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□ Original Article □

Dietary Iron Intake and Body Iron Status of Myocardial Infarction Patients in Chunan Area*

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ABSTRACT

It has been known for some time that elevated body iron could be a risk factor for coronary heart disease. The present study was conducted to determine body iron status and dietary iron intake of patients with myocardial infarction(MI). Seventy five patients from the Chunam area with their first MI history within the past 2 months were recruited. The serum iron concentration, total iron binding capacity(TIBC) and percent transferrin saturation(TS) were selected as indicators of body iron status. Twenty four hour recall was conducted by trained interviewers to assess the dietary intake. Most women(91.3%) showed waist to hip ratio(W/H) greater than 0.85 while 17.3% of men were assessed to have a tendency of abdominal obesity(W/H>0.95). The average BMI of women was 25.80 and that of men was 23.98. The average diet intake of participants was below the recommended dietary allowances(RDA) for most nutrients. The average dietary iron intake was 10.03 mg/day for all subjects while women's iron intake was significantly lower than men's. However, a great proportion of participants(77%) showed a tendency to have normal iron status. About 9% of the participants were assessed as iron deficient and 14% had an iron overload. The mean serum iron concentration was 125 g/dl ranging from 13.3 to 280.6 g/dl. Iron intake from animal sources were significantly associated with body iron status($r=0.257$, $p=0.026$) when TIBC was used as an iron status indicator. When iron status was assessed with TS, it was directly associated with iron intake from animal sources($r=0.278$, $p=0.05$) for the subjects in the normal iron status group. The results of the present study showed that the nutrient intake of MI patients in Chunan was not quite adequate while iron status was mostly in the normal range. Further studies are needed to investigate whether there is a possible difference in iron metabolism of the MI patients. (*Korean J Community Nutrition* 1(2) : 140~147, 1999)

KEY WORDS : myocardial infarction patients · dietary iron · iron status.

Introduction

Coronary heart disease(CHD) is the leading cause of death in most developed countries and incidences of CHD in Korea have been remarkably increased during the last decade(Cho et al. 1997). The response to injury hypothesis explains atherosclerosis as a chronic inflammatory response to injury of the endothelium, which leads to complex cellular and molecular interactions among cells derived from the endothelium and several blood cell components. Inflammations and other stimuli trigger an overproduction of free radicals, which promote peroxidation of lipids in low density lipoprotein(LDL) trapped in the subendothelial space, which has been postulated to be involved in the development of atherosclerosis(Steinberg et al. 1989). Free iron catalyzes free radical production, which generates a range of potent oxidants that can induce oxidation of lipids(Cross et al. 1987 ; Halliwell & Gutteridge 1990 ; McCord 1991). Thus, free iron advances the development of atherosclerosis, and therefore increases the risk of CHD by promoting the oxidation of lipids(Klipstein-Grobusch et al. 1999). The supporting evidence arises from a cohort study of eastern Finnish men, in whom high body iron status and dietary iron were positively associated with the incidence of myocardial infarction(Salonen et al. 1990). Furthermore, body iron store was observed to be one of the strongest indicators of the presence and progression of carotid artery disease(Kiechl et al. 1994 ; Kiechl et al. 1997).

Since many nutritional factors including iron intake contribute to risk for CHD, recent changes in diet and

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life style have been repeatedly suggested to be the important causes for the CHD increase in Korea. Despite the changes in diet patterns of Koreans, iron deficient anemia is still prevalent in Korea while incidences of CHD are increasing. Several studies showed that iron status or dietary iron intake were associated with increased risk of CHD(Corti et al. 1997 ; Magnusson et al. 1994 ; Morrison et al. 1994 ; Sempos et al. 1994). There are, however, no previous reports concerning the relation of iron status to the risk of CHD in Korea.

The objectives of the present study were to assess the iron status of Korean myocardial infarction(MI) patients using several indicators of iron status and to investigate the relation of dietary iron intake to the iron status. In addition, iron status and dietary iron intake were compared by sex and the association of dietary iron intake with iron status was also compared by the amount of iron intake.

Methods

1. Subjects

The study population consisted of patients living in Chunan, Chungnam area with a verified history of first MI within at least 2 months before the study. The subjects were aged from 35 to 77 years old(n=75) and were recruited from the Chunan hospital of Soonchunhyang University and congregated on the 7th of July for the study and cardiac rehabilitation program. As presented in Fig. 1, there were 1.3% of participants of age thirties, 10.7% of forties, 18.7% of fifties, 40.0% of sixties and 29.3% of seventies. All subjects were received a detailed description of the study protocol and informed consents were obtained. Since the purpose of congregation was cardiac rehabilitation program, all subjects participated education program including nutrition education, exercise, and drug therapy after survey for the study. Rehabilitation program started after survey so that nutrition education would not affect patients' dietary habits until the congregation.

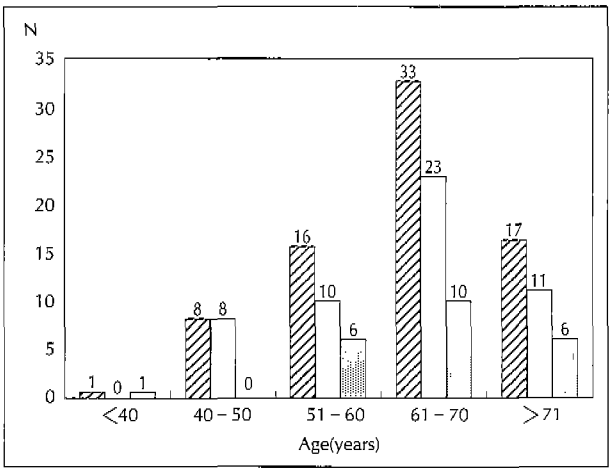

Fig. 1. Age distribution of participants.

2. Baseline information and experimental measurements

Information on current health status, medical history and drug use was obtained with a survey form by trained interviewers. Height and weight were measured and body mass index [wt(in kg)/ht^2(in m)] was calculated. Sitting blood pressure was measured on the right upper arm with a random-zero sphygmomanometer.

Fasted blood samples were collected by trained phlebotomists from an antecubital vein of each subject, then made visible by temporary use of a tourniquet, into two 7-ml vacutainers. Samples were brought back to the laboratory on ice and processed within 1 hour of collection. Serum total and HDL-cholesterol(HDL-C) concentrations were determined by using an automated enzymatic procedure. Values for LDL-cholesterol(LDL-C) were calculated by Friedwald's equation(Friedwald et al. 1972). Serum samples collected from all subjects were processed and frozen at −80℃ until used to determine concentrations of serum iron(SI), total iron binding capacity(TIBC) and transferrin saturation(TS).

Before analysis, frozen specimens were thawed at room temperature. SI and TIBC were determined in duplicate on an automated analyzer(7150, Hitachi, Japan). All samples were analyzed in a single batch to eliminate any batch-to-batch analytical variation. TS values were computed from the values of SI and TIBC.

3. Dietary assessment

Twenty four hour recall was conducted by one to one interview with trained interviewers. Detailed descriptions of all foods and beverages consumed and estimated food portion sizes were recorded by interviewers with the use of food models, standard household measures and natural-sized colored photographs as memory aids. Twenty four hour recall data were converted to nutrient intake by using the computer aided nutrient analysis program (CAN-pro). Nutrient intakes from nutritional supplements were not considered because brand labels, doses, and du-

rations were not recorded with sufficient accuracy. Nutrient intakes were calculated as percent of recommended dietary allowance(RDA) according to RDA values of each sex and age.

4. Statistical analysis

Association between dietary iron intake and iron status for patients with MI were investigated by using Pearson's correlation coefficients ; those for categorical variables were investigated by using the chi-square test. Students' t-test was used to examine gender differences in baseline characteristics and to compared values between groups with different levels of dietary iron intake(groups of iron intake more than 75% RDA and less than 75% RDA). To evaluate whether there was a graded association between dietary iron intake and iron status, analyses were performed for three different iron status groups (deficient, normal and overload). Statistical analyses were performed by using SPSS statistical software.

Results

Subject characteristics were shown in Table 1. Male and female subjects differed significantly in BMI. Sixty five percent of female subjects showed BMI values higher than 25 while 29% of male subjects showed BMI over 25. The waist to hip ratio of the subjects was 0.92. More female subjects(91.3%) showed a tendency of abdominal obesity(W/H ratio$>$0.85) than male subjects(17.3% were W/H ratio$>$0.95). There were no gender differences in serum lipid profiles and blood pressure(BP). More men showed hypertension while more women were diabetes.

Table 1. Baseline characteristics of subjects with myocardial infarction

Variables	Total(n=75)	Men(n=52)	Women(n=23)
Age(year)	63.33±9.07[1)]	63.05±9.13	63.96±9.08
Body mass index(kg/m^2)	24.52±2.49	23.98±2.34	25.80±2.38*
Waist-to-hip ratio	0.92±0.04	0.92±0.04	0.92±0.05
Serum cholesterol(mg/dl)	188.91±45.38	183.41±38.79	201.35±56.48
Serum HDL cholesterol(mg/dl)	42.10±8.34	42.24±8.80	41.77±7.39
Serum LDL cholesterol(mg/dl)	112.97±59.67	113.98±33.58	110.65±48.69
Diastolic blood pressure(mmHg)	89.60±12.46	90.19±13.50	88.26±9.84
Systolic blood pressure(mmHg)	136.13±22.17	135.96±24.27	136.52±16.95
Hypertension(%)[2)]	22.0	25.1	15.2
BP lowering medication(%)[3)]	65.3	65.4	65.3
Diabetes(%)	28.0	23.1	39.1

1) Values are mean±SD
2) Defined as a systolic blood pressure$>$160mmHg, a diastolic blood pressure$>$95mmHg
3) Beta-blocker
*Significantly different from values in the same row, $p<0.05$

Table 2. Mean daily nutrient intake of subjects

Nutrient	Total		Male		Female	
	Intake	%RDA	Intake	%RDA	Intake	%RDA
Energy(kcal)	1511.3±446.2[1)]	66.25	1613.4±459.7	67.23	1280.6±315.7	64.03
Protein(g)	58.1±26.2	82.02	64.6±27.5	86.13	43.6±15.7	72.73
Fat(g)	26.7±22.0		29.9±24.5		19.3±11.9	
Carbohydrate(g)	250.1±62.7		258.1±63.4		231.8±58.1	
Calcium(mg)	477.9±253.2	68.27	532.7±266.5	76.10	353.9±166.9*	50.56
Phosphorus(mg)	955.3±352.0	136.47	1049.7±368.1	149.97	741.8±184.3*	105.90
Iron(mg)	10.0±4.0	83.58	10.8±4.2	90.08	8.3±2.9	68.88
Vitamin A(gRE)	681.9±912.2	97.43	775.4±1011.7	110.78	470.7±598.9	67.24
Ascorbic acid(mg)	82.3±48.8	149.67	87.0±53.6	158.23	71.7±34.6	130.30
Thiamin(mg)	0.92±0.36	80.42	0.97±0.36	81.08	0.79±0.35	78.91
Riboflavin(mg)	0.68±0.30	50.43	0.76±0.31	54.21	0.50±0.22*	41.89
Niacin(g)	12.75±6.73	83.77	14.29±7.43	89.32	9.26±2.49*	71.20
Sodium(mg)	4267.2±1725.8		4634.4±1816.6		3437.0±1153.0	

1) Values are mean±SD
*Significantly different between sex groups at $p=0.05$

Table 3. Mean daily iron intake and iron status of subjects by sex

Variables	Unit	Total(n=75)	Male(n=52)	Female(n=23)
Total iron intake	mg/d	10.03±4.01[1)]	10.81±4.21	8.27±2.86*
Iron intake from animal source	mg/d	2.49±2.50	2.96±2.79	1.43±1.10*
(% animal Fe/total Fe)		(23.21±14.49)	(25.89±14.62)	(17.12±12.47)
Iron intake from plant source	mg/d	7.54±2.96	7.85±3.14	6.84±2.43
(% plant Fe/total Fe)		(76.79±14.50)	(74.10±14.62)	(82.87±12.82)
% of RDA	%	83.58±33.41	90.08±35.12	68.87±23.87*
SI	μg/dl	125.41±50.09	134.38±51.78	102.54±35.49*
TIBC	μg/dl	328.43±34.76	328.46±36.58	321.70±27.74
TS	%	37.65±12.63	40.23±12.63	31.62±9.73*

1) Values are mean±SD *Significantly different between sex groups at p=0.05

Sixty five percent of the subjects were taking BP lowering medication.

Table 2 showed the average daily nutrient intake of the subjects. Intakes of phosphorus and ascorbic acid were more than RDA while intakes of other nutrients were less than RDA. Intakes of calcium, phosphorus, riboflavin and niacin of female subjects were significantly lower than those of male subjects. Intakes of calcium and riboflavin were especially low for most subjects. Percentages of subjects showed more than 75% of RDA of calcium and riboflavin intakes were only 37% and 13%, respectively.

The amount of iron intake, percent of RDA and iron status determined by different indicators were presented by gender in Table 3. Men showed a higher amount of dietary iron intake. Iron intake especially from animal sources was more than double the women's intake. Overall iron intakes of the subjects were less than the RDA and women's average iron intake was 68.87% of the RDA. The iron status of most subjects(77%) determined by 3 different indicators, which were SI, TIBC and TS, was within normal range. Cut-off values of three indicators to assess the normal range of iron status were 65-175g/dl for SI (Klipstein-Grobusch et al. 1999), 300-360g/dl for TIBC (Gibson 1990) and 20-60% for TS(Gibson 1990). More women were iron deficient(10.2%) than men(8.3%) while more men(16.0%) showed above normal range of iron status than women(10.1%). Iron status of female subjects was significantly lower than that of male subjects when assessed by SI and TS.

Fig. 2 showed the assessment of iron status using 3 indicators. Proportions of participants who were assessed as iron deficient were 8.0%, 13.3% and 5.3% when assessment was conducted by SI, TIBC and ST, respectively. When assessment was conducted with TIBC, the proportion of participants, belonging to the normal range(65.3%) was least among the 3 indicators(77.3% for SI, 88.0% for TS). The proportions of participants assessed as iron overloaded were 14.7%, 21.4% and 6.7% by SI, TIBC and TS, respectively. Overall proportions of iron status calculated as an average of the results from 3 indicators were 8.9%, 76.9%, 14.2% of deficient, normal and overloaded, respectively.

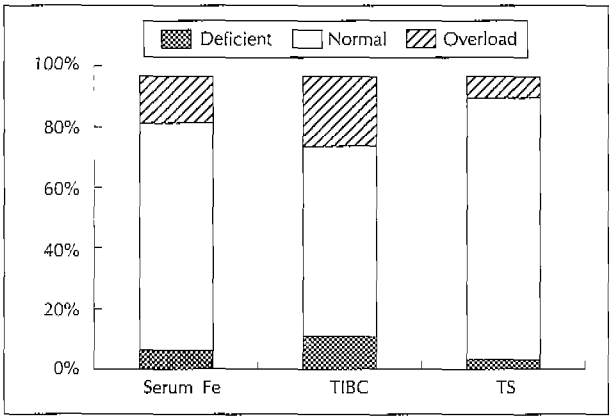

Fig. 2. Distribution of subjects by iron status when assessed with three indicators.

The relation of iron intake to iron status was tested using Pearson's correlation but no significant correlation was reported(data not shown). To evaluate whether there was graded association between dietary iron intake and iron status, subjects were grouped by the amount of iron intake as adequate intake group and inadequate intake group. The adequate intake group was subjects with an iron intake of more than 75% RDA and the inadequate intake group was subjects with iron intake of less than 75% RDA. Table 4 showed the amount of iron intake and body iron status when subjects were grouped by amount of iron intake. When iron status was determined

by TIBC, no significant difference was observed between the adequate intake group and the inadequate intake group. Therefore, results of iron status assessment could be different depending on the selected indicator.

The amount of dietary intake of subjects in deficient, normal and overload groups and the relation of iron intake and iron status when subjects were categorized by iron status were shown in Table 5. The mean serum iron concentration was 125g/dl ranging from 13.3 to 280.6g/dl. In a total of 75 serum samples, 77%(58 of 75) had iron levels between 65-175g/dl, the level at which iron nutrition is being considered adequate(Gibson 1990 ; Klipstein-Grobusch et al. 1999). Only 8%(6 of 75) of the participants had serum iron levels indicative of iron deficiency and 15%(11 of 75) were assessed as iron overloaded. The relation of iron intake to body iron status was tested using Pearson's correlation. No significant correlation was found except that iron intake from animal sources was significantly associated with body iron status($r=0.257$, $p=0.026$) when TIBC was used as an iron status in-

Table 4. Mean daily iron intake and body iron status of subjects when categorized by amount of iron intake

Variables	Unit	Inadequate intake[1](n=30)	Adequate intake[2](n=45)
Total iron intake	mg/d	6.66±1.39[3]	12.17±3.59*
Iron intake from animal source(% animal Fe/total Fe)	mg/d	1.34±0.84	3.26±2.92*
Iron intake from plant source(% plant Fe/total Fe)	mg/d	5.32±1.51	9.01±2.77*
% of RDA	%	55.54±11.56	102.27±29.93*
SI	μg/dl	124.29±45.23	124.84±52.50
TIBC	μg/dl	329.50±33.59	324.31±34.61
TS	%	37.72±10.91	37.84±13.43

1) Iron intake less than 75% RDA 2) Iron intake more than 75% RDA
3) Values are mean±SD *Significantly different between groups at p=0.05

Table 5. Associations of dietary iron intake to iron status according to three iron status groups

Variables	Total	Stages of iron status			Remarks
		Deficient	Normal	Overload	
SI					
Mean(μg/dl)	125.41±50.09[1]	44.90±20.84	116.72±28.38	209.77±33.27	
(n)	(75)	(6)	(58)	(11)	
Cut-off range(μg/dl)		<65	65-175	>175	
Dietary iron intake(mg/d)	10.03±4.01	9.87±3.57	9.52±3.58	12.80±5.45	
Correlation(r)	0.114	-0.288	-0.053	-0.457	
Iron intake from animal source(mg/d)	2.49±2.50	2.65±1.66	2.06±1.48	4.70±5.09	
Correlation(r)	0.192	-0.759	0.071	-0.283	
TIBC					
Mean(g/dl)	328.43±34.76	383.40±21.43	329.29±16.78	281.88±15.62	
(n)	(75)	(10)	(49)	(16)	
Cut-off range(g/dl)		>360	300-360	<300	
Dietary iron intake(mg/d)	10.03±4.01	11.63±5.84	9.56±3.38	10.46±4.43	
Correlation(r)	0.050	0.138	0.011	-0.214	
Iron intake from animal source(mg/d)	2.49±2.50	4.43±5.58	2.17±1.55	2.26±1.21	
Correlation(r)	0.257*	0.317	0.066	-0.111	p=0.03
TS					
Mean(%)	37.65±12.63	11.59±6.63	37.14±8.70	64.34±3.37	
(n)	(75)	(4)	(66)	(5)	
Cut-off range(%)		<20	20-60	>60	
Dietary iron intake(mg/d)	10.03±4.01	10.29±2.27	10.05±4.15	9.57±3.66	
Correlation(r)	0.111	-0.705	0.229	-0.156	
Iron intake from animal source(mg/d)	2.49±2.50	3.32±0.98	2.43±2.59	2.61±1.73	
Correlation(r)	0.133	-0.717	0.278*	-0.446	p=0.05

1) Values are Mean±SD *Statistically significant at p value presented in remarks

Table 6. Assessment of iron status by amount of iron intake

Iron status		Cut-off range	Total (n=75)	Amount of iron intake		Remarks
				Inadequate[1]	Adequate[2]	
SI		(μg/dl)				
	Deficient	<65	6(8.0)[3]	2(6.7)	4(8.9)	χ^2=2.586
	Normal	65 - 175	58(77.3)	26(86.7)	32(71.7)	df=2
	Overload	>175	11(14.7)	2(6.7)	9(20.0)	p=0.240
TIBC		(μg/dl)				
	Deficient	>360	10(13.3)	4(13.3)	6(13.3)	χ^2=0.055
	Normal	300 - 360	49(65.3)	20(66.7)	29(64.4)	df=2
	Overload	<300	16(21.3)	6(20.0)	10(22.2)	p=0.973
TS		(%)				
	Deficient	<20	4(5.3)	1(3.3)	3(6.7)	χ^2=0.398
	Normal	20 - 60	66(88.0)	27(90.0)	39(86.7)	df=2
	Overload	>60	5(6.7)	2(6.7)	3(6.7)	p=0.820

1) Iron intake less than 75% RDA 2) Iron intake more than 75% RDA 3) Number of subjects(%)

dicator(Table 5). Again, assessment of iron status differed depending on the indicator. When iron status was assessed with TS, iron status was directly associated with iron intake from animal source(r=0.278, p=0.05) for the subjects in the normal iron status group(Table 5).

In Table 6, assessment of iron status by the intake of iron was presented. The distribution of serum iron concentrations was not significantly different between two groups by chi-square analysis when subjects were grouped by the amount of dietary iron intake. When TIBC and TS were used as iron status indicator and the subjects were divided into adequate intake group and inadequate intake group according to iron status groups, the values were not significantly different. As shown in Table 6, greater proportion of participants in adequate intake group showed a tendency of iron overload when SI was used as an iron status indicator. Twenty percent of participants in adequate intake group were iron overload, while 6.7% of participants in inadequate intake group were iron overload. Ironically, a greater proportion of participants in adequate intake group(8.9%) showed a tendency of deficient when compared with inadequate intake group(6.7%). Most subjects(average 77% of values from 3 indicators) belonged to normal range of iron status. Even 81%(average of values from 3 indicators) of participants in inadequate iron intake group showed normal iron status.

Discussion

The results of the present study showed that the overall diet intake of MI patients in Chunan area was not adequate. Amount of iron intake was inappropriate for both men and women although range variations were large(3.63 - 23.70mg/day). More women showed a tendency of insufficient iron intake. Iron status, however, was mostly in normal range(more than 77%). The discrepancy observed could be explained either by underreporting tendency of elderly people in dietary survey(Kye et al. 1999) or by some other factors such as disease(MI) related or age related physiological changes which could result in changes in iron metabolism(Herbert 1990 ; Vogel 1980 ; Yip & Dallman 1984). However, it is unfortunate that with the present results of this study, sufficient explanations of the disease related changes in iron metabolism can not be provided. Further study is needed on that matter.

There have been several reports on underreporting in food recording results among elderly, women and obese subjects(Briefel 1997 ; Mertz et al. 1991). Since 70% of the participants of this study were over 60 years old, few results of 24 hr recall reported by elderly subjects could be underestimated. As shown in Table 6, higher proportion of participants in inadequate intake group belonged to normal iron status group than adequate intake group. If subjects of this study had tendency to underreport their actual food intake, results of other nutrients intake could be also underestimated. Considering for all that, there were a few nutrients reported as more than 100% of RDA(Table 2). Especially high sodium intake should be seriously considered since subjects of the present study were patients with MI history. Appropriate

nutrition education for patients must be conducted continuously.

According to anthropometrical data, male and female subjects differed significantly in BMI. Waist to hip ratio of all subjects was 0.92(Table 1). Since W/H ratio greater than 0.95 in men and 0.85 in women indicates a tendency of an abdominal obesity which is known to be at high risk of obesity-related health problems such as heart disease, hypertension and diabetes(Kushner 1993), there were more female subjects with android obesity than male subjects in the present study. In addition, there were more women with diabetes which is also well known risk factor for CHD.

Although no significant relation was observed between dietary iron intake and body iron status, iron intake from animal source was significantly correlated to body iron status when iron status was determined with certain indicators. The results of iron status were different according to the iron status indicators used. Recent reviews presented conflicting results with studies investigating whether iron status can be considered a CHD risk factor. It is not surprising since there was a previous report announcing that none of the indicators of iron status elevated hemoglobin(Hb), hematocrit(Hct), SI, transferrin, TS, TIBC or ferritin accurately reflects body iron(Cook et al. 1974).

In the present study, SI, TIBC and TS were selected as indicators of iron status. The decision regarding which indicators to use in determining iron status should be made with caution since most of traditional measures are known to vary to some degree with age, sex and/or a number of factors, including variability, sensitivity and specificity of the measurements(Bothwell 1979). It has been also reported that there were age-related physiological changes, such as a decrease in Hb, Hct, SI, TIBC and an increase in serum ferritin(Herbert 1990). When variability in biochemical indicators of iron status in elderly population was tested, the order of variability was lowest in Hct, Hb, TIBC, serum ferritin, SI and TS (Ahluwalia 1993). Hct and Hb, however, are not generally considered to be good indicators of iron status since values of these indicators start to fall only after body iron stores are depleted(Gibson 1990). The analytical variation for the serum ferritin assays was more than double that of the assays for SI and TS even though serum ferritin was proposed by Skikne et al.(1990) as reliable measures of storage iron in a healthy elderly female population. In the present study, due to the lack of feasibility of serum ferritin assay regarding a matter of costs and benefits, serum ferritin was not selected as an iron status indicator. Even though SI and TS showed relatively high biological variability, if blood samples were drawn in a fasted state it was possible to obtain reliably accurate variability estimates(Ahluwalia 1993). Intraindividual variation in iron status indexes is important from a diagnostic and assessment point of view because a single determination would be unreliable and may provide inaccurate information for assessment. In order to improve the sensitivity and reliability of diagnosis and classification of iron status it is important to chose a combination of indexes to complement each other(Cook et al. 1976).

Especially for elderly population such as population of the present study, based on the fact that there are changes in iron status with aging and the significant impact which many chronic diseases have on iron status such as a shift of iron from the transferrin and red cell compartments into the storage pool, selecting a combination of iron status indexes was an important key point to be considered seriously. TIBC showed a relatively low biological and intraindividual variation(Ahluwalia 1993) and TS is crucial to the multiple indicator approach for diagnosing iron status as one of the key indicators of iron deficient erythropoiesis(Cook et al. 1976). Therefore, in spite of a few drawbacks, a combination of TIBC, SI and TS as iron status indexes was expected to give a relatively reliable data. Results showed some discrepancies in assessing iron status of the participants(Fig. 2). However, it was unavoidable under the conditions of the present study such as physiological states of the participants. Some patients with MI are expected to have inflammations or infections which might alter SI and/or TIBC.

In conclusion, baseline data showed that women had more generally known CHD risk factors such as high BMI, W/H ratio, diabetes than men. Although more hypertension cases were observed in men than in women, it should be cautiously interpreted since most participants were under BP lowering medication. Both amount of dietary iron intake and body iron status were higher in men than in women. Results from women showed insufficient intake of most nutrients. There may be gender differences in mechanisms of pathophysiological changes in MI patients.

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