

A Study on Hematological Index and Health-Related Habit according to the BMI of Middle-Aged Men

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ABSTRACT

This research analyzed the hematological index and health related habits such as alcohol drinking, smoking and exercise, by classifying 539 middle-aged men (age: 40 – 59) into a normal weight group, an overweight group and an obese group, according to BMI (body mass index). As a result, 33.6% (n = 181) of subjects had a BMI of 23 or less and 30.2% (n = 163) were overweight and 36.2% (n = 195) were obese (BMI > 25). The average systolic/diastolic blood pressures of total subjects were 130.96mmHg and 80.38mmHg, respectively. And the average pressure of normal subjects was 126.85/77.57mmHg, which was significantly lower than in overweight and obese subjects. Diastolic blood pressure shows significant differences among the three groups. The overall average cholesterol level of normal subjects was 193.81mg/dl, which was significantly lower than those in overweight subjects. Those in obese subjects were significantly higher than in overweight subjects. The GOT (glutamic oxaloacetic transaminase), GPT (glutamic pyruvic transaminase), γ -GTP (gamma-glutamyl transpeptidase) levels of obese subjects were significantly higher than in the overweight subjects. Frequency of alcohol drinking showed no significant difference among the groups. The smoking ratio in the obese group was higher than in the normal and overweight groups. The ratio of smokers was 53.1%, and the alcohol drinking ratio was 81.0% of the total subjects. The frequency of drinking showed significant correlations with systolic blood pressure ($p < 0.05$) and diastolic blood pressures ($p < 0.01$) and γ -GTP ($p < 0.01$). The duration of smoking showed a negative correlation ($p < 0.01$) with diastolic blood pressure, total cholesterol and γ -GTP. On the other hand, exercising frequency showed negative correlations with blood glucose, γ -GTP and GPT ($p < 0.01$). These hematological indices were correlated with health related habits such as alcohol drinking, smoking and lack of exercise, and to be the cause of chronic diseases. Therefore, proper nutritional education is needed to establish advisable health-related habits to maintain proper body weight. (*J Community Nutrition* 8(2): 63~68, 2006)

KEY WORDS: BMI · hematological index · smoking · drinking · exercises.

Introduction

The Westernization of dietary life has deepened the nutritional imbalance and increased the prevalence of adult diseases such as obesity, cardiovascular disease, diabetes and hypertension. According to a national nutrition survey in 2001, 46% of Koreans were chronic disease patients for more than a month annually, and this rose 15% compared to 1995 (Ministry of Health and Welfare 2002). Obesity is associated

with many diseases including cardiovascular disease, cancer, high blood pressure, diabetes, gallbladder diseases and respiratory disease, and also is deeply related to individuals' health related habits (Nieman 1992).

Unhealthy lifestyles such as smoking, alcohol consumption and lack of exercise as well as unbalanced nutrition lead to various diseases, causing many to lead unhealthy elderly lives. It can be stated that maintaining balanced nutrition based on adequate food intake is essential toward a healthy senescence (Lee 2004).

During adulthood, as we age, lean body mass decreases and body fat increases; as bodily components change, fat tends to be stored in the abdomen. In other words, obesity is likely to occur during middle age. From the national health and nutrition survey in 2001 (Ministry of Health and Welfare

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2002), 32.2% of males in their 30s to 50s, and 40.0% of females in their 30s to 50s, were overweight (including obese), with a body mass index (BMI) of 25.0 or more. Accordingly, obesity's prevalence among middle-aged Koreans has become a problem to be carefully observed.

The average serum cholesterol and triglyceride levels are on the increase for Korean adults as well as the morbidity rate of diseases caused by arteriosclerosis (Korean National Statistical Office 2002). This research targeted middle-aged men in Ulsan City to investigate the differences in daily life habits and hematological index between the normal weight group and the overweight group, and to analyze their correlations. This research is to be utilized as basic data collection to prevent chronic degenerative disease or to lower its prevalence.

Subjects and Methods

1. Subjects and questionnaire

The subjects of this study were 539 male workers aged 40 – 59 living in Ulsan Metropolitan City. The Korean Society for the Study of Obesity (2000) classified people by their BMI value: the normal group is 18.5 – 22.9 (n = 181), the overweight group is 23 – 24.9 (n = 163), and the obese group is 25 or more (n = 195). Information on lifestyles such as alcohol consumption, smoking and exercise was obtained through a questionnaire.

2. Physical characteristics

The height and weight were measured with automatic instrument (Fanocs model: Fa-95) and body mass index (BMI) was calculated. The systolic/diastolic blood pressures were measured.

3. Measurement of hematological index

After taking fasting blood samples, hemoglobin concentrations were measured with Automatic Blood Cell Counter

(Sysmex NE 8000, Toa Medical Electronics Co., Japan). Each serum separated by centrifugal separator was stored under -70°C . Total cholesterol and blood glucose were analyzed by automatic blood analyzer (747, Hitachi, Japan), And, GOT (glutamic oxaloacetic transaminase), GPT (glutamic pyruvic transaminase), γ -GTP (gamma-glutamyl transpeptidase) levels were measured using the Boehringer Mannheim kit (German).

4. Statistical Analysis

All data collected were statistically analyzed, using SPSS PC+ package. For each variable, the values of average and standard deviation were calculated. The differences of anthropometric characteristics, hematological indices, health-related habits by obesity analyzed by one-way analysis of variance (ANOVA) with Duncan's Multiple Test at $p < 0.05$. The correlation between the health-related habits and hematological indices were identified for significance by Pearson's correlation coefficient.

Result and Discussion

1. Anthropometric characteristics of the subjects

Table 1 shows the physical measurements of the subjects. As a result, 33.6% of subjects had a BMI of 23 or less, and 30.2% were overweight and 36.1% were obese, with a BMI of 25 or more. According to Woo and Kim's research (1997) the ratio of men with a BMI of 25 or more was 23.6% of working men aged 34 – 64 in the Daejeon area, and Park and Koo (2001) research showed that 25.7% were obese. Meanwhile, the research of Lee et al. (2004) revealed that 44.6% of the middle-aged men in Seoul had a BMI of 25 or more, which was higher than the results of this research. The average height and weight of the total subjects was 170.68 cm and 70.42 kg, respectively. These results were similar to the result of the other study conducted in Ulsan (You and Kim 2003). The average BMI of the total subjects was 24.15

Table 1. Physical characteristics of subjects

Variables	BMI			
	Normal (n = 181)	Overweight (n = 163)	Obese (n = 195)	Total (n = 539)
Age (years)	47.51 ± 7.82	47.42 ± 8.02	46.68 ± 5.24	47.19 ± 5.13
Height (cm)	170.75 ± 5.05	170.26 ± 4.81	170.96 ± 5.32	170.68 ± 5.08
Body weight (kg)	62.20 ± 5.46 ^c	69.42 ± 4.25 ^b	78.89 ± 7.02 ^a	70.42 ± 9.06
BMI (kg/m ²) ¹⁾	21.31 ± 1.36 ^c	23.92 ± 0.58 ^b	26.96 ± 1.78 ^a	24.15 ± 2.73

1) BMI (kg/m²): Body mass index

2) Values with the different letters are significantly different from the others within the same row ($p < 0.05$)

Table 2. Blood pressure and hematological index of the subjects

Variables	BMI			
	Normal (n = 181)	Overweight (n = 163)	Obese (n = 195)	Total (n = 539)
SBP ¹⁾	126.85 ± 14.87 ^b	131.38 ± 14.90 ^a	134.41 ± 14.27 ^a	130.96 ± 14.97
DBP ²⁾	77.57 ± 9.57 ^c	80.61 ± 10.34 ^b	82.79 ± 9.91 ^a	80.38 ± 10.15
Hemoglobin (g/dl)	14.39 ± 0.94	14.61 ± 1.04	14.90 ± 0.90	14.63 ± 0.98
Blood glucose (mg/dl)	87.61 ± 22.43	88.47 ± 28.33	89.79 ± 24.96	88.66 ± 25.21
Total cholesterol (mg/dl)	193.81 ± 35.13 ^c	202.01 ± 39.42 ^b	218.85 ± 41.94 ^a	205.35 ± 40.36
GOT (unit/l) ³⁾	23.87 ± 8.52 ^c	26.68 ± 10.11 ^b	31.27 ± 12.99 ^a	27.40 ± 11.21
GPT (unit/l) ⁴⁾	24.65 ± 15.77 ^c	30.44 ± 19.80 ^b	45.07 ± 30.95 ^a	33.79 ± 24.98
γ-GTP (unit/l) ⁵⁾	34.72 ± 55.54 ^b	37.77 ± 37.15 ^b	61.25 ± 46.35 ^a	45.24 ± 48.67

1) Systolic blood pressure, 2) Diastolic blood pressure, 3) Glutamic oxaloacetic transaminase, 4) Glutamic pyruvic transaminase

5) Gamma-glutamyl transpeptidase

6) Values with the different letters are significantly different from the others within the same row (p < 0.05)

Table 3. Frequency of exercise, drinking, smoking of the subjects

Variables	BMI			Total (n = 539)	χ ²	
	Normal (n = 181)	Overweight (n = 163)	Obese (n = 195)			
Frequency of exercise	Never	46 (25.4)	34 (20.9)	52 (26.7)	132 (24.6)	21.94*
	1~2 times /week	77 (42.5)	70.3 (42.9)	84 (43.1)	231 (43.0)	
	3~4 times/week	48 (26.5)	30 (18.4)	40 (20.5)	118 (22.0)	
	5~6/ times/week	5 (2.8)	13 (8.0)	6 (3.1)	24 (4.5)	
	Everyday	3 (1.7)	16 (9.8)	13 (6.7)	32 (6.0)	
Frequency of drinking alcoholic beverage	None	38 (21.0)	30 (18.4)	34 (17.4)	102 (19.0)	31.88*
	2~3 times/month	57 (31.7)	50 (30.7)	54 (27.7)	161 (30.0)	
	1~2 times/week	70 (38.9)	67 (41.1)	76 (39.0)	213 (39.7)	
	3~5 times/week	11 (6.1)	12 (7.4)	28 (14.4)	51 (9.5)	
	Everyday	4 (2.2)	3 (1.8)	3 (1.5)	10 (1.9)	
Frequency of smoking	None	94 (51.9)	83 (50.9)	76 (39.0)	253 (46.9)	7.749
	< 1/2 pack/day	27 (14.9)	25 (15.3)	23 (11.8)	75 (26.2)	
	1/2~1 pack/day	49 (27.1)	46 (28.2)	67 (34.4)	162 (56.6)	
	1~2 pack/day	11 (6.1)	9 (5.5)	29 (14.9)	49 (17.1)	

*: p < 0.05

2. Hematological index of normal and overweight or obese subjects

Table 2 shows the blood pressure and hematological indices of the subjects. The average systolic/diastolic blood pressures of total subjects were 130.96mmHg and 80.38 mmHg, respectively. And the average pressure of normal subjects were 126.85/77.57mmHg, which was significantly lower than in overweight and obese subjects. Diastolic blood pressure shows significant differences among the three groups. The average hemoglobin concentration of normal subjects was 14.39g/dl, which shows no significant differences in overweight (14.61g/dl) and obese subjects (14.90g/dl). The average cholesterol level of normal subjects was 193.81mg/dl, which was significantly lower than those in overweight (202.01mg/dl) subjects, and those in obese subjects (218.85

mg/dl) were significantly higher than in the overweight subjects. Lee et al. (1999) reported that blood cholesterol increased as obesity was higher. In the national health and nutrition survey in 2001, the average hemoglobin concentration was 14.9g/dl and cholesterol concentration was 194.91 mg/dl (aged 40 - 59).

The average cholesterol level of the total subjects was 205.35mg/dl, which was similar with 203.4mg/dl, the average of the middle-aged men living in Seoul (Lee et al. 2004). The average GOT level of the normal subjects was 23.87 unit/l, and the GPT and γ-GTP levels were 24.65 unit/l and 34.72 unit/l. Those indices in overweight subjects were significantly higher in normal subjects. And, the GOT (31.27 unit/l), GPT (45.07 unit/l), γ-GTP (61.25 unit/l) levels of obese subjects were significantly higher than in the over-

weight subjects.

3. Exercise, drinking, smoking habits of the subjects

Table 3 indicates the survey results for lifestyles concerning alcohol consumption, smoking and exercising of the subjects. In response to the question about exercise frequency of normal subjects, "1 ~ 2 times a week" 42.5%, "3 ~ 4 times a week" 26.5%, "Never" 25.4% "5 ~ 6 times a week" 2.8%, "Everyday" 1.7%. The obese subjects responded that "1 ~ 2 times a week" 43.1%, "Never" 26.7% "3 ~ 4 times a week" 20.5%, "Everyday" 6.7%, "5 ~ 6 times a week" 3.1%.

The overall alcohol consumption rates of normal subjects were 79.0% and 38.9% who said that they drink "1 ~ 2 times a week", "2 ~ 3 times a month" 31.7%, "3 ~ 5 times a week" 6.1%, "Everyday" 2.2%. 48.1% of the normal subjects answered that they smoked, with 27.1% saying that they smoke "1/2 ~ 1 pack a day", "< 1/2 pack a day" 14.9%, "1 ~ 2 pack/day" 6.1%. The overall alcohol consumption rate of obese

subjects was 82.6%, and 39.7% said that they drink "1 ~ 2 times a week", "2 ~ 3 times a month" 30.0%.

Frequency of alcohol drinking showed no significant difference among the groups. The frequency of smoking showed significantly difference among three groups. 61.0% of the obese subjects answered that they smoked, with 34.4% saying that they smoke "1/2 ~ 1 pack a day". "1 ~ 2 pack/day" 14.9%, "< 1/2 pack a day" 11.8%. The ratio of smokers was 53.1%, and the alcohol drinking ratio was 81.0% of the total subjects. In a study conducted by Jung et al. (2002) for urban workers, 85% of them said that they consume alcohol and 64% said that they smoked.

4. Blood pressure and hematological indices according to the health-related habits

Table 4 shows the blood pressure and hematological indices between smokers and nonsmokers. The hemoglobin concentrations, cholesterol concentrations and γ -GTP level ($p < 0.05$) were significantly higher in smokers than in nonsmokers. In studies conducted by Song and Kim (2003), smokers had higher levels of triglyceride and cholesterol compared to non-smokers.

Table 5 shows the correlations among alcohol consumption, frequency of smoking, exercise habits and hematological indices. The frequency of drinking showed significant correlations with systolic blood pressure ($p < 0.05$) and diastolic blood pressures ($p < 0.01$) and γ -GTP ($p < 0.01$). In Lee and Kim's study (1991), it was investigated that the higher the amount and frequency of alcohol consumption, the higher the BMI, triglyceride and r-GTP levels in the middle aged men.

The duration of smoking showed a negative correlation ($p < 0.01$) with diastolic blood pressure, total cholesterol and γ -GTP. On the other hand, exercising habits showed nega-

Table 4. Blood pressure and hematological index of smokers and nonsmokers

Variables	Nonsmoker (n = 253)	Smoker (n = 288)
SBP ¹⁾	131.45 ± 15.27	130.55 ± 14.74
DBP ²⁾	80.62 ± 9.69	80.18 ± 10.62
Hemoglobin (g/dl)	14.55 ± 0.93	14.83 ± 0.99*
Blood glucose (mg/dl)	87.93 ± 24.34	89.39 ± 26.18
Total cholesterol (mg/dl)	201.94 ± 41.88	208.70 ± 38.41*
GOT (unit/l) ³⁾	26.88 ± 10.68	27.94 ± 11.74
GPT (unit/l) ⁴⁾	31.78 ± 23.35	35.83 ± 26.49
r-GTP (unit/l) ⁵⁾	39.22 ± 38.64	51.15 ± 56.43*

1) Systolic blood pressure

2) Diastolic blood pressure

3) Glutamic oxaloacetic transaminase

4) Glutamic pyruvic transaminase

5) Gamma-glutamyl transpeptidase

*: $p < 0.05$

Table 5. Correlation coefficient between hematological index and health-related habit

Variables	Frequency of drinking	Amount of cigarettes	Duration of smoking	Frequency of exercise
SBP ¹⁾	0.106*	0.025	0.059	0.062
DBP ²⁾	0.113**	-0.046	0.131**	0.050
Hemoglobin (g/dl)	0.086	0.076	-0.042	0.029
Blood glucose (mg/dl)	0.026	0.026	0.016	-0.147**
Total cholesterol (mg/dl)	0.073	0.136*	0.157**	-0.002
GOT (unit/l) ³⁾	0.073	-0.008	0.050	-0.014
GPT (unit/l) ⁴⁾	0.017	0.006	0.001	-0.123**
r-GTP (unit/l) ⁵⁾	0.274**	0.053	0.118**	-0.134**

1) Systolic blood pressure, 2) Diastolic blood pressure, 3) Glutamic oxaloacetic transaminase

4) Glutamic pyruvic transaminase, 5) Gamma-glutamyl transpeptidase

*: $p < 0.05$, **: $p < 0.01$

tive correlations with blood glucose, γ -GTP and GPT ($p < 0.01$). In the study of Kang et al. (1992), it was indicated that regular exercise decreases the serum cholesterol and obesity had positive correlations with the blood pressure, cholesterol, GOT, GPT, and γ -GTP levels in the normal adult Koreans.

This research revealed that the hematological indices were correlated with exercise frequency, alcohol drinking and smoking ratios. Accordingly, proper daily life habits are needed for the prevention of chronic degenerative diseases.

Summary and Conclusion

This research analyzed blood values and daily life habit differences such as alcohol drinking, smoking and exercise, by classifying 539 working men into normal weight group, overweight group and obese group, according to BMI.

1) As a result, 33.6% of subjects had a BMI of 23 or less, 30.2% were overweight and 36.1% were obese with a BMI of 25 or more.

2) The average systolic/diastolic blood pressures of total subjects were 130.96 mmHg and 80.38 mmHg, respectively. The average blood pressures of normal subjects were 126.85/77.57 mmHg, which was significantly lower than those in overweight and obese subjects. Diastolic blood pressure shows significant differences among the three groups. The average hemoglobin concentration for those in normal subjects was 14.39 g/dl, which shows no significant differences from overweight (14.61g/dl) and obese subjects (14.90g/dl). The overall average cholesterol level of normal subjects was 193.81 mg/dl, which was significantly lower than that of overweight (202.01mg/dl) subjects and that in obese subjects (218.85mg/dl) was significantly higher than that in overweight subjects. The GOT (31.27 unit/l), GPT (45.07 unit/l), γ -GTP (61.25 unit/l) levels of obese subjects were significantly higher than those of the overweight subjects.

3) The overall alcohol consumption rates of obese subjects was 82.6%. Frequency of alcohol drinking showed no significant difference among the groups. The smoking ratio in the obese group was higher than that in the normal and overweight groups. The ratio of smoking was 53.1%, and the alcohol drinking ratio was 81.0% of the total subjects.

4) The hemoglobin concentrations, cholesterol concentrations and γ -GTP level ($p < 0.05$) were significantly higher in smokers than in nonsmokers. The frequency of drinking showed significant correlations with systolic blood pressure

($p < 0.05$), diastolic blood pressures ($p < 0.01$) and γ -GTP ($p < 0.01$). The duration of smoking showed a negative correlation ($p < 0.01$) with diastolic blood pressure, total cholesterol and γ -GTP. On the other hand, exercising habits showed negative correlations with blood glucose, γ -GTP and GPT ($p < 0.01$).

This study revealed that the rates of alcohol and smoking were relatively high, which are related to hematological index levels that can cause degenerative diseases. The obese group demonstrated higher blood pressure than the normal weight group, and also higher GOT and GPT values, which indicate cholesterol level and abnormality of liver function, respectively. These hematological indices were examined to be correlated with daily life habits such as alcohol drinking, smoking and lack of exercise. It is required, therefore, to provide nutritional education to prevent obesity and to develop proper health related habits.

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