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The influencing factors of metabolic syndrome and the impact of oral health of aged 50 and older Koreans: from the 6th Knhanes

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ABSTRACT

The study on relationship between metabolic syndrome and oral health, is rare. We investigated to find out the correlation of metabolic syndrome and oral health. We investigated to find out the correlation of metabolic syndrome and oral health with the data from the 6th Korea national health and nutrition examination survey. Metabolic syndrome was defined as National Cholesterol Education Program Adult Treatment Panel. To analyze influencing factors of metabolic syndrome, multivariable logistic regression was used. Our results showed that gender (male) (OR 1.86; 95%CI: 1.27-2.72; p<.05) and not taking dietary supplements (OR 1.74; 95%CI: 1.22-2.48; p<.05) factors were the most influencing factors of metabolic syndrome. And then, presence of stress (OR1.59; 95%CI: 1.28-1.98; p<.05), lowest education level (elementary) (OR1.48; 95%CI: 0.98-2.21; p=.05) and oral health (periodontitis) (OR1.39; 95%CI: 1.09-1.78; p<.05) factors were showed as the next strong factors of metabolic syndrome in order. We highlighted on the impact of oral health in metabolic syndrome including chewing difficulty as well as periodontitis. And to prevent metabolic syndrome cause of serious disability and lowering quality of life, we tried to find out the influencing factors of metabolic syndrome considering of this study with diverse view point such as adding the dietary supplements as dietary habit, stress as psychological value, and sedentary time as health-related factors. The government and public health associates should do urgently preparing the policies and strategies focusing on gender disparities, dietary supplements and oral health to prevent metabolic syndrome among ageing population.

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INTRODUCTION

Metabolic syndrome was prevalent and increasing worldwide. Metabolic syndrome, the serious health problem resulted in cardiovascular disease, consists of hypertension, glucose intolerance, abdominal obesity, hypertriglyceridemia and low HDL cholesterol. Oral health factors, the major indicator of quality of life (Cervino *et al.*, 2019), were reported to being associated with metabolic syndrome (Kaur *et al.*, 2019). Gender disparities were also reported to be related with metabolic syndrome (Kim *et al.*, 2019a) the relationship between metabolic syndrome and healthy lifestyle factors (Hoyas and Leon-Sanz, 2019; Lin *et al.*, 2019). Coping style and occupational stress were reported to be associated with

periodontitis among workers by the cross-sectional study (Islam *et al.*, 2019). Circulation microparticles in metabolic syndrome with cardiovascular risks were reported to be associated with oxidative stress (Zahran *et al.*, 2019). Post traumatic stress was reported to be related with metabolic syndrome especially in women (LIhua *et al.*, 2020). In current evidence on natural agents, they were reported to be on thoughtful perspective in oral health including periodontitis (Flores, 2019). It was reported on the links that serum vitamin C and antioxidant levels were related with periodontitis (Isola *et al.*, 2019; Van Der Velden, 2020).

Especially, the relationship between vitamin D level and metabolic syndrome was suggested as important one in obese patient as well as general people for reducing metabolic disease and increasing longevity (Moukayed and Grant, 2019). Dietary nitrate was also reported to be associated with activating of metabolic pathways and reducing of oxidative stress (Lundberg *et al.*, 2018). Dietary supplements such as botanical oil and fish oil was reported to be related with metabolic syndrome as well as type-2 diabetes (Lee *et al.*, 2014).

In addition to that, dietary supplementation of watermelon juice was reported to being ameliorating the metabolic syndromes in obese animals (Wu *et al.*, 2007) though it has kinds of some limitation in animal subjects. And more, oral health was reported to be closely connected with improving of overall health especially among adults (Uloma *et al.*, 2019; Ismail *et al.*, 2019; Rawal *et al.*, 2019). In addition to that number of teeth, as the important indicator of oral health, was reported to increase the risk of metabolic syndrome among elderly (Pedro *et al.*, 2019). Additionally, diabetes and smoking were closely associated with poor oral health such as tooth loss by recent cohort study (Kim *et al.*, 2019b). Through reviewing of current studies, we investigated to find out the major influencing factors of metabolic syndrome and impacting factors of oral health of 50 and older aged Koreans using nationally representative data of 6th Knhanes. Considering potential impact on subjects and lifestyle, we included demographic, socioeconomic, health related and oral health factors.

MATERIALS AND METHODS

Using derived from nationally representative data from 6th Knhanes (Korea National Health and Nutrition Examination Survey), of stratified sampling one, after exclusion of missing and not available one, this study was analyzed. The standards of NCEP-ATP (National Cholesterol Education Program Adult Treatment Panel) for the criteria of metabolic syndrome was used for the study. This study is a cross-sectional designed one.

Study-subjects

This study was conducted to find out on relationship between oral health and metabolic syndrome of 2433 consented participants, 50 aged and older, using complex-sampling-methods by multiple-logistic-regressions with SPSS (ver. 21.0).

Study-analysis

This study was analyzed by complex sampling methods. For the general characteristic of the 2433 subjects of aged 50 and over, demographic statistics methods were used. And chi-square test was used for analyzing prevalence of association between metabolic- syndrome and determinant factors. To investigate influencing factors of metabolic- syndrome and impact of oral health, multi-variable logistic regression methods with SPSS (ver. 21.0) were used. The significance- level was (p<.05).

RESULTS AND DISCUSSION

Out of 2433 participants, 42.0% were men Table 1. 50-64 aged group was 52.2%. The prevalence of metabolic syndrome was 13.6%. About 30.2% participants reported no-taking of dietary supplements. 73.2% participants had stress. The lowest educational group (elementary) was 42.9%. Around 38.1% participants had periodontitis. Table 2 show prevalence of association between metabolic syndrome and determinant factors with impact of oral health among Korean 50 and older adults. The prevalence of metabolic- syndrome was 55.7% (men) and 44.3% (women). Prevalence of metabolic syndrome was showed as smoking (50.3%), yes feeling stress (64.5%), not taking dietary supplements (35.5%), and periodontitis (45.5%).

Table 3 depicts the major determinants of metabolic syndrome and the impact of oral among Korean 50 and over aged adults. By multivariable logistic regression explained that gender (male) (OR1.86;95%CI:1.27-2.72; p<.05), not taking dietary supplements (OR1.74;95%CI:1.22-2.48; p<.05) factors were the strongest one of metabolic syndrome. The next determinant factors were presence of stress (OR1.59;95%CI:1.28-1.98; p<.05), lowest education level (OR1.48;95%CI:0.98-2.21; p<.05), oral health factor (periodontitis) (OR1.39; 95%CI: 1.09-1.78; p<.05), were the major determinants of metabolic syndrome respectively. While the related smoking and drinking factors were showed as not associated one with no significance.

Table 1: General characteristics of 50 and older participants.

Variables	N (2433)	%
Gender		
Male	1023	42.0
Female	1410	58.0
Age		
50-64	1271	52.2
65 over	1162	47.8
Residence		
Urban (Dong)	1851	76.1
Rural (Eup, Myeon)	582	23.9
Marital status (spouse)		
No	27	1.1
Yes	2406	98.9
Income level		
Lowest	562	23.1
Middle-low	625	25.7
Middle-high	615	25.3
Highest	631	25.9
Education level		
Elementary	1044	42.9
Middle-school	428	17.6
High-school	593	24.4
College	368	15.1
Smoking		
No	1506	61.9
Yes	927	38.1
Drinking		
No	480	19.7
Yes	1953	80.3
Physical activity (exercise)		
No	1860	76.4
Yes	573	23.6
Stress recognition		
No	653	26.8
Yes	1780	73.2
Taking dietary supplements		
No	735	30.2
Yes	1698	69.8
Sedentary time		
Less than 5 hrs.	662	27.2
Over 5 hrs.	1771	72.8
Chewing difficulty		
Severe	919	37.8
Moderate	405	16.6
None	1109	45.6
Periodontitis		
No	1506	61.9
Yes	927	38.1
Metabolic syndrome		
No	2101	86.4
Yes	332	13.6

Table 2: Prevalence of association between metabolic syndrome and determinant factors.

Variables	Metabolic syndrome		P-value
	Yes N(%)	No N(%)	
Gender			
Male	185(55.7)	838(39.9)	<.001
Female	147(44.3)	1263(60.1)	
Age			
50-64	186(56.0)	1085(51.6)	.137
65 over	146(44.0)	1061(48.4)	
Residence			
Urban(Dong)	2509(78.0)	1592(75.8)	.374
Rural(Eup, Myeon)	73(22.0)	50.9(24.2)	
Marital status (spouse)			
No	5(1.5)	22(1.0)	.458
Yes	327(985)	2079(99.0)	
Income level			
Lowest	78(23.5)	484(23.0)	.895
Middle-low	85(25.6)	540(25.7)	
Middle-high	88(26.5)	527(25.1)	
Highest	81(24.4)	550(26.2)	
Education level			
Elementary	142(42.8)	902(42.9)	.897
Middle	56(16.9)	372(17.7)	
High	86(25.9)	507(24.1)	
College	48(14.5)	320(15.2)	
Smoking			
No	165(49.7)	1341(63.8)	<.001
Yes	167(50.3)	760(36.2)	
Drinking			
No	53(16.0)	427(20.3)	.064
Yes	279(84.0)	1674(79.7)	
Physical activity (exercise)			
No	258(77.7)	1602(76.2)	.560
Yes	74(22.3)	499(23.8)	
Stress Recognition			
No	118(35.5)	535(25.5)	<.001
Yes	214(64.5)	1566(74.5)	
Taking dietary supplements			
No	118(35.5)	617(29.4)	.023
Yes	214(64.5)	1484(70.6)	
Sedentary time			
Less than 5hrs.	85(25.6)	577(27.5)	.507
Over hrs.	247(74.4)	1524(72.5)	
Oral Health			
Chewing difficulty			
Severe	128(38.6)	791(37.7)	.947
Moderate	54(16.3)	351(16.7)	
None	150(45.1)	959(45.6)	
Periodontitis			
No	181(54.5)	1325(63.1)	.003
Yes	151(45.5)	776(36.9)	

Table 3: Determinant factors of metabolic syndrome and the impact of oral health of 50 and older Koreans by multi-variable logistic regression.

Variables	OR	95% CI		p-value
Gender				
Male	1.86	1.27	2.72	.001
Female		Reference		
Age				
50-64	1.28	.98	1.65	.061
65 over		Reference		
Socio-economic status				
Residence				
Urban (Dong)		Reference		
Rural (Eup, Myeon)	0.84	.63	1.13	.262
Marital status (spouse)				
No	1.19	.43	3.24	.730
Yes		Reference		
Income level				
Lowest	1.11	.80	1.55	.522
Middle-low	1.01	.70	1.44	.961
Middle-high	1.01	.71	1.42	.968
Highest		Reference		
Education level				
Elementary	1.48	.98	2.21	.050
Middle	1.16	.74	1.78	.519
High	1.26	.85	1.86	.249
College		Reference		
Smoking				
No		Reference		
Yes	1.15	.79	1.67	.465
Drinking				
No		Reference		
Yes	1.03	0.74	1.45	.825
Physical activity (exercise)				
No	1.20	.89	1.61	.215
Yes		Reference		
Stress recognition				
No		Reference		
Yes	1.59	1.28	1.98	.001
Taking dietary supplements				
No	1.74	1.22	2.48	.001
Yes		Reference		
Sedentary time				
Less than 5hrs.		Reference		
Over 5hrs.	1.13	0.86	1.48	.360
Oral Health				
Chewing difficulty				
Severe	.924	.657	1.301	.651
Moderate	.910	.692	1.196	.498
None		Reference		
Periodontitis				
No		Reference		
Yes	1.39	1.09	1.78	.007

These findings suggest that men compared to women, not taking of dietary supplements, much stress, lower education level and periodontitis, as the indicator of oral health, were the major determinants of metabolic syndrome with analyzing 2433 participants aged 50 and older participants of the 6th Korea National Health and Nutrition Examination Survey. The prevalence of metabolic syndrome was 13.6%. This prevalence of metabolic syndrome result was low compared to that of another study (Kim *et al.*, 2018) and these results were thought to be due to the total prevalence regardless of gender. Regarding gender (male), which was found to be the strongest factor of metabolic syndrome in this study, was mainly having common with the results of other studies even though they had some difference in age of participants (Kim *et al.*, 2018; Jang and Kim, 2019).

But it was not consistent with the results of another studies in case of post-traumatic stress of women who had more metabolic risk (LIhua *et al.*, 2020) and having more metabolic risks in female nurses by an observational study (Chico-Barba *et al.*, 1993). With key regard to dietary supplements, as identified as one of the strongest factor of metabolic syndrome through this study, they have been identified to influence on the metabolic syndrome in several studies (Moukayed and Grant, 2019; Lee *et al.*, 2014). In addition to that, the cardio-metabolic effect of dietary nitrate was reported to be very critical in the point of view of including mitochondrial respiration in health and disease as well as metabolic effects (Lundberg *et al.*, 2018). And the results of this present study on the association between natural agents and oral health like periodontal health were supported by current studies (Flores, 2019; Isola *et al.*, 2019).

Concerning stress, which was identified as the determinant factor of this study, that result was supported in some aspects by another studies (Zahran *et al.*, 2019; LIhua *et al.*, 2020). Especially, high stress was also known as being associated with taking the risk of periodontitis (Islam *et al.*, 2019). 50-64 aged group compared to 65 and older group was more in being risk of metabolic syndrome of this study and this result was supported by another study (Pedro *et al.*, 2019). In the point of view of periodontitis, as a key indicator of oral health, which was identified as the strong influencing factor of metabolic syndrome of this study, was partially in consistent with the result of another study even though there are difference in the aspects of racial sample and study design (Uloma *et al.*, 2019) and it was supported by another study which was reported on association between oral health and metabolic syndrome among elderly (Pedro *et al.*, 2019) even though the difference in gender. And that, even the awareness and habits of oral care was reported to be contributed to improving of life satisfaction as well as lifestyles of the elderly (Hirano *et al.*, 2019). Poor oral health like periodontitis was shown to be seriously related with diabetes, one of the metabolic components (Rawal *et al.*, 2019) including peripheral vascular disease and these results were partially consistent with our results (Wang *et al.*, 2019). Moreover, periodontitis was reported to be associated with occupational stress and low coping condition (Islam *et al.*, 2019).

Chewing, which was related with tooth loss causing of worsening cognition (Zahran *et al.*, 2019; Lee and Choi, 2019) was already identified as the indicator of good oral health (Kim *et al.*, 2019b; Natarajan *et al.*, 2019) even though it was not significant in this study. In view of education level, as the indicator of socioeconomic status, it was suggested the major factor of metabolic syndrome through this study, that was supported by another study which was reported on the close relationship between education level, alcohol consumption and physical activity and metabolic syndrome (Kim *et al.*, 2018). Smoking and alcohol consumption which were known as the important factors of metabolic syndrome even though they were not significant in this study, were not consistent with the results of other study despite common results in the aspects of education level, and they seem to because of gender difference by study design (Kim *et al.*, 2018).

The strength of this study was based on the nationally representative data with stratified survey in the point of reliability and validity. Major consideration of this study was including and dealing with the importance of the oral health variables such as chewing level and periodontitis as the critical role of potential and influencing on general health of middle older adults. The limitation of this study is in cross-sectional nature design. To conclude, gender (male), not taking of dietary supplements, stress as the psychological factor, lower education level and periodontitis as the indicator of oral health were the influencing major determinants of metabolic syndrome. So, public health professionals might be needed to manage the education strategies considering age, gender disparities, education level and promoting oral health to prevent metabolic syndrome. Further researches might be necessary to explore the mechanisms for validity between metabolic syndrome and oral health by gender to prepare early public and nursing interventions in this population.

CONCLUSIONS

In conclusion, it was suggested that gender(male) and not taking of dietary supplements were the major determinants of metabolic syndrome. And then, the next determinant factors were stress of the psychological status, elementary school in lowest education level and periodontitis in oral health were the important determinants of metabolic syndrome respectively. Therefore, public health and nursing professionals might urgently consider managing the public education strategies heightening on age, gender disparities, dietary habits and improving oral health as well as including to prevent metabolic syndrome. Continued researches should be accomplished to find out the links and associations of metabolic syndrome and dietary habits, psychological areas as well as oral health by gender for the future successful ageing.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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