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

Moon-Hee Kwon*
Department of Nursing, Kyungdong University, Wonju, Gangwon-26495, South Korea

Article History:
Received on: 12 Oct 2020
Revised on: 09 Nov 2020
Accepted on: 12 Nov 2020

Keywords:
Dietary Supplements, Education Level, Gender, Metabolic Syndrome, Periodontitis, Stress

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.

*Corresponding Author
Name: Moon-Hee Kwon
Phone: +82-10-9722-2127
Email: ellizzabeth@hanmail.net

ISSN: 0975-7538
DOI: https://doi.org/10.26452/ijrps.v11iSPL4.3879

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.
stress (Zahran et al., 2019). Post traumatic stress was reported to be related with metabolic syndrome especially in women (Lhua 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; 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; Isola 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. 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
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|
| Variables                                | Metabolic syndrome | P-value |
|------------------------------------------|--------------------|---------|
| **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(98.5)          | 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                            | 1.15 | .79     | 1.67    | .465   |
| Yes                           |      | Reference |        |
| Drinking                      |      |         |         |
| No                            | 1.03 | 0.74    | 1.45    | .825   |
| Yes                           |      | Reference |        |
| Physical activity (exercise)  |      |         |         |
| No                            | 1.20 | .89     | 1.61    | .215   |
| Yes                           |      | Reference |        |
| Stress recognition            |      |         |         |
| No                            | 1.59 | 1.28    | 1.98    | .001   |
| Yes                           |      | Reference |        |
| Taking dietary supplements    |      |         |         |
| No                            | 1.74 | 1.22    | 2.48    | .001   |
| Yes                           |      | Reference |        |
| Sedentary time                |      |         |         |
| Less than 5hrs.               | 1.13 | .86     | 1.48    | .360   |
| Over 5hrs.                    |      | Reference |        |
| 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   |
Poor oral health like periodontitis was shown to be contributed to improving of life satisfaction as awareness and habits of oral care was reported to though the difference in gender. And that, even the 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 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.

Funding Support
The authors declare that they have no funding support for this study.

Conflict of Interest
The authors declare that they have no conflict of interest.

REFERENCES
Cervino, G., et al. 2019. Diabetes: Oral Health Related Quality of Life and Oral Alterations. BioMed Research International, pages 1–14.

Chico-Barba, G., et al. 1993. Burnout and Metabolic Syndrome in Female Nurses: An Observational Study. International Journal of Environmental Research and Public Health, 16(11).

Flores, M. E. J. 2019. Cocoa Flavanols: Natural Agents with Attenuating Effects on Metabolic Syndrome Risk Factors. Nutrients, 11(4):751.

Hirano, M., et al. 2019. Effect of Awareness and Habits of Oral Care on Life Satisfaction. Oral Health & Preventive Dentistry, 17(2):131–138.

Hoyas, I., Leon-Sanz, M. 2019. Nutritional Challenges in Metabolic Syndrome. Journal of Clinical Medicine, 8(9):1301.

Islam, M. M., et al. 2019. Influence of Occupational Stress and Coping Style on Periodontitis among Japanese Workers: A Cross-Sectional Study. International Journal of Environmental Research and Public Health, 16(19):3540.

Ismail, F., et al. 2019. Factors affecting cognition in individuals with tooth loss. Annals of Dental Specialty, 7(4):7.

Isola, G., et al. 2019. Assessment of vitamin C and antioxidant profiles in saliva and serum in patients with periodontitis and ischemic heart disease. Nutrients, 11(12):2956.

Jang, I., Kim, J. S. 2019. Risk of Cardiovascular Disease Related to Metabolic Syndrome in College Students: A Cross-Sectional Secondary Data Analysis. International Journal of Environmental Research and Public Health, 16(19):3708–3708.

Kaur, K. K., et al. 2019. With the advancement of knowledge regarding correlation of oral health and obesity role of dentist emphasized to act in prevention of further progression, along with association with pregnancy, fetal macrosomia, beta 3 adrenergic receptor polymorphisms. EC Dental Science, 18(8):1927–1938.

Kim, J. S., et al. 2019a. Association between Periodontitis and Metabolic Syndrome in a Korean Nationally Representative Sample of Adults Aged 35-79 Years. International Journal of Environmental Research and Public Health, 16(16):2930.

Kim, Y. H., et al. 2018. Effects of socioeconomic status, health behavior, and physical activity on the prevalence of metabolic syndrome. Journal of Exercise Rehabilitation, 14(2):183–191.

Kim, Y. T., et al. 2019b. Association between health status and tooth loss in Korean adults: longitudinal results from the National Health Insurance Service-Health Examinee Cohort. Journal of Periodontal & Implant Science, 49(3):158.

Lee, K. H., Choi, Y. Y. 2019. Association between oral health and dementia in the elderly: a population-based study in. Korea. Scientific Reports, 9(1):14407.

Lee, T. C., et al. 2014. The impact of polysaturated fatty acid-based dietary supplements on disease biomarkers in a metabolic syndrome/diabetes population. Lipids in health and disease, 13(1):196.

Lihua, M., et al. 2020. Metabolic syndrome risk in relation to posttraumatic stress disorder among trauma-exposed civilians in Gansu Province, China. Medicine, 99(1):18614.

Lin, W. T., et al. 2019. Clustering of Metabolic Risk Components and Associated Lifestyle Factors: A Nationwide Adolescent Study in Taiwan. Nutrients, 11(3):584.

Lundberg, J. O., et al. 2018. Metabolic Effects of Dietary Nitrate in Health and Disease. Cell Metabolism, 28(1):9–22.

Moukayed, M., Grant, W. B. 2019. Linking the metabolic syndrome and obesity with vitamin D status: risks and opportunities for improving cardiometabolic health and well-being. Diabetes, Metabolic Syndrome and Obesity, 12:1437–1447.

Natarajan, P., et al. 2019. Body Mass Index and Tooth Loss: An Epidemiological Study in a Sample of Suburban South Indian Population. Journal of Pharmacy And Bioallied Sciences, 11(6):402.
Pedro, R. E. L., et al. 2019. Relationship between dentition, anthropometric measurements, and metabolic syndrome in the elderly. Revista de Odontologia da UNESP, 48.

Rawal, I., et al. 2019. Association between poor oral health and diabetes among Indian adult population: potential for integration with NCDs. BMC Oral Health, 19(1):191.

Uloma, O., et al. 2019. Oral healthcare measures to improve overall health in older adults. Journal of Comprehensive Nursing Research and Care, 4:156.

Velden, U. V. D. 2020. Vitamin C and its role in periodontal diseases past and the present: A narrative review. Oral Health & Preventive Dentistry, 18(1):115–124.

Wang, J., et al. 2019. The risk of periodontitis for peripheral vascular disease: a systematic review and meta-analysis. Reviews in Cardiovascular Medicine, 20(2):81.

Wu, G., et al. 2007. Dietary supplementation with watermelon pomace juice enhances arginine availability and ameliorates the metabolic syndrome in Zucker diabetic fatty rats. Journal of Nutrition, 137(12):2680–2685.

Zahran, A., et al. 2019. Circulating microparticle subpopulation in metabolic syndrome: relation to oxidative stress and coagulation markers. Diabetes, Metabolic Syndrome and Obesity, Volume 12:485–493.