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A Study on Health Risk Behavior Factors and Chronic Disease Risk Factors

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Abstract

This study classified subjects aged 30 to 64 into normal group, impaired fasting glucose group, and diabetes mellitus patient group based on data from the 6th period of the National Health and Nutrition Examination Survey (2013-2015). Skipping breakfast, lack of physical activity, inadequate sleep time, inadequate weight, excessive drinking, and current smoking are classified as a low health risk group when three or less items are present, and a high health risk group when three or more items are included. By classification, each item included in the physical measurement and biochemical analysis factors and health risk behavior factors was comparatively analyzed. As a result, in the normal group, impaired fasting glucose group, and diabetes group, the average age was higher in the group with high health risk factors than the group with low risk factors, and the male ratio was higher. Body mass index, waist circumference, blood pressure, triglyceride showed a significantly higher result. In the normal group, the fasting blood glucose level and total cholesterol level were also higher in group 2. Therefore, it is thought that it is necessary to control health risk behaviors through lifestyle changes in the normal group, fasting glucose disorder group, and diabetes group.

Keywords: Health Risk Behaviors, KNHANES, Chronic Disease Risk Factors, Fasting Glucose, Lifestyle

Major classifications: Health Science (Public Health)

1. Introduction

Due to rapid socio-economic development and lifestyle changes, the prevalence and complications of chronic diseases are increasing because of lifestyle changes including western dietary patterns, excessive stress, irregular eating habits, imbalance in nutritional intake, and lack of physical activity. Among them, diabetes is known as a 'lifestyle disease', and proper diet and lifestyle are important for diabetes. Representative factors include drinking and smoking, lack of exercise,

various stresses, and western dietary patterns. As these characteristics could be considered to be related to health, it can be seen that the individual's own management in daily life is important (Lim, 2012).

Recently, disease prevention and maintaining healthy body functions have become increasingly important, and for this purpose, lifestyle habits of practicing healthy behaviors are becoming more and more important. According to the World Health Organization (WHO), health risk behaviors related to dietary habits, including smoking, excessive drinking, obesity, and lack of physical activity, affect the onset of chronic diseases and their deaths (Pak, Sohn, & Park, 2015; WHO 2016). Also, in the Alameda County Study, 7 types of health behaviors were studied and defined while analyzing the factors affecting the health level (Housman & Dorman, 2013). Health risk behavior in daily life was perceived more comprehensively as an act of making decisions such as choice or avoidance at every moment. Health risk behavior is more dangerous when several behaviors are performed than one, and by correcting the risk behavior, complex interventions on behaviors can reduce individual disease risk and recurrence than simple interventions. In addition, a comprehensive prevention strategy was possible in the health promotion program plan, thus, an appropriate prevention program could be performed (Schuit, Van Loon, & Tijhuis, 2002; Park, Jang, & Kim, 2014). The rate of progression to diabetes in the prediabetic stage, impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), is reported to be 6.3 to 9.6 times higher than that of normal people, and Lee & Son's study reported that 25% of the patients progressed to diabetes (Lee & Son, 2007). In addition, in the case of IFG or IGT, it is possible to prevent the progression to type 2 diabetes by appropriate weight control and improvement of lifestyle such as exercise (Tuomilehto, Lindstrom, & Eriksson, 2001; Chung, 2016).

Therefore, in this study, health risk behaviors were investigated using data from the Korea National Health and Nutrition Examination Survey (KNHANES). By examining the demographic and biochemical factors according to health risk behavior, we want to identify health risk behavior that needs to be managed to reduce the development of diabetes among chronic diseases. In addition, it is intended to prevent diabetes progression and complications and manage chronic diseases caused by aging through complex management.

2. Method

2.1. Subjects

The data for this study is the 6th KNHANES data conducted by the Korea Disease Control and Prevention Agency of Ministry of Health and Welfare (MOHW), and data approved by the Research Ethics Review Committee of the Korea Disease Control and Prevention Agency (approval number: 2013-07CON-03-4C, 2013-12EXP-03-5C) was used. Out of 22,948 subjects who participated in the 6th KNHANES (2013-2015), among the variables of the prevalence of diabetes over the age of 19 (n=14,084), the subjects aged 30 to 64 (n=7,870) were classified according to the blood glucose level classification (normal group n=5,263, IFG group n=1,893, diabetes group n=714). If 0 to 3 of the 6 health risk behaviors were met, they were classified as a low-risk behavior group (Group 1), and if 4 to 6 were met, classified as a high-risk behavior group (Group 2).

2.2. Anthropometric and Biochemical Factors

As anthropometric data, Body Mass Index (BMI), waist circumference, and blood pressure (systolic and diastolic blood pressure) data were used. As biochemical factors, fasting blood glucose, glycated hemoglobin, triglyceride, total cholesterol, high-density lipoprotein (HDL)-cholesterol, and low-density lipoprotein (LDL)-cholesterol were used.

2.3. Health Risk Behavior Factors

As health risk behavior factors, skipping breakfast, lack of physical activity, inadequate sleep time, inappropriate weight, excessive drinking, and current smoking were used.

In the skipping breakfast category, for the past 1 year, if the frequency of breakfast was less than 3 to 4 times a week, it was classified as a skipping meal and 5 to 7 times a week was classified as an appropriate meal. For lack of physical activity, in walking, flexibility exercise, and strength exercise, walking and flexibility exercise less than 5 days a week or strength exercise 3 days or less were considered insufficient, and walking and flexibility exercise 5 days or more or strength exercise 4 days or more was classified as sufficient. If two or more of the lack of walking, flexibility exercise, and strength exercise correspond to the lack of exercise, it was reclassified as inactivity, and if less than one, it was reclassified as sufficient. In

the inadequate sleep time category, when the average daily sleep time was 6 hours or less or 8 hours or more, it was classified as inadequate sleep, and the case of 7 hours sleep was classified as adequate sleep. In the case of inappropriate weight, underweight and obese cases were classified as inappropriate weight, and normal weight cases were classified as appropriate weight. Excessive drinking was classified as excessive drinking more than twice a week for the past year, and moderate drinking as less than or not drinking. In the case of smoking, current smoking and occasional smoking were classified as smoking, and those who did not smoke at all or smoked in the past but not currently not were reclassified as non-smoking.

2.4. Data Analysis Method

As the data analysis method, the data from KNHANES were extracted using a stratified colony sampling design, thus composite sample elements were reflected and analyzed using the IBM SPSS Statistics 20.0 program. The general characteristics and distribution of health risk behaviors of the subjects were presented in terms of frequency and percentage through cross-sample cross-analysis. Biochemical factors were presented as mean and standard deviation using complex sample general linear analysis. The statistical significance of all results of this study was verified based on $p<0.05$.

3. Results and Discussion

3.1. Anthropometric and Biochemical Factors

In the results of anthropometric and biochemical factors analysis according to the normal group, IFG group, and diabetes group (Table 1), 44.75 years old in the normal group, 48.51 years old in the fasting glucose disorder group, and 52.46 years old in the diabetic group, which the age in the diabetic group was significantly higher ($p<0.001$). In the normal group, the male ratio was 40.9%, in the IFG group, 58.5%, and in the diabetic group, 63.0%, showing a statistically significant difference ($p<0.001$). In terms of BMI and waist circumference, the diabetic group was 25.58 kg/m^2 and 87.62 cm, which was higher than that of the other groups ($p<0.001$). The systolic blood pressure was 122.92 mmHg in the diabetic group and the diastolic blood pressure was 79.38 mmHg in the IFG group, which was significantly higher ($p<0.001$). In the diabetic group, the fasting blood glucose (FBG) was 150.21 mg/dL and the glycated hemoglobin (HbA1c) was 7.53% ($p<0.001$). The triglyceride level was also higher in the diabetic group, at 211.32 mg/dL ($p<0.001$). Total cholesterol and LDL-cholesterol were high at 197.99 mg/dL and 119.95 mg/dL in IFG group ($p<0.001$), and HDL-cholesterol showed low results at 45.15 g/dL in the diabetic group ($p<0.001$).

Table 1: Comparison of normal, impaired fasting glucose and diabetes mellitus according to biochemical factors

	Total (n=7,870)			P-value
	Normal (n=5,263)	IFG (n=1,893)	DM (n=714)	
Age(yrs)	44.75±0.18	48.51±0.28	52.46±0.36	<0.001
Sex				
Male	1757(40.9)	959(58.5)	390(63.0)	<0.001
Female	3506(59.1)	934(41.5)	324(37.0)	
BMI(kg/m^2)	23.30±0.05	25.11±0.09	25.58±0.15	<0.001
Waist circumference(cm)	79.30±0.15	85.12±0.26	87.62±0.40	<0.001
Blood pressure(mmHg)				
Systolic pressure	113.02±0.26	120.46±0.45	122.92±0.67	<0.001
Diastolic pressure	75.23±0.20	79.38±0.32	78.75±0.46	<0.001
Fasting blood glucose(mg/dL)	90.36±0.10	106.76±0.17	150.21±1.81	<0.001
HbA1c(%)	5.49±0.01	5.78±0.01	7.53±0.07	<0.001
Triglyceride(mg/dL)	123.93±1.66	172.72±4.01	211.32±8.03	<0.001
Total cholesterol(mg/dL)	190.64±0.56	197.99±0.83	189.85±2.05	<0.001
HDL-cholesterol(mg/dL)	52.61±0.17	48.56±0.29	45.15±0.44	<0.001
LDL-cholesterol(mg/dL)*	117.25±0.79	119.95±1.21	111.68±2.31	0.004

*LDL-Cholesterol is different number of 3,424
P value by Chi-square test and GLM (general linear model)
Data represents n(%) and Mean±SE (Standard Error)
IFG: impaired fasting glucose
DM: diabetes mellitus

Nam et al. reported that the management of blood sugar was insufficient in women, younger age groups, long illness period, and drinking as factors related to blood sugar management (Nam, Shin, & Kweon, 2012). In this study, gender and age were not distinguished, and in particular, in the case of women, analysis of menopause was not performed. Since the effects of visceral fat accumulation and abdominal obesity due to the rapid decrease in female hormones after menopause and the effects of endogenous sex hormones on blood sugar control are different in men and women, further analysis is needed in the future.

3.2. Health Risk Behavior Factors

For the past one year, skipping breakfast with less than 3 to 4 times a week was observed in 38.6% of the normal group, 36.8% of the fasting glucose disorder group, and 26.2% of the diabetic group ($p<0.001$). For breakfast, the overall ratio of eating was higher than 60%, and in particular, the breakfast ratio of the diabetic group was the highest. This is expected to be a result of the dietary management of diabetes, and it is believed that it may be a difference of age. In the case of lack of physical activity, there was no statistical difference between the three groups. For inadequate sleep, the overall rate was over 65%, and in particular, 73.9% of the diabetic group showed a result ($p=0.041$). In the case of inappropriate weight, 30.6% of the normal group, 48.3% of the IFG group, and 52.4% of the diabetic group, which showed a difference ($p<0.001$). In the excessive drinking category, 20.8% of the normal group and 32.7% of the IFG group experienced excessive drinking, and in the diabetic group, excessive drinking was significant at 31.1% ($p<0.001$). The IFG group had the highest rate of excessive drinking. It can be assumed that if you drink too much, your blood sugar will not be well controlled. Smoking was higher in the diabetic group at 32.2% ($p<0.001$)(Table 2).

According to study of Lim JH, total cholesterol, triglyceride, and HDL-cholesterol levels are affected depending on the dietary pattern, and when more than 5 dietary and lifestyle guidelines were followed, blood sugar was significantly improved and regulated compared to the group that did not [1]. In addition, it was reported that the risk of diabetes was 1.7 times higher in smokers than that of non-smokers.

Table 2: Comparison of normal, impaired fasting glucose, and diabetes according to lifestyle risk behaviors

	Total (n=7,870)			P-value
	Normal (n=5,263)	IFG (n=1,893)	DM (n=714)	
Breakfast skipping				
No	3368(61.4)	1256(63.2)	548(73.8)	<0.001
Yes	1895(38.6)	637(36.8)	166(26.2)	
Physical inactivity				
No	932(18.8)	337(17.8)	123(17.3)	0.556
Yes	4331(81.2)	1556(82.2)	591(82.7)	
Inadequate sleep				
No	1647(31.9)	566(30.9)	184(26.1)	0.041
Yes	3616(68.1)	1327(69.1)	530(73.9)	
Inadequate weight				
No	3689(69.4)	979(51.7)	334(47.6)	<0.001
Yes	1574(30.6)	914(48.3)	380(52.4)	
Heavy drinking				
No	4263(79.2)	1330(67.3)	519(68.9)	<0.001
Yes	1000(20.8)	563(32.7)	195(31.1)	
Current smoking				

No	4369(80.0)	1442(71.3)	522(67.8)	<0.001
Yes	894(20.0)	451(28.7)	192(32.2)	

P value by Chi-square test
Data represents n(%)
IFG: impaired fasting glucose
DM: diabetes mellitus

3.3. Anthropometric and Biochemical Factors According to Types of Health Risk Behaviors

Table 3 shows the results of anthropometric measurements and biochemical factor analysis according to health risk behavior types. The normal group, the IFG group, and the diabetic group were classified into group 1 with less risky behavior and group 2 with more risky behavior according to health risk behaviors, respectively. The average age of group 2 was higher than that of group 1 in all of the normal group, IFG group, and diabetic group, and the male ratio was higher. In the case of the normal group, the BMI was 24.7 kg/m^2 and higher in group 2 ($p<0.001$) than in group 1 ($p<0.001$), waist circumference was 83.9 cm ($p<0.001$), systolic blood pressure was 116.1 mmHg ($p<0.001$), and diastolic blood pressure was 77.9. mmHg ($p<0.001$) and FBG were statistically significantly higher at 91.0 mg/dL ($p<0.001$). The glycated hemoglobin level was not statistically significant at 5.49% in group 1 and 5.50% in group 2 ($p=0.522$). In group 2, triglyceride was 164.3 mg/dL ($p<0.001$) and total cholesterol was 193.2 mg/dL, which shows a significant result ($p=0.026$). HDL-cholesterol was statistically lower in group 2 at 50.4 mg/dL ($p<0.001$). In group 2 of IFG group, BMI was 26.3 kg/m^2 ($p<0.001$), waist circumference was 89.0 cm ($p<0.001$), systolic blood pressure was 121.8 mmHg ($p=0.0191$), and diastolic blood pressure was 81.4 mmHg ($p<0.001$) and triglyceride 207.8 mg/dL ($p<0.001$), which showed a statistically significantly high result. HDL-cholesterol showed a significantly lower result at 47.4 mg/dL ($p=0.006$). In the case of FBG, glycated hemoglobin, total cholesterol, and LDL-cholesterol, there was no difference between the health risk behavior groups. In group 2 of diabetic-group, BMI was 27.3 kg/m^2 ($p<0.001$), waist circumference was 92.4 cm ($p<0.001$), diastolic blood pressure was 81.5 mmHg ($p<0.001$), triglyceride was 266.7 mg/dL ($p<0.001$) and total cholesterol 198.5 mg/dL ($p=0.004$), which showed a significantly higher result. In the case of systolic blood pressure, FBG, glycated hemoglobin, HDL-cholesterol, and LDL-cholesterol, there was no difference between the health risk behavior groups).

Table 3: Comparison of normal, impaired fasting glucose, diabetes mellitus in the behavioral classification of biochemical factors

	Total (n=7,870)								
	Normal (n=5,263)			**IFG (n=1,893)**			**DM (n=714)**		
	Group1 (n=4,274)	**Group2 (n=989)**	**P-value**	**Group1 (n=1,341)**	**Group2 (n=552)**	**P-value**	**Group1 (n=504)**	**Group2 (n=210)**	**P-value**
Age(yrs)	45.5±0.19	42.0±0.33	<0.001	50.1±0.30	45.2±0.45	<0.001	53.7±0.41	49.9±0.66	<0.001
Sex									
Male	1175(34.3)	582(65.3)	<0.001	555(48.8)	404(78.3)	<0.001	234(54.5)	156(80.5)	<0.001
Female	3099(65.7)	407(34.7)		786(51.2)	148(21.7)		270(45.5)	54(19.5)	
BMI(kg/m^2)	22.9±0.05	24.7±0.14	<0.001	24.5±0.11	26.3±0.17	<0.001	24.8±52.6	27.3±0.32	<0.001
Waist circumference(cm)	78.0±0.16	83.9±0.37	<0.001	83.2±0.30	89.0±0.45	<0.001	85.3±8.12	92.4±0.79	<0.001
Blood pressure(mmHg)									
Systolic pressure	112.2±0.28	116.1±0.54	<0.001	119.8±0.53	121.8±0.72	0.019	122.3±2.19	124.3±1.16	0.135
Diastolic pressure	74.5±0.21	77.9±0.40	<0.001	78.41±0.34	81.4±0.59	<0.001	77.4±1.72	81.5±0.69	<0.001
Fasting glucose(mg/dL)	90.2±0.11	91.0±0.20	<0.001	106.7±0.20	106.9±0.30	0.536	149.4±28.7	151.9±2.94	0.481
HbA1c(%)	5.49±0.01	5.50±0.01	0.522	5.79±0.01	5.75±0.02	0.062	7.58±2.82	7.43±0.12	0.286
Triglyceride(mg/dL)	113.0±1.55	164.3±4.98	<0.001	155.6±4.14	207.8±8.37	<0.001	184.2±145.7	266.7±17.9	<0.001
Total cholesterol(mg/dL)	190.0±0.59	193.2±1.38	0.026	197.1±1.02	199.8±1.53	0.157	185.6±88.0	198.5±4.17	0.004
HDL-cholesterol(mg/dL)	53.2±0.19	50.4±0.45	<0.001	49.1±0.34	47.4±0.55	0.006	45.7±59.2	44.0±0.77	0.055

LDL-cholesterol(mg/dL)*	117.7±0.85	116.3±1.60	0.408	120.9±1.49	118.4±2.00	0.318	108.2±0.06	117.2±4.43	0.061

*LDL-cholesterol is different number of 3,424
P value by Chi-square test and GLM (general linear model)
Data represents n(%) and Mean±SE (Standard Error)
IFG: impaired fasting glucose
DM: diabetes mellitus

Lifestyle modification of patients with impaired glucose tolerance showed weight loss and a decrease in the incidence of diabetes, thus it is suggested that high FBG leads an increase in the incidence of diabetes, showing the importance of management (Kosaka, Noda, & Kuzuya, 2005). Park et al. found that 69.8% of subjects engage in two or more health risk behaviors, and the greater the number of health risk behaviors, the greater the risk of disease. It is suggested that various risk behaviors show the interaction and correlation between health risk behaviors rather than simple combinations that are not related to each other (Park & Woo, 2012).

3.4. Health Risk Behavior Factors by Type of Health Risk Behavior

Table 4 shows the results of analysis by dividing 6 items of health risk behavior into risk groups. In the case of skipping breakfast in Groups 1 and 2, 28.4% and 76.1% in the normal group, 22.1% and 67.1% in the IFG group, and 11.4% and 56.5% in the diabetic group, the ratio of breakfast skipping in Group 2 of all groups was high, and the rate of having breakfast in group 1 was high ($p<0.001$). The lack of physical activity was 77.8% and 93.7% in the normal group, 77.2% and 92.6% in the fasting glucose disorder group, and 76.5% and 95.3% in the diabetic group. Both group 1 and group 2 lacked physical activity, especially group 2 of all groups were particularly high ($p<0.001$). Inadequate sleep was also found in 62.7% and 88.1% of the normal group, 60.1% and 87.4% of IFG group, and 65.6% and 90.8% of the diabetic group, showing inadequate sleep in both groups 1 and 2. In particular, group 2 of the diabetic group accounted for a high percentage ($p<0.001$). When looking at inappropriate weight of groups 1 and 2, in the normal group, 21.8%, 63.1%, in IFG group, 37.6%, 70.3%, in the diabetic group, 40.7%, 76.4%, the proportion of inappropriate weight was high in Group 2 of all groups, and in Group 1, the proportion of appropriate weight was high ($p<0.001$). Excessive drinking was found to be 11.6% and 54.8% in the normal group, 16.3% and 66.3% in IFG group, and 15.5% and 63.0% in the diabetic group when looking at groups 1 and 2. The ratio of excessive drinking was high in each group 2, and the ratio of not drinking excessively was high in group 1 ($p<0.001$). When examining groups 1 and 2, the items of current smoking were 9.5% and 58.7% in the normal group, 13.1% and 60.6% in IFG group, and 17.6% and 62.0% in the diabetic group. The current smoking rate was high in Group 2 of all groups, and the non-smoking rate in Group 1 was high in all groups ($p<0.001$).

Table 4: Comparison of normal, impaired fasting glucose, diabetes mellitus in the behavioral classification of lifestyle risk behaviors

	Total (n=7,870)								
	Normal (n=5,263)			**IFG (n=1,893)**			**DM (n=714)**		
	Group1 (n=4,274)	**Group2 (n=989)**	**P-value**	**Group1 (n=1,341)**	**Group2 (n=552)**	**P-value**	**Group1 (n=504)**	**Group2 (n=210)**	**P-value**
Breakfast skipping									
No	3112(71.6)	256(23.9)	<0.001	1069(77.9)	187(32.9)	<0.001	447(88.6)	101(43.5)	<0.001
Yes	1162(28.4)	733(76.1)		272(22.1)	365(67.1)		57(11.4)	109(56.5)	
Physical inactivity									
No	875(22.2)	57(6.3)	<0.001	302(22.8)	35(7.4)	<0.001	113(23.5)	10(4.7)	<0.001
Yes	3399(77.8)	932(93.7)		1039(77.2)	517(92.6)		391(76.5)	200(95.3)	
Inadequate sleep									
No	1546(37.3)	101(11.9)	<0.001	503(39.9)	63(12.6)	<0.001	168(34.4)	16(9.2)	<0.001
Yes	2728(62.7)	888(88.1)		838(60.1)	489(87.4)		336(65.6)	194(90.8)	
Inadequate weight									
No	3335(78.2)	354(36.9)	<0.001	824(62.4)	155(29.7)	<0.001	286(59.3)	48(23.6)	<0.001

Yes	939(21.8)	635(63.1)		517(37.6)	397(70.3)		218(40.7)	162(76.4)	
Heavy drinking									
No	3811(88.4)	452(45.2)	<0.001	1134(83.7)	196(33.7)	<0.001	438(84.5)	81(37.0)	<0.001
Yes	463(11.6)	537(54.8)		207(16.3)	356(66.3)		66(15.5)	129(63.0)	
Current smoking									
No	3935(90.5)	434(41.3)	<0.001	1208(86.9)	234(39.4)	<0.001	436(82.4)	86(38.0)	<0.001
Yes	339(9.5)	555(58.7)		133(13.1)	318(60.6)		68(17.6)	124(62.0)	

P value by Chi-square test
Data represents n(%)
IFG: impaired fasting glucose
DM: diabetes mellitus

4. Conclusion

This study has a limitation in that it is difficult to present a clear precedence relationship between cause and effect due to the nature of the cross-sectional research design. There is a possibility that there may be a bias according to the difference in menopause or not, the duration of the disease, and the degree of blood sugar management. As the prevalence of diabetes and chronic diseases is rapidly increasing in recent years, systematic and continuous research should be conducted based on a prospective cohort study. Because there is also the influence of hormones, if a comparison of differences by gender is also made, it is assumed that it will be helpful in the prevention of chronic diseases through acquired risk behavior management in the future.

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