 0.210 (242)	15.737 ± 1.37 15.738 (242)
T test		t=1.135 p=0.257	t=2.055 p=0.04	t=0.I3 p=0.896	t=0.940 p=0.062
Age group	Childre (<10 years)	0.515 ± 0.253[b,c] (89)	0.218 ± 0.017 (95)	1.134 ± 0.263' (96)	16.005 ± 1.015 [b] (96)
	Adolescent (10-19 years)	0.589 ± 0.231[b] (162)	0.223 ± 0.018 (162)	1.202 ± 0.199 (161)	16.160±1.493 [b,d] (161)
	Adult (20-55 years)	0.454 ± 0.234 (184)	0.221± 0.016 (193)	1.180 ± 0.213 (191)	15.532 ± 1.305 (189)
	Elderly (>55 years)	0.512 ± 0.237 (7)	0.214 ± 0.017 (7)	1.137 ± 0.180 (7)	15.000 ± 0.870 (7)
ANOVA		F=9.345 p=0.0001	F=1.318 p=0.268	F= 2.021 p=0.110	F=8.052 p=0.0001
Location	A. Perak				
	Legap	0.576 ± 0.227[f,g,h] (164)	0.234±0.011[e,f,g,h] (165)	1.243±0.160[f,g] (162)	16.008±1.606[e,f,g,h] (162)
	Perwor	0.559 ± 0.19[f,g,h] (121)	0.220 ± 0.015[g,h] (121)	1.210±0.132[f,g] (122)	14.867 ± 0.539 [f,g,h] (122)
	B. Pahang	0.714 ± 0.042''''	0.217± 0.012[g,h]	0.763± 0.09[g,h]	15.307± 0.08 [g,h]
	Tual	(22)	(36)	(36)	(34)
	Sinderut	0.495 ± 0.264[h] (93)	0.205 ± 0.009" (93)	1.133 ± 0.269[h] (93)	16.169 ± 1.254 [h] (93)
	Bertang	0.113 ± 0.042 (42)	0.207 ± 0.006 (42)	1.286 ± 0.174 (42)	16.803 ± 0.013 (42)
ANOVA		F=52.96) p=0.0001	F=109.52 p=0.0001	F=59.91 p=0.0001	F=42.33 p=0.0001
Total		0.517 **±0.243*** **(442)**	0.221 **±0.016*** (457)	1.178 ± 0.221 **(455)**	15.847 ± 1.348) **(453)**

a. significant difference compared to female p<0.05
b. significant difference compared to adult p< 0.05
c. significant difference compared to adolescent p<0.05
d. significant difference compared to elderly p<0.05
e. Significant difference compared to Perwor p<0.05
f. Significant difference compared to Tual p<0.05
g. Significant difference compared to Sinderut p<0.05
h. Significant difference compared to Bertang p<0.05

[1]Data presented in mean±sd (n)

Serum micronutrient levels according to gender and age

The female aborigines showed higher serum manganese levels when compared with the males ($p<0.05$) (Table II). The levels of selenium and zinc were significantly different by age groups ($p<0.05$). Serum selenium was found to be the highest in children (4 – 9 years old) followed by the adolescents (10 – 19 years old) and the elderly (>55 years old). Similarly, the zinc level was decreased with increase in age. Meanwhile, serum magnesium level was the highest in the adolescents followed by the adult and the children ($p<0.05$).

Serum micronutrients level according to location

In general, there were significant differences in the mean of serum micronutrients level between locations ($p<0.05$). The selenium and manganese levels among aborigines from Bertang were significantly lower than normal in range especially. However readings from zinc levels from the same group of subjects was significantly the highest when compared with subjects from other locations ($p<0.05$). The manganese levels were low in all locations in Perak and Pahang. Although the magnesium levels for the aborigines were normal, subjects from Tual showed lower serum magnesium level compared to the normal value.

DISCUSSION

The data on micronutrients among populations in Malaysia is still lacking. This study was an effort to provide the status of micronutrients among populations of aborigines living in remote areas. The study showed that the mean of serum selenium concentration for aborigines was significantly lower ($0.517 \pm 0.243 \mu$mol/l) when compared with the reference value. Generally, the level of selenium among the aborigines was lower when compared to others healthy population in Italy (Lockitch 1989) and among Kelabit ethnic in Bario (Zaleha et al. 2003) The low intake of selenium in their diet was probably responsible for this deficiency because aborigines rarely eat selenium-riched plants and foods such as broccoli, tuna, brown rice, oatmeal and seafood. It is a known fact that Se has important roles in thyroid metabolism. Selenium is responsible for changing thyroxine hormone into the active form of T3 by extrathyroidal deiodination. Therefore, apart from iodine deficiency, the high prevalence of goiter in remote areas (Osman et al. 1995) might be associated with deficiency of Se as reported in other studies. Previous studies have also shown that plasma selenium levels increased with age, wherein levels increased from the neonatal period until the age of 16 years old, after which they become stabilized (Wasowicz & Zachara 1987). The levels then begin to decrease steadily after the age of 60 years. Similarly, in this study, the selenium levels among the Hulu Langat population in the urban fringe area registered an increase until adulthood and a decrease after the age of 55.

It is significant to note that the serum manganese levels among the aborigines from the remote area was substantially lower than the population from the urban fringe area. The levels were also low compared with the reference value (Greger 1990). Generally, serum concentrations of manganese vary in response to dietary intake (Greger 1990). Therefore, the low levels of manganese among aborigines may be due to low intake of manganese from foods such as whole grains, cereal products, lettuce, dry beans and peas. It was also found that subjects who consumed 15 mg of chelated manganese as from which supplement had serum manganese levels of 1.48 μg/l while unsupplemented control subjects had a mean of study 1.1 μg/l. Additionally, it was also revealed that serum manganese levels were significantly higher in females than in males among the aborigines. This difference may be related to the fact that males absorbed significantly less manganese than females, as a study by Finley (1999) have shown Finley had found that high ferritin concentrations found in males were associated with low manganese absorption.

Conversely, the study found that zinc concentrations for aborigines were within normal range of the reference value. Generally, aborigines in Legap took less cereal in their daily food which consequently, reduces the intake of phytate that could in turn inhibit zinc absorption. This provides a probable explanation as to why aborigines in this study did not show zinc deficiency. A study done by Zaleha (1999) confirmed that 84.1% of the population including the aborigines in Legap ate tapioca root daily and only 52.2 % of them ate rice daily. The zinc level that decreased with increase in age may be because of aging and their body's ability to absorb food is now reduced and the presence of disease would further alter zinc metabolism.

On the other hand, magnesium levels of aborigines were normal when compared to the reference value. Magnesium is abundant in foods such as fruits, vegetables, whole grains and fish and deficiency is rare. Intake of magnesium from foods was enough for the aborigines. Magnesium

deficiency intensified adverse reaction to stress. The lifestyle of aborigines that active **arid** less stress also were among factors that lead to normal magnesium levels. A study in China also found that serum magnesium and zinc levels among farmers in rural areas were higher when compared to the urban population (He et al 1996).

Deficiency in selenium and manganese may probably be due to the fact that the aborigines maybe experiencing micronutrient malnutrition as their life styles are different from other populations in Malaysia. For instance, 50% of the aborigines consume tapioca at least once a week compared to less than 20% of the Malays ($p<0.004$). Meat, beef and mutton are rarely eaten by the aborigines when compared to Malays ($p<0.002$) (Osman 1991) as they are regarded as "special" food that is usually consumed during religious or cultural ceremonies

CONCLUSION

Generally it may be concluded that the aborigines living in the rural area were found to have lower selenium and manganese levels when compared to others population, whilst normal serum zinc and magnesium levels. More studies have to be conducted, however, to explain the difference in the levels of micronutrients between ethnic groups and locations.

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