

METABOLIC SYNDROME AND ADULTS AS KEYWORDS OF CO-OCCURRENCE IN SCIENTIFIC ARTICLES

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Abstract. *Introduction. Metabolic syndrome is a metabolic disease affects patients of all ages around the world. The simultaneous occurrence of obesity, lack of physical activity, hyperlipidemia, hypertension, and diabetes mellitus is becoming important for the occurrence of metabolic syndrome. Method. Keywords are the terms used to verbalize the core of a research article. To obtain information on the metabolic syndrome keyword and adults, the Scopus database was used. The keywords of metabolic syndrome and adults were used as a reference for extracting search results. We have limited the continuous updating of the database to search in the range of 2017 - 2021 with the following parameters: open access, area category: medicine, document type: full text, country of selection, and language of documents: without restriction. A total of 56, 505 documents were found in the Scopus database accessed on March 3, 2022. After*

that search, the result extraction was performed using VOSviewer. By VOSviewer we corrected vocabulary differences due to inconsistent keywords in published articles in Scopus to perform a visualization of a map focused on main keywords. At the time of data collection, we captured 177 publications over the five-year period (2017 - 2022) according to search criteria. The aim of the article is to identify the co-occurrence and strength of the relationship of selected keywords „metabolic syndrome” and „adults” in research articles. Result. In the field of analysis of co-occurrence bibliographic coupling by countries, we found that South Korea is the country that has occur the most articles, followed by Iran, and China. The Korean Journal of Family Medicine, the Journal of Clinical Medicine and Frontiers in Endocrinology have the most in the field of analysis of the bibliographic coupling of co-occurrence of the sources. Conclusion. Bibliometric analysis found a strong density correlation between the keywords metabolic syndrome and obesity, but a lower co-occurrence of metabolic syndrome and adults. In the period after the outbreak of COVID-19, we can predict a dramatic increase in metabolic syndrome and obesity, especially in the adult population.

Keywords: *metabolic syndrome, adults, VOSviewer, bibliometric analysis, Scopus*

Introduction. Metabolic syndrome now affects more than a billion people and is one of the diseases that often occurs in the population of adults. Develops during childhood and is highly prevalent among overweight children and adolescents [1]. The definitions of metabolic health vary and usually include ideal levels of blood sugar, triglycerides, high-density lipoprotein (HDL) cholesterol, blood pressure, and waist circumferences [2]. The first clinical definition of metabolic syndrome originated in the World Health Organization in the late 1990s.

The factors that contribute to the development of metabolic syndrome are insulin resistance, which has been shown to be a major cause of metabolic syndrome, dyslipidemia, oxidative stress, and aging, which usually affects individuals over the age of 50, often women more than men, and an inactive lifestyle. The risk factor for cardiovascular disease is atherogenic dyslipidemia [3]. Atherogenic dyslipidemia develops due to impaired insulin resistance that increases lipolysis and the conversion of triglycerides to free fatty acids in adipocytes. These free fatty acids are transported to the liver and muscles by blood. The majority of free fatty acids are re-esterified into triglycerides that together with post-translational stabilization of Apoprotein B enhance and secrete VLDL particles. In the liver, two types of VLDL are synthesized VLDL-1, which is larger, and VLDL-2, which is smaller. The increased secretion of VLDL-1 led to an increase in sdLDL production and a decrease in HDL, resulting in an imbalance ratio between LDL and HDL [4]. Kim (2020) reveals that dyslipidemia is a risk factor for cardiovascular disease and is inversely associated with lack of physical activity [5]. It is often seen in patients with metabolic syndrome, obesity, insulin resistance, and type 2 diabetes mellitus. For these reasons, dyslipidemia is a common and important health problem from the perspective of cardiovascular disease prevention. Dyslipidemia is well managed by therapeutic lifestyle changes with increased physical activities, regular exercise, and diets low in carbohydrates and high in PUFA, as the primary intervention. The next risk factor associated with metabolic syndrome is unhealthy lifestyle habits characterized by calorie-dense diets and physical inactivity [6]. The modern lifestyle has become a burden on health and well-being due to the occurrence of metabolic syndromes in all age groups. Diet-related factors such as eating a more protein diet, high fiber, a fish diet, green leafy vegetables, and having a regular breakfast have been shown to

protect against obesity. Less physical activity, inadequate sleep, and alcohol addiction also may contribute to obesity [7]. Preventing and/or treating metabolic syndrome in adult populations through exercise has been considered a first-line intervention. We perform a bibliometric visualization of the keywords to identify a significant link between them and identify the source title of the article.

Methodology. In this paper, we have used Scopus as one of the online databases to collect bibliometric data [8]. In the online database, we selected the "search" option and entered key words to obtain available publications related to metabolic syndrome and adults. We have limited the continuous updating of the database to search in the range of 2017 - 2021 with the following parameters: open access, area category: medicine, document type: full text, country of selection, and language of documents: without restriction. To avoid possible bias produced by continuous database updates, the retrieval, and export of publications, we created within the Scopus database on one day (3 March 2022). We used bibliometric analysis and the bibliometric visualization method using the VOSviewer 1.6.18 software [9]. VOSviewer, we corrected vocabulary differences due to inconsistent keywords in published articles in Scopus to perform a visualization of a map focused on main keywords. Visualization of keywords on the map creates a cluster that contains keywords that belong to only one file and do not belong to another file. The VOSviewer browser determines scores and the colour layout. The more keywords that are close to the main keyword, the higher the weight of adjacent keywords, and the closer the colour of the main point is yellow. On the contrary, the smaller the number of keywords close to the main keyword, the lower the weight of adjacent keywords toward blue.

Results and Discussion. We perform a bibliometric visualization of the main keywords divided into clusters to identify a significant connection between

them. At the time of data collection in the Scopus database $n = 56\,505$ documents were extracted with the keywords „metabolic syndrome” and „adults”. We limited the search database to the period from 2017 to 2021, type of document: full text was extracted $n = 17\,849$ documents. Then our documents were limited by year and type of area focused on medicine. The results were $n = 7\,389$ documents. We further restricted the keywords „metabolic syndrome” and „adults”. VOSviewer we corrected vocabulary differences focused on main keywords „metabolic syndrome” and „adults”. We corrected differences for merging abbreviation terms with full terms, to ignore each term for metabolic syndrome (eg, Syndrome X, insulin resistance syndrome, deadly quartet), and we apply plural terms for „adults”. At the time of data collection, we captured 177 publications obtained from the Scopus database during the five-year period (2017 - 2022) according to search criteria. The appearance of articles with the keyword „metabolic syndrome” and „adults” was the most frequent research topic in 2021 (55 articles), followed by 2020 (35 articles), 2019 (27 articles), 2018 (25 articles) and 2017 (35 articles). We analysed co-occurrences of keywords to find out to what extent there is a cooperation between countries (international) and identify the source title of the article. To search for co-occurrence, we adjust the score in the minimum number of documents and citations for a given author. By setting all authors in the Scopus database to the minimum number of documents and the minimum number of citations per author, we get a global view of the authors' collaboration network.

Table 1 shows the occurrence of the keyword „metabolic syndrome” and „adults” was appeared in publications ($n = 177$) for the period from 2017 – 2021 published in the Scopus database. The most published articles have the Korean Journal of Family Medicine, followed by the Journal of Clinical Medicine and Frontiers in Endocrinology.

Table 1 List of the top 10 countries and source with the keyword metabolic syndrome in adults published articles between 2017 – 2021 year

Ranking	Country	Number of documents	Articles	Number of documents
1st	South Korea	24	Korean Journal of Family medicine	14
2nd	Iran	18	Journal of Clinical Medicine	9
3th	China	15	Frontiers in Endocrinology	5
4th	India	11	Medical Journal of the Islamic republic of Iran	5
5th	United States	11	Indian Journal in Community Medicine	4
6th	Russian Federation	9	Archives of Public Health	3
7th	Mexico	7	Iranian Journal of Public Health	3
8th	Cuba	6	Revista Habanera De Ciencias Medicas	3
9th	France	6	American Journal of Lifestyle De Medicine	2
10th	Italy	6	Bulletin de L Academie Nationale De Medicine	2

Figure 1 shows us bibliographic coupling by countries and how often co-occurrence keywords are used. We entered 25 for the maximum number of countries per document. The minimum number of documents per country was 5 and the minimum number of country citations was 0. Of the 56 countries, 14 met the limits. For each of the 14 countries, the greatest overall strength of the link between bibliographic links and other countries was calculated. Figure 1 visualizes two clusters with countries and their cooperation in the period from 2017 - 2021. The cluster 1 includes countries (India, South Korea, Iran, Mexico, China, Russian Federation, United States). The first place according to several publications has South Korea, followed by Iran and China.

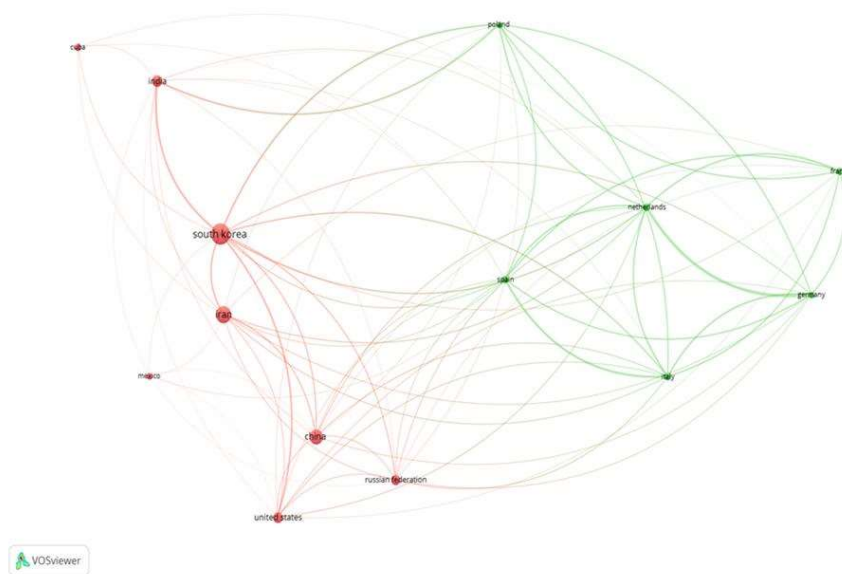


Fig. 1 Co – occurrence bibliographic coupling of keyword „metabolic syndrome“ and „adults“ by countries – full counting

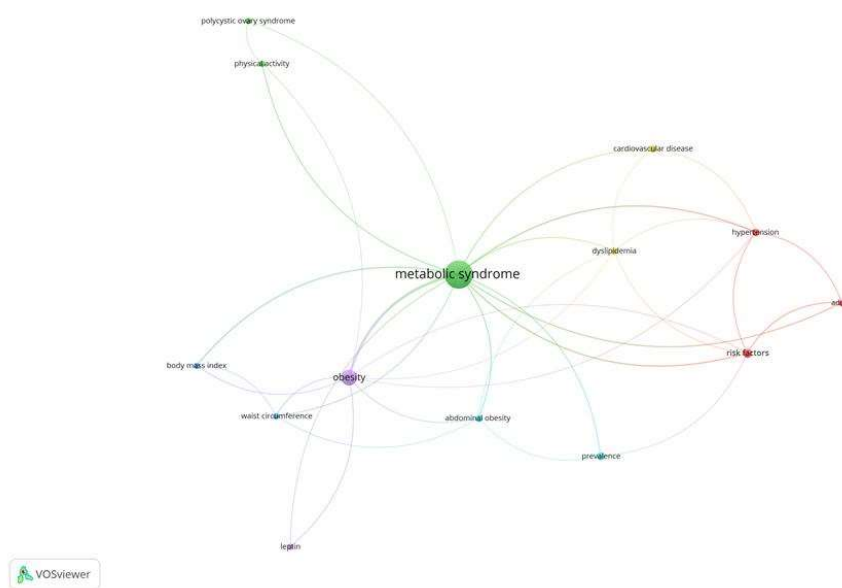


Fig. 1a Network visualisation of co – occurrence keywords related to metabolic syndrome and adults – full counting

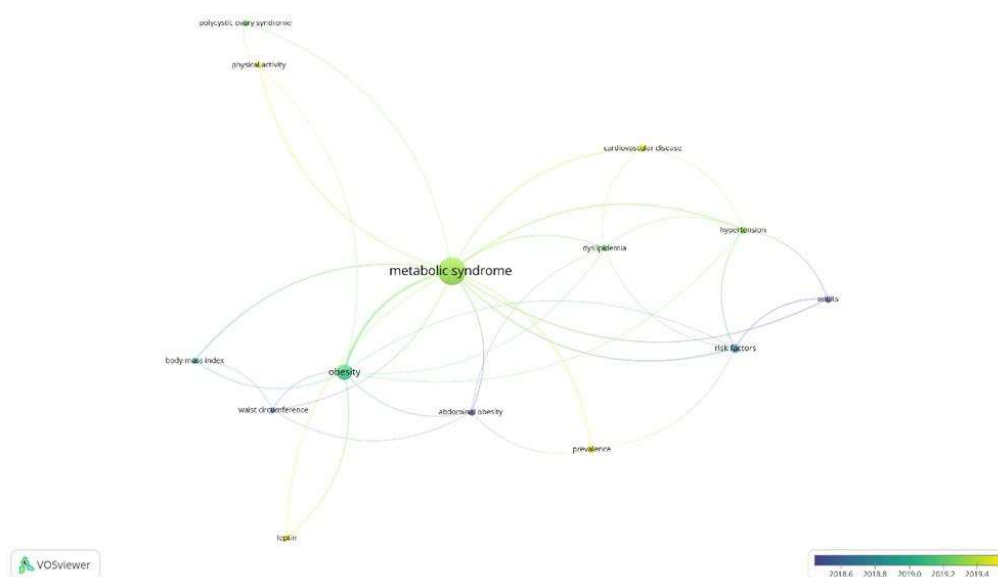


Fig. 1b Overlay visualization co – occurrence keywords related to metabolic syndrome and adults – full counting

Figures 1a and 1b show us how often keywords appear together. Keywords are terms that are used to verbally define basis of a research article. By VOSviewer, the keywords $n = 17$ with the highest total link strength were selected. The size of the circles represents the frequency of appearance as the keywords. The distance between the two circles indicates their correlation. Keyword „metabolic syndrome” has appeared with all keywords divided into 6 clusters. Cluster 1 (adults, hypertension, risk factor), Cluster 2 (metabolic syndrome, physical activity, polycystic ovary syndrome), Cluster 3 (body mass index, waist circumference), Cluster 4 (cardiovascular disease, dyslipidemia), Cluster 5 (leptin, obesity), Cluster 6 (abdominal obesity, prevalence). There was a significant visualization of the density of two keywords. Bibliometric analysis found that the metabolic syndrome has a strong association with obesity, but a lower connection for adults. Obesity is a chronic disease of different origins. Develops when calorie intake is greater than expenditure in genetically susceptible individuals. According

to co – occurrence bibliographic coupling by countries South Korea visualize more articles and sources.

Conclusion. Based on search results on the Scopus database and VOSviewer visualization, we found the strong connection of co-occurrence of keywords. Keywords, which are divided into six clusters, indicate how often they occurred together. According to the co-occurrence of keywords of metabolic syndrome and adults, we found a strong association of risk factors as well as a significant association with diseases. Bibliometric analysis found a strong density correlation between the keywords metabolic syndrome and obesity, but a lower co-occurrence of metabolic syndrome and adults. In the period after the outbreak of COVID-19, we can predict a dramatic increase in metabolic syndrome and obesity, especially in the adult population.

Declaration in interest

The authors declare that they have no conflict of interest.

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