National Health Examination Metabolic Syndrome Item and Health Behavior Analysis

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ABSTRACT

OBJECTIVES The purpose of this study is to investigate the relationship between the habits of physical activities in several intensities, drinking, and smoking of the general public who live in the S city and diabetes, high blood pressure, high-density lipoprotein cholesterol, plasma triglyceride, and waist circumference of them.

METHODS For research, residents of 2,438,370 in S city were selected by using the big data of health checkups sheets that were conducted by the National Health Insurance Corporation in 2017. Physical activities were classified into three groups by intensity. The part of drinking was divided into three groups of non-alcohol, low, and high-drinking people. There were four groups in smoking of non-smoking, the group that smoke lower than the half pack of cigarettes per day, the half to one pack, and more than one pack. Metabolic syndrome frequency analysis and logistic regression analysis were used for this research.

RESULTS Compared to the low-intensity physical activity group, the high-intensity group had 0.992, 0.954, 0.871, 0.83, and 0.878 times of lower risk in fasting plasma glucose, blood pressure, high density lipoprotein (HDL-C), plasma triglycerides, and abnormal waist circumference. High drinking group had more risk of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and abnormal waist circumference by 1.326, 1.894, 1.334, 2.125 and 1.263 times than non-drinking group. The group who smoked more than one pack a day had more risk of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and abnormal waist circumference by 1.971, 1.225, 3.229, 2.871, and 1.522 times than the group of non-smoking.

CONCLUSION The subjects who did not have risk factors for metabolic syndrome were 29.7%. The average of patients with metabolic syndrome was 25.2%, of which males were 30.3%, and females were 20.1% of them. Metabolic syndrome factors were proved statistically valid. In the physical activity group, the high-intensity physical activity group had a lower risk of metabolic syndrome factors than the low and medium-intensity physical activity groups. The high-drinking group had a higher risk of metabolic syndrome in triglycerides, and the smoking group who smoked more than one pack per day had a higher risk of metabolic syndrome in high-density lipoprotein cholesterol.

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Introduction

In 2017, Korea's average life expectancy is 82.7 years (male: 79.7 years, female: 85.7 years). Compared to 2007, the average life span has increased by 3.5 years [1]. It is on the

increase because of implementing national health insurance system and developing medical technologies and machines. However, the physical activity is decreasing year by year while there is little change in high-risk drinking and smoking rate. Korea has high risk of death and the burden of illness by chronic diseases according to the statistics [2] from Korea Centers for Disease Control and Prevention. Chronic diseases

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account for 80.8 percent of all causes of death. Above all, heart disease, cerebrovascular disease, and diabetes are the main reasons of both males and females' death. Therefore, it is very important to care those diseases in public health level [3,4]. Furthermore, it is well known that Metabolic syndrome causes cardiovascular disease and diabetes [5].

Metabolic syndrome generally refers to the state of getting more than three factors among abdominal obesity, high blood pressure, fasting plasma glucose, plasma triglyceride, and high-density lipoprotein (HDL-C) at a time. It is still not so clear in pathophysiology, but it is estimated that Metabolic syndrome is made up for obesity and insulin resistance [6]. The main potential risk factors are the life habits such as physical activities, drinking, smoking and nutriture [7,8]. Decreasing physical activity causes high blood pressure, diabetes, and coronary artery disease [9]. In addition, it is reported that the people who sit for a long time in front of a computer or lack of physical activity have more symptoms of Metabolic syndrome [7]. Drinking affects lipid metabolism that makes the concentration of plasma triglyceride grown up, and reduces high-density lipoprotein cholesterol which suppresses arteriosclerosis, so it also increases Metabolic syndrome [10]. Smoking increases total cholesterol, plasma triglyceride, and the level of low-density lipoprotein cholesterol in blood [11]. Overall, the bad life habits are closely connected with the outbreak and prevention of Metabolic syndrome.

For managing and preventing Metabolic syndrome, it is effective for modification of health behavior to control a diet, physical activity, drinking and smoking [12]. However, most researches have the limitation that the subjects of experiments had been with a small number. It could make reliability lower or cause uncertainty about cause-and-effect relationship, so the larger scale of research is needed.

Therefore, the purpose of this study is to investigate the relationship between the factors of Metabolic syndromes such as diabetes, high blood pressure, HDL-C, plasma triglyceride and waist circumference and life habits of physical activities in several intensities, drinking and smoking from the general public living in S city with the big data of the National Health Insurance Corporation's health examination.

Methods

Subjects

This study took sample of 2,520,958 adults over the age of 20 who lived in S city and took general health examination of National Health Insurance Corporation (NHIC) in 2017. The residents of 2,438,370 were selected, because 415 people of no response in physical activity questions, 222 in smoking, 1,573 in drinking, 61,019 beneficiaries of medical care with mismatched individual identification number, 19,359 of not-tested some sectors of Metabolic syndrome were excluded. This study was obtained big data of Korean National Health Examination, and the qualification of health insurance, insurance fee in 2017 with approval of IRB from S university institutional review board (IRB: SM-201905-042-1).

Method and Process of Materials

Definition of Metabolic syndrome

In this study, Metabolic syndrome was defined by NCEP ATP III(The National Cholesterol Education Program Adult Treatment Panel III, 2007)[13], and the waist circumference of abdominal obesity was followed the standard given by the Korean Society for the Study of Obesity(2012). There were five factors: plasma glucose(fasting plasma glucose ≥ 100 mg/dL, or subjects taking hypotensor), blood pressure(systolic blood pressure ≥ 130 mmHg, diastolic blood pressure ≥ 85 mmHg), waist circumference(Male ≥ 90 cm, Female ≥ 85 cm), plasma triglyceride (TG plasma ≥ 150 mg/dL), HDL-C (male < 40 mg/dL, female < 50 mg/dL). When more than three of them were fulfilled, then it was defined into Metabolic syndrome.

Factors of Health Behavior

Health behavior was divided into three variables: physical activity, drinking, and smoking. There were some questions about physical activity in health examination sheet. The question of high intensity physical activity level group (HPAG) was 'How many days did you exercise more than 20 minutes with much more heavily gasping respiration than usual during this week?(ex. running, aerobics, bicycle riding with high speed, climbing etc.)', moderate intensity physical activity level group (MPAG) was 'How many days did you exercise more

than 30 minutes with more gasping respiration than usual during this week?(ex. power walking, tennis doubles, bicycle riding with usual speed, mopping)', and low intensity physical activity level group (LPAG) was 'How many days did you walking more than 30 minutes total, adding least ten minutes at a time during this week?(ex. light exercise, walking during commute or spare time)'. The main recommendation of health behavior from the American College of Sports Medicine and the American Heart Association is doing moderate intensity of aerobic physical activity at least 30 minutes a day five days a week or high intensity of activity at least 20 minutes three days a week for healthy adult aged 18 to 65[14]. Based on these, we decided to make three groups about health behavior by intensity in this study. HPAG was doing drastic activities more than 20 minutes a day, three days a week. MPAG was participating in moderate intensity of activities more than 30 minutes a day, five days a week. LPAG was the people who checked in low intensity of activities and did less activities than high and moderate intensity.

Drinking alcohol was divided into three variables with reference from the guide line of World Health Organization(WHO). There were none-drinking group, the low group of alcohol consumption which drunk no more than two days a week and no more than four cups a day, and the high group that more than three days a week and more than five cups a day.

In the definition of WHO, smoker means the person who has smoked more than five packs (100 cigarettes) of cigarettes in life. It is divided into two groups: Current smoker who answered his or her smoking was every day or sometimes, and past smoker who answered he or she had smoked before but did not now. According to this information, the group of smokers was divided into four parts. None-smoking group had no experience about smoking or had smoked less than five packs of cigarettes. The rest three groups were classified by the variables of average smoking amount, so the first smoking group was less than half of a pack per day, the second group smoked more than half and less than one pack a day, and the third group smoked more than one pack a day.

Health Examination Institution and Methods

The Ministry of Health and Welfare assigned 1,167 medical institution in Seoul (50 general hospital, 129 hospitals, 965 clinics, 18 health facilities, and five oriental medical facilities) as national health examination institution. The recipients of health examination were examined in the medical institutions where they had been assigned. Several medical institutions implemented standardized examination which is followed the guidance of health examination from the NHIC [15].

Waist circumference was measured at midpoint between the bottom of rib and the top of crista ilaca in erect position. Systolic and diastolic blood pressure were measured by using a sphygmomanometer after taking a rest more than at least five minutes. The blood was gathered by a disposable syringe or a vacutainer tube after fasting for more than eight hours, and the blood was stored in a disposable test tube or a well-cleaned and dried tube. Blood analysis was measured by enzyme method, NADH UV method according to the test items. Individual interview investigations such as medical examination, consultation and counselling were implemented by systematic sheet between doctors and subjects of health examination.

Statistical Analysis

SAS Enterprise Guide 7.1(32-bit) was the statistic program utilized to make statistics in this study. Basic statistic analysis was used for current state of the number of subjects by variables. The explanatory variables were the amount of physical activity, alcohol consumption, and smoking, and they were Metabolic syndrome indicator. The average and standard deviation of Metabolic syndrome indicator were approved by t-test when there were two groups of explanatory variables, and by variance analysis when there were more than three of them. HSD multiple comparison method of Tukey was used in intergroup post-analysis during analyzed whatever difference was significant. The relationship between the explanatory variables and metabolic syndrome indicator (normal, abnormal) was tested by comparative analysis through Odd Ratio (OR) with plasma glucose. The significant statistic level was set up 5%.

Results

Statistic of subjects

LPAG accounted for 69.8 percent (1,701,549) of the 2,438,370 subjects. MPAG was 11.6%(281,800), and HPAG was 18.7%(455,025). The percentage of male subjects was 49.7 (1,212,740) and female was 50.3 (1,225,630). The distribution by age group based on physical activity was the highest in the LPAG under 39 years of age, and the highest in the MPAG and LPAG was more than 60 years old <Table 1>.

Metabolic syndrome variables based on physical activity

<Table 2> was the result of analysis about the difference of Metabolic syndrome variables based on the amount of subjects' physical activity. The mean value of plasma glucose about Metabolic syndrome variables in LPAG was 100.2mg/dL, which slightly exceeded the normal boundary value. The others were all normal. The value of HPAG, the variable of Metabolic syndrome, was shown 54.2mg/dL in HDL-C and 81.1cm of waist circumference which were significantly higher

Table 1. Current Status of Research Subjects by Variables (Unit: Person, %)

Variables		LPAG		MPAG		HPAG		Total	
		n	%	n	%	n	%	n	%
Gender	Male	824,837	68.0	132,713	10.9	255,190	21.0	1,212,740	100.0
	Female	876,712	71.5	149,087	12.2	199,831	16.3	1,225,630	100.0
Age	≤39	484,507	74.7	65,866	10.2	98,414	15.2	648,787	100.0
	40~49	415,698	72.0	62,572	10.8	99,099	17.2	577,369	100.0
	50~59	375,889	67.9	65,930	11.9	111,642	20.2	553,461	100.0
	60≤	425,455	64.6	87,432	13.3	145,866	22.1	658,753	100.0
Alcohol consumption	None	797,344	69.8	137,597	12.1	206,907	18.1	1,141,848	100.0
	Low	744,747	69.9	119,521	11.2	201,684	18.9	1,065,952	100.0
	High	159,458	69.2	24,682	10.7	46,430	20.1	230,570	100.0
Smoking amount (pk/day)	Non-smoking	1,350,508	68.6	237,027	12.0	379,719	19.3	1,967,254	100.0
	<1/2	66,668	71.8	9,869	10.6	16,311	17.6	92,848	100.0
	1/2~1	172,376	73.7	23,053	9.9	38,566	16.5	233,995	100.0
	1<	111,997	77.6	11,851	8.2	20,425	14.2	144,273	100.0

LPAG: Low intensity Physical Activity Level Group, MPAG: Moderate intensity Physical Activity Level Group, HPAG: High- intensity Physical Activity Level Group

Table 2. Metabolic Syndrome Variables According to Physical Activity

Variables	Physical activity			p
	LPAG	MPAG	HPAG	
	n=1,701,549	n=281,800	n=455,021	
Fasting plasma glucose(mg/dL)	100.2±22.2	99.5±21.8	99.7±23.6#	<.001
Systolic blood pressure(mmHg)	123.3±14.5	122.3±14.7*	121.8±14.9	<.001
Diastolic blood pressure(mmHg)	76.0±10.0	75.6±10.1	75.6±10.3	<.001
HDL-C(mg/dL)	58.0±15.4	59.2±15.5*	59.2±15.6*	<.001
Plasma triglyceride(mg/dL)	129.0±99.5	120.2±88.8	120.8±91.9#	<.001
Waist circumference(cm)	80.9±10.3	80.5±9.8	81.1±9.3*#	<.001

LPAG: Low intensity Physical Activity Level Group, MPAG: Moderate intensity Physical Activity Level Group, HPAG: High- intensity Physical Activity Level Group, Bold: p < 0.05, HDL-C: High Density Lipoprotein Cholesterol
*Significantly different from LPAG; #Significantly different from MPAG.

than LPAG and MPAG. plasma glucose of HPAG(99.7mg/dL), systolic blood pressure(121.8mmHg), diastolic blood pressure (75.6mmHg), and plasma triglyceride were significantly lower than other groups.

Metabolic syndrome variables based on alcohol consumption

The result about analysis of the difference in Metabolic syndrome variables based on alcohol consumption was shown in <Table 3>. The mean value of fasting plasma glucose in high alcohol consumption group was 105.3mg/dL and plasma triglyceride was 168.5mg/dL. They exceeded the normal boundary value. The other variables of high group were all normal.

The value of fasting plasma glucose in high alcohol consumption group (the variable of Metabolic syndrome) was 105.3mg/dL. Systolic blood pressure was 126.9mmHg.

Diastolic blood pressure was 79.6mmHg. HDL-C was 54.7mg/dL. Plasma triglyceride was 168.5mg/dL. Waist circumference was 84.8cm. These variables were all higher than low and non-alcohol consumption groups. Plasma triglyceride (168.5mg/dL) was especially higher in high group.

Metabolic syndrome variables based on smoking

The result about analysis of the difference in Metabolic syndrome variables based on the amount of subjects' smoking was shown in <Table 4>. The mean values of fasting plasma glucose in the group of 1/2pk~1pk was 101.6mg/dL and the group of more than 1pk was 106.8mg/dL, and plasma triglyceride was 163.3mg/dL in the group of 1/2pk~1pk, 181.4mg/dL in the group of more than 1pk. They exceeded the normal boundary value. The other variables of high group were all normal.

Table 3. Metabolic Syndrome Variables According to Alcohol consumption

Variables	Alcohol consumption			p
	None	Low	High	
	n=1,141,848	n=1,065,952	n=230,570	
Fasting plasma glucose(mg/dL)	99.4±23.2	98.8±21.9	105.3±27.2*#	<.001
Systolic blood pressure(mmHg)	121.9±15.2	121.3±14.4	126.9±14.3*#	<.001
Diastolic blood pressure(mmHg)	74.7±9.9	75.9±10.3*	79.6±10.8*#	<.001
HDL-C(mg/dL)	57.6±14.9	58.9±15.7*	59.7±16.4*#	<.001
Plasma triglyceride(mg/dL)	116.8±77.4	127.7±99.6*	168.5±147.5*#	<.001
Waist circumference(cm)	79.8±9.9	81.3±10.2*	84.8±9.2*#	<.001

Bold: p < 0.05, HDL-C: High Density Lipoprotein Cholesterol

*Significantly different from Non-risk group; #Significantly different from Low risk group.

Table 4. Metabolic Syndrome Variables According to Smoking amount (pk/day)

Variables	Smoking amount (pk/day)				P
	Non-smoking	< 1/2pk	1/2pk ~ 1pk	1pk <	
	n=1,967,254	n=92,848	n=233,995	n=144,273	
Fasting plasma glucose(mg/dL)	99.0±21.9	99.1±23.4*	101.6±25.6*#	106.8±32.4*#§	<.001
Systolic blood pressure(mmHg)	121.7±15.0	121.5±14.2	123.6±13.9*#	125.1±14.1*#§	<.001
Diastolic blood pressure(mmHg)	75.2±10.2	76.0±10.4*	77.6±10.3*#	78.7±10.3*#§	<.001
HDL-C(mg/dL)	59.5±15.4	57.5±15.6	53.9±14.3	51.8±14.2	<.001
Plasma triglyceride(mg/dL)	117.3±83.6	141.9±111.7*	163.3±130.3*#	181.4±147.3*#§	<.001
Waist circumference(cm)	80.0±10.0	82.2±10.0*	84.4±9.2*#	85.9±9.1*#§	<.001

Bold: p < 0.05, HDL-C: High Density Lipoprotein Cholesterol

*Significantly different from Non-smoking; #Significantly different from <1/2pk; §Significantly different from 1/2pk ~ 1pk.

The result about Metabolic syndrome variables based on smoking were as follows. HDL-C of the group of more than 1pk was 46.8mg/dL. Fasting plasma glucose was 106.8mg/dL. Systolic blood pressure was 125.1mmHg. Diastolic blood pressure was 78.7mmHg. HDL-C was 46.8mg/dL. Plasma triglyceride was 181.4mg/dL. Waist circumference was 85.9cm. Except HDL-C, these variables of the group of more than 1pk were higher than other groups. Above all, it was the highest that HDL-C of non-smoking group was 54.5mg/dL.

Relationship between Health Behavior and Metabolic syndrome variables

<Table 5> showed how health behavior (physical activity, alcohol consumption, and smoking) affected fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference regardless of gender. It was analyzed by

OR with plasma glucose. In MPAG, which was independent variable, there was no significant difference in dependent variable HDL-C and plasma triglyceride of significant level<0.5, and the other dependent variable were shown noticeable differences. In variables of physical activity, the risk of making indicators abnormal of HPAG was lower than LPAG as much as following statement: fasting plasma glucose was 0.992 times, blood pressure 0.954, HDL-C 0.871, plasma triglyceride 0.83, and waist circumference 0.878. In other words, HPAG improved the indicators of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference each as $(1-0.992)*100=0.8\%$, $(1-0.954)*100=4.6\%$, $(1-0.871)*100=12.9\%$, $(1-0.83)*100=17\%$, $(1-0.878)*100=12.2\%$ times better than LPAG. In variables of alcohol consumption, the risk of high group to make the indicator worse was higher than non-alcohol group as much

Table 5. Regression analysis of related to Metabolic syndrome based on health behavior

Variables	Fasting plasma glucose		Blood pressure		HDL-C		Plasma triglyceride		Waist circumference	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
LPAG	1.00		1.00		1.00		1.00		1.00	
HPAG	0.992 (0.962-1.072)	<.0001	0.954 (0.914-1.034)	<.0001	0.871 (0.791-0.951)	<.0001	0.83 (0.750-0.910)	<.0001	0.878 (0.798-0.958)	<.0001
MPAG	1.073 (1.043-1.103)	<.0001	1.047 (1.017-1.077)	<.0001	0.997 (0.967-1.027)	0.7255	0.996 (0.966-1.026)	0.6272	0.984 (0.954-1.014)	<.0049
Alcohol(None)	1.00		1.00		1.00		1.00		1.00	
Alcohol(High)	1.326 (1.205-1.447)	<.0001	1.894 (1.773-2.015)	<.0001	1.334 (1.213-1.455)	<.0001	2.125 (2.004-2.246)	<.0001	1.263 (1.142-1.384)	<.0001
Alcohol(Low)	1.688 (1.367-2.009)	<.0001	1.887 (1.566-2.208)	<.0001	1.789 (1.468-2.110)	<.0001	1.693 (1.372-2.014)	<.0001	1.375 (1.054-1.696)	<.0001
Non-smoking	1.00		1.00		1.00		1.00		1.00	
Smoking(1pk <)	1.971 (1.489-2.453)	<.0001	1.225 (0.743-1.707)	<.0001	3.229 (2.747-3.711)	<.0001	2.871 (2.389-3.353)	<.0001	1.522 (1.040-2.004)	<.0001
Smoking (1/2pk~1pk)	2.085 (1.693-2.477)	<.0001	1.387 (0.995-1.779)	<.0001	2.12 (1.728-2.512)	<.0001	1.803 (1.411-2.195)	<.0001	1.451 (1.059-1.843)	<.0001
Smoking(< 1/2pk)	1.622 (1.394-1.850)	<.0001	1.151 (0.923-1.397)	<.0001	1.414 (1.186-1.642)	<.0001	1.248 (1.020-1.476)	<.0001	1.238 (1.010-1.466)	<.0001

MPAG: Moderate intensity Physical Activity Level Group, HPAG: High intensity Physical Activity Level Group,

Bold: p< 0.05, HRG: High risk group, LRG: Low risk group

Dependent variable: Fasting blood sugar, Blood Pressure, HDL-C, Plasma triglyceride, Waist Circumference

Independent variable: HPAG, MPAG, Alcohol consumption(High), Alcohol consumption(Low), Smoking amount(1pk <), Smoking amount(1/2pk~1pk),

Smoking amount(<1/2pk), OR Comparison group: Physical Activity-LPAG, Alcohol Consumption-None, Smoking-Non smoking

NCEP ATP III: Fasting plasma glucose ≥100mg/dl, Blood pressure ≥130/85 mmHg, HDL cholesterol <40mg/dL(men) or <50mg/dL(women), Plasma triglycerides ≥150mg/dL, Waist circumference >90cm(men) or 85cm(women).

Table 6. Statistics on the number of metabolic syndrome risk factors gender. (Unit: Person, %)

Division	Number of Actual Examinees	Total	Caution(1-2pcs)			Metabolic syndrome(3-5pcs)			
			Sub total	1pcs	2pcs	Sub total	3pcs	4pcs	5pcs
Sum total	2,438,370	70.3	45.1	24.9	20.2	25.2	14.4	8.1	2.7
Male	1,212,740	80.3	50.0	25.5	24.5	30.3	17.9	9.6	2.8
Female	1,225,630	60.4	40.3	24.2	16.1	20.1	11.0	6.5	2.6

Metabolic syndrome: Fasting plasma glucose, Blood pressure, HDL cholesterol, Plasma triglycerides, Waist circumference

as 1.326, 1.894, 1.334, 2.125, 1.263 times in each of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference. In variables of smoking, the risk of smoking group which smoked more than one pack a day to make the indicator worse was higher than non-smoking group as much as 1.971, 1.225, 3.229, 2.871, 1.522 times in each of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference.

Metabolic syndrome risk factor statistics

The sufferer of Metabolic syndrome was 25.2% on average who had more than three risk factors of Metabolic syndrome based on NCEP-ATP III. Among them, male was 30.3% which was higher than female of 20.1%. The percentage of subjects who didn't have a risk factor was 29.7%, and had one factor was 24.9%, two was 20.2%, three was 14.4%, four was 8.1%, and five was 2.7% <Table 6>.

Discussion

This study researched the relationship between the indicators of Metabolic syndrome and the health behavior of physical activity, alcohol consumption, and smoking with the big data from health examination of NHIC in 2017. The advanced research about the amount of physical activity had analyzed the risk factor of Metabolic syndrome based on the intensity of Korean adults's physical activity [16,17]. According to this research, there were no significant statistic difference in blood pressure and fasting plasma glucose, but plasma triglyceride of LPAG was higher than HPAG, and HDL-C of HPAG was higher than LPAG. Lee et al. [18-20] showed that HPAG had positively affect to the risk factors

of Metabolic syndrome, and the amount of physical activity became lower and lower in process of years. It said that middle aged- women needed some alternatives to get more physical activity for improvement of the risk factors about Metabolic syndrome. In addition, HDL-C of Korean male aged of 19 to 69 was increased as the amount of physical activity had been grown [21-23].

In this study, all variables had significant difference, which was different from the advanced research. Plasma triglyceride of HPAG was 120.8mg/dL and LPAG was 129.0mg/dL, which meant there was a noticeable difference between them, while the other factors - fasting plasma glucose, blood pressure, HDL-C and waist circumference showed a slight difference in values. Though exercise generally knows to good at diabetes, high blood pressure, and obesity cause of managing plasma glucose and reducing insulin resistance, the reason of why there was a small difference in changes based on the amount of physical activity was estimated that the distribution of the subjects aged 40s to 60s was high (63.6%) so the difference of the mean values would become smaller.

The advanced research about alcohol consumption showed that HDL-C of high drinking group was significantly lower than moderate drinking group, and fasting plasma glucose, blood pressure, plasma triglyceride, and waist circumference were high enough in high group [24]. In this study, all of fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference in high group were much higher than those in low group. The high alcohol consumption group would have to manage consistently because it had high risk to become a sufferer cause of especially exceeded from normal boundary values in fasting plasma glucose and plasma triglyceride.

The advanced research about smoke showed that smokers had high plasma triglyceride and low HDL-C[25]. The reason of lipid level change in smoking was uncertain, but it was assumed smoking would cause insulin resistance so metabolic ability of dietary got decreased and blood concentration of plasma triglyceride increased, affected by metabolism of plasma triglyceride after meals. This study also showed similar result like this. The smokers with more than half pack of cigarette a day would have to be demanded the education and arbitration about quit smoking because their fasting plasma glucose and plasma triglyceride exceeded the normal boundary values.

In the advanced research with OR, MPAG had no meaningful difference of outbreaking Metabolic syndrome before adjustment, compared to non-physical activity group. However, the active group of health promotion was reduced 0.802 times of Metabolic syndrome incidence. The risk about Metabolic syndrome of heavy drinking group was higher 1.814 times than moderate drinking group [26]. Lym et al. [27,28] reported that female, smokers, the more drinking group had more risk than male, non-smoker and non-drinking group. There was the tendency when the times of exercise increased, then the odds ratio became reduced according to Park et al. [29]. It is well known that moderate exercise makes the blood pressure of hypertensive patient decreased and improved the whole lipid level so it could delay and restrain diabetes [30]. Looking through association between relative grasping power and incidence of Metabolic syndrome, it appeared the risky incidence of Metabolic syndrome decreased significantly in the group of the highest grasping power as 0.439 times to the group of the lowest in case of males. The risk of females also decreased as grasping power went up (medium group 0.817 times and high group 0.608 times) [31]. The prior research about the number of the risk factors in Metabolic syndrome was reported as there were 25.8% of none-have (male 22.7%, female 29.6%), 31.2% of one factor, 21.5% of two factors, 15.4% of three factors, 5.3% of four, and 0.8% of five [32]. It was similar result with this study.

The limitation of this study was that it was hard to represent the whole population because the sample of subjects was limited in S city. There was also limitation to record absolute

quantity of health behavior in health examination sheet about physical activity, alcohol consumption, and smoking. However, it was implemented by national and the record of health examination would be managed during the entire life with one-on-one counselling with a doctor based on the sheet, so there would be a reliability in the data. Therefore, there was a significance at the investigation about the relationship between health behavior and the factors of metabolic syndrome with using the big data of health examination.

Conclusions

This study affirmed that indicator of Metabolic syndrome variables-fasting plasma glucose, blood pressure, HDL-C, plasma triglyceride, and waist circumference had significant statistic association with the amount of physical behavior. HPAG had lower risk of Metabolic syndrome indicator than LPAG and MPAG. High alcohol consumption group was much dangerous in the degree of plasma triglyceride. Smoking group with more than one pack a day had high risk in high-density lipoprotein cholesterol. Therefore, there would have to devise an individual management system by developing public health promotion program and sports curers with considering the existence of each indicator in Metabolic syndrome, the amount of physical activity, alcohol consumption and smoking. The prospective study would also be insisted that investigate the affection of the period and intensity in physical activity, the frequency and consumption of alcohol, and the period and amount of smoking to Metabolic syndrome through vertical big data of health examination during long period.

Conflicts of Interest

The researcher claims no conflicts of interest.

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