ภาวะของเหตุในสนามไทยที่รับประสบการณ์ทาง

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บทคัดย่อ

วัตถุประสงค์เพื่อศึกษาภาวะของเหตุในสนามที่รับประสบการณ์ทาง โดยศึกษาในผู้ฝึกฝีมือไทยที่มีอายุ 30-50 ปีที่รับประสบการณ์ยาวนาน 5 ปี จำนวน 109 คน เป็นเพศหญิง 49 คน เพศผู้ชาย 60 คน และศึกษาในกลุ่มผู้ที่รับประสบการณ์ทางไกลกว่า 86 คน เป็นเพศชาย 41 คน เพศผู้หญิง 45 คน เพื่อให้เป็นกลุ่มควบคุม โดยการวิเคราะห์สถิติโดยคริสต์ ระดับของเหตุ และเหตุการณ์ ในชีวิต

จากการศึกษาพบว่ากลุ่มที่รับประสบการณ์ทางมีระดับของเหตุและเหตุการณ์ในชีวิตของผู้ที่มีฝีมือที่ดีกว่ากลุ่มผู้ที่รับประสบการณ์ทางไกลกว่า 86 คน เป็นเพศชาย 41 คน เพศผู้หญิง 45 คน เพื่อให้เป็นกลุ่มควบคุม โดยการวิเคราะห์สถิติโดยคริสต์ ระดับของเหตุและเหตุการณ์ในชีวิต แต่ไม่ได้พิจารณาผลกระทบของผลการวันรับประสบการณ์ทาง

โดยสรุปกลุ่มที่รับประสบการณ์ทางจะมีภาวะของเหตุและเหตุการณ์ในชีวิตกว่ากลุ่มที่รับประสบการณ์ทางไกลที่จะมีการสูญเสียสุขภาพ (ที่มีมากจากพิษ) ที่อยู่ในรูปที่น่าจะได้ดี

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Iron Status among Thai Vegans

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Abstract

Background: Despite the possible overall health benefits of vegan diets, there is concern that some vegans, particularly females, may have low iron status due to no intake of heme-iron.

Objective: The objective was to investigate the iron status of Thai adult vegans.

Methods: Forty-nine male and 60 female healthy vegans, aged 30–50 years, who have been on a diet devoid of animal products including milk and egg for at least 5 years, volunteered for the study while 41 male and 45 female age- and BMI-matched omnivores served as controls. Iron status was assessed by measuring hematocrit, serum iron, and serum ferritin.

Results: Serum iron and ferritin concentrations were significantly lower in vegans than in omnivores of both sexes. Female vegans had hematocrit values lower than female omnivores. Serum ferritin levels correlated with hematocrit values and serum iron concentrations but not with duration of vegan practice.

Conclusion: Thai vegans had low iron status showing as some females had low hematocrit values. In addition, iron deficiency among Thai vegans is probably due to low bioavailability of iron in the vegan diets.

Keywords: Vegan, Serum iron, Serum ferritin

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Introduction

In recent years, vegetarian diets have been increasingly popular in many countries for health, philosophical, ecologic and religious reasons. Despite the health benefits, vegetarian diets have been associated with deficiencies on cobalamin, riboflavin, calciferol, calcium, zinc and iron.\(^{(1-3)}\)

The bioavailability and absorption of iron are dependent on the source of iron, the composition of the diet as well as the iron status in the human body. Heme iron is dominant in animal-derived foods (with exception of eggs and milk), while non-heme iron is the only iron compound in plants. The absorption of non-heme iron from plant sources, which is low compound compared with heme iron, can be improved by dietary constituents such as ascorbic acid and other organic acids and can be decreased by components such as phytic acid and tannins.\(^{(4-6)}\) Therefore, one of the nutritional problems related to nutrient adequacy in vegetarian diets is iron deficiency.\(^{(5)}\) Different definitions and cut-off points are used to classify iron deficiency. A serum ferritin concentrations of <12 ng/ml indicates a depletion of iron storage and is often used as an indicator for a marginal iron status. Although there is no evidence that an absence of iron stores has any adverse consequences. Iron deficiency anemia (IDA) is used to indicate that the reduction in body iron associate with the decrease in the level of red blood cell indicator such as haemoglobin and hematocrit.

Several studies in different countries have shown that vegetarians had significantly lower serum ferritin concentrations than those of omnivores\(^{(7-10)}\), some found vegetarians to have inadequate serum ferritin concentrations (defined as <12 ng/ml) compared with omnivores, despite adequate iron intake.\(^{(11,12)}\)

Vegetarian diets can be classified as either lactovegetarian; consumption of diary products, ovovegetarian; consumption of eggs lactoovovegetarian; both diary products and eggs and vegan; no animal product consumption. In Thailand, one publication\(^{(13)}\) had reported that serum ferritin levels were lower in lactovegetarians than the controls. Few studies have examined the impact of vegan diets; avoid food of animal origin, on iron status. Hence, the present study was to determine the iron status in Thai adult vegans based on the values of hematocrit, serum iron and ferritin concentrations.

Materials and Methods

This study was conducted on 195 apparently healthy subjects, aged 30–50 years. One hundred and nine vegans; 49 men and 60 women, were volunteer from Buddhist Sect (Practitioner Association Pathrom Asoke and Thienjon, Bangkok). All subjects were interviewed before participating in this study. A vegan was defined as someone who
ate no meat, no eggs and no dairy products
or ate eggs and dairy products less than 5
times per years. They practise their diet for
\( \geq 5 \) years prior to enroll this study. Eighty-six
omnivores; 41 men and 45 women, were
selected from the staff of Farmer Bank and
Krungthep Bank, Bangkok served as the
controls. The major excluding criterions
were as follows; body weight \( \geq 120\% \) ideal,
a history of chronic disease (renal disease,
cancer, diabetes mellitus, heart disease,
and hypertension) alcohol intake, cigarette
smoking, oral contraceptive, hormonal
therapy, pregnancy, excessive physical
exercise and vitamin supplementation or stop
supplement less than 5 years. The study
protocol was approved by the Human Eth-
ics Committees of Ramathibodi Hospital,
Mahidol University and was explained to
the subjects before they gave their informed
consent.

Blood samples were collected after
an overnight fasting. Serum was separated
by centrifugation at 3,500 rpm for 10 min-
utes and aliquoted, then stored at \(-70^\circ\)C
until analysis. Serum ferritin concentration
was measured by using Vitros Immunodi-
agnostic system (Ortho-Clinical Diagnostics,
Amersham, UK). Serum iron levels were
photometrically assay.\(^{(14)}\)

**Statistical Analysis**

Statistical analysis was performed
with SPSS software, version 11.0. Data are
presented as mean \( \pm \) SD unless otherwise
stated. Normal distributions of data were
checked by using the Kolmogorov–Smirnov
test. For normal data, differences between
dietary groups within each sex were com-
pared with student t-test. For nonparametric
data, ferritin concentrations were reported
as medians and ranges. The Mann–Whitney
test was used for inter-group comparison.
Dealing with nominal data, the chi-square
test was employed to evaluate statistically
significant differences. Pearson correlation
coefficient was performed to assess the
association between serum ferritin and
variable factors. The levels of statistical
significance were set at \( p<0.05 \).

**Results**

The characteristics of the omnivore
and vegan subjects are shown in Table 1 as
separated by gender. In male subjects, the
mean age, weight and height did not differ
between the two dietary groups, except the
body mass index was lower in the vegans
than in those of omnivores (\( p=0.041 \)). The
vegan women had higher mean age but
lower in mean weight and height than the
omnivore women (\( p=0.006, 0.047, 0.002, \)
respectively). The body mass index in
female subjects did not differ between two
dietary groups. The averages of vegan diet
practice were 10.9 years (5–26 years) for
males and 12.0 years (5–29 years) for
females.
Results of biochemical parameters of iron status are presented in Table 2 and the distribution of serum ferritin in the two dietary groups is shown in Fig. 1. For male subjects, hematocrit values were not different between the omnivores and vegans, but male vegans had significantly lower of serum iron and ferritin concentrations when compared with male omnivores. Four (8%) vegan men had serum ferritin values below the cut-off point (defined as <12 ng/ml) for indication of depletion of iron stores. The female vegans had significantly lower of hematocrit values, serum iron and ferritin concentrations than those of female omnivores. The prevalence of iron depletion in female omnivores and vegans were 13% and 35% respectively. The frequency distribution patterns of serum ferritin were different between the two dietary groups of both females and males; the vegans had toward lower ferritin (Fig. 1A and 1B).

There were statistical significance correlations between serum ferritin levels and hematocrit values and between serum ferritin and serum iron in either omnivores and vegans (Table 3), but did not associate between serum ferritin concentrations and duration of vegan practices.

Discussion

Vegetarian diet has become increasingly popular in various countries including Thailand. Most vegetarians believe that vegetarian dietary practices are much healthier than eating large amount of meat. From the studies in Western countries it is known that various dietary vegetarian regimens have beneficial effects on health status and longevity. However, vegetarian diets or vegan diets that provided large amounts of iron absorption inhibitors, may lead to a deficiency of iron and consequent anemia. Because the vegetarian dietary practices were different from countries to countries and the reports have been limited in large number of vegan subjects. Therefore, we did the study the effect of vegan diets on iron status in Thai adult subjects.

All subjects in our study were in good health. Although the biochemical data of both dietary groups were in normal ranges, the values of plasma glucose, serum uric acid, cholesterol, HDL, LDL, total protein, albumin, blood urea nitrogen and creatinine were lower significantly in vegans than those of omnivores (data not shown).

Both omnivore and vegan groups were of comparable age and weight categorized by gender as shown in Table 1, except in female vegans had older and lower weight and height when compared with the omnivore women. However, these differences were not affected iron status. The duration of vegan practices ranged from 5 to 29 years, which was expected to be sufficient to demonstrate dietary effect on individual iron status.
Assessment of iron status in both omnivore and vegan subjects by analyzing of hematocrit, serum iron and ferritin concentrations are presented in Table 2 and the distribution of serum ferritin in both dietary groups by gender is shown in Fig. 1. In our study, the criteria of anemia and iron depletion were set at hematocrit <36 g\% and serum ferritin <12 ng/ml, respectively. Low hematocrit values were observed only in female vegans with 8 (13\%) of the 60 vegan females having a level <36 g%. This prevalence of anemia was similar to previous findings in female vegans by determining hemoglobin concentrations that reported 13\%(10) and 14\%(18), whereas some studies reported that hemoglobin and hematocrit values for both vegetarians and omnivores were within the normal ranges and were not significantly different.(8)

Serum iron is used for indication of iron transport tissues. It reflects the balance between several factors, including iron absorbed, iron used for hemoglobin synthesis, iron released by red cell destruction and iron stored. The serum iron concentration represents an equilibrium between the iron entering and the iron leaving the circulation. The result showed that both male and female vegans had significantly lower serum iron than the omnivores in respective sex (Table 2). In contrast to previous investigators showed that serum iron levels were similar between lactoovovegetarians and nonvegetarians(19) or between female vegetarians and female nonvegetarians but in male vegetarians had slightly increased.(20)

Median serum ferritin concentrations were significantly lower in vegans than in omnivores in both sexes (Table 2). This result agreed with the finding of several studies in both vegans(10) and vegetarians.(7-9,13)

When values of serum ferritin <12 ng/ml was considered as an indicator for iron deficiency, the prevalences of iron deficiency were significantly higher in female vegans (35\%) than those of female omnivores (13\%), 2.7 times higher, but did not differ in male subjects between the dietary groups. Some investigators found that there was no difference in the prevalences of iron deficiency between female vegans and females omnivores(10,20), because they studied in small sample size (n=15) and some vegans took iron supplements.(10) Serum ferritin concentrations tended to be distributed toward the lower end of the reference range in the vegans but toward the higher end in the omnivores of both sexes as shown Fig. 1A and 1B. These observations were confirmed by other.(8) Levels of serum ferritin were correlated with either hematocrit values or serum iron concentrations in both omnivores and vegans (Table 3), but not associated with years on vegan diets. Lack of correlation between serum ferritin concentrations and years of vegan practice was also noted by Shaw N-S.(9) When employing the low
serum ferritin and low hematocrit values to define iron deficiency anemia (IDA), 7 (12\%) female vegans had IDA. In general, iron deficiency was more common in females than in males because male adults typically have iron storages more than females, 1 g vs. <0.5 g respectively.\(^{(21)}\) Normally, women have increased iron loss due to menstruation and lower iron intake due to low energy consumption.\(^{(22)}\) Apart from low iron status, low serum vitamins B12 and B6 were also found in 65 (60\%) vegans and 7 (6.4\%) vegans respectively (data not shown).

Several studies have been demonstrated that vegetarians have iron intakes higher than\(^{(9,10,20)}\) or similar to\(^{(8)}\) those of omnivores. The major sources of dietary iron for vegetarians include whole-grain and fortified cereals, legumes, dark-green vegetables, nuts, seeds and dried fruits (e.g., dates, figs, raisins, and prunes).\(^{(23)}\) Ball and Batlett\(^{(8)}\) reported that approximately 80\% of all dietary iron in their vegetarians was from cereals and cereal products (29.8\%), vegetables (27.1\%), breakfast cereals (15.0\%), and fruit (6.4\%), whereas in omnivores approximately 80\% of all dietary iron was from cereals and cereal products (27.7\%), meat and meat products (16.1\%), vegetables (16.0\%), breakfast cereals (15.0\%), and nonalcoholic beverages (4.6\%). We speculated our vegans (males and females) adequate iron intake by interviewing yet both showed impaired iron status, indicating that lower iron bioavailability was the major determinant. The bioavailability of dietary iron can be reduced considerably by the phytic acid and possibly other constituents of some plant foods.

One possibility to prevent and treat iron deficiency in vegan population who avoid foods of animal origin, and have already remarkably high mean daily vitamin C intake when compared to the average population, is the consumption of iron supplements. Absorption is enhanced when the supplement is taken between meals rather than with meals, and when the supplement is taken with water or juice rather than with tea, coffee or milk.\(^{(6)}\) Iron from a multivitamin mineral supplement is absorbed to a lesser extent than from an equivalent amount of iron given alone.\(^{(24)}\) Due to the decreased absorption, it seems advisable to select multivitamin mineral products that contain 60 mg of iron rather than the recommended dose of 30 mg. The calcium content of these products should be no more than 250 mg.\(^{(5)}\) Nevertheless iron supplementation seems to be the best way for curing and preventing iron deficiency in vegan population.

**Conclusion**

Iron deficiency status was significantly more prevalence in females vegans. Advice to reduce the risk of iron deficiency is not only taking rich sources of iron in the diet (iron-fortified breakfast cereals) but
also taking dietary components (e.g vitamin C rich food and drinks) that may improve iron absorption or taking iron supplements in form of tablet.

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