

## Prevalence and Intensity of Periodontal Disease in Individuals with Metabolic Syndrome

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### Abstract

Metabolic syndrome is one of the actual problems of modern medicine because of its high prevalence in the general population and its essential role in the development and progression of cardiovascular diseases.

In the last decade, studying the relationship between metabolic syndrome and periodontal diseases has attracted many scientists' attention. Based on this, the study of the clinical features of periodontal diseases in the early stages of metabolic syndrome is relevant and necessary for timely and successful pathogenetic therapy.

The purpose of our study was to investigate and analyze the prevalence and intensity of periodontal disease in people with metabolic syndrome. To solve this goal, we surveyed 190 people with metabolic syndrome who were registered at the endocrinological clinic in Chernivtsi. They formed the main observation group. The comparison observation group included 90 people without metabolic disorders. The age of the patients ranged from 25 to 55 years. Periodontal disease was detected in 155 of 190 patients with metabolic syndrome ( $81.58 \pm 2.82\%$ ). In 90 patients without endocrinological pathology, the prevalence of periodontal disease was 1.2 times lower ( $65.56 \pm 5.04\%$ ;  $p < 0.01$ ). Generalized periodontitis prevailed in the structure of periodontal diseases in patients with metabolic syndrome:  $26.45 \pm 3.56\%$  cases were in the second stage of generalized periodontitis (GP), and  $21.94 \pm 3.33\%$  in the third stage of GP,  $p < 0.01$ . Therefore, the metabolic syndrome, as a state with a high risk of diabetes development, creates conditions for the formation and rapid progression of inflammatory-destructive periodontal lesions.

**Keywords:** Metabolic syndrome, periodontal disease, pathogenetic therapy.

### Introduction

Metabolic syndrome is one of the actual problems of modern medicine because of its high prevalence in the general population and its important role in the development and progression of cardiovascular diseases [1-4]. The metabolic syndrome includes abdominal obesity, dyslipidemia, arterial hypertension, and disorders of carbohydrate metabolism, and its pathogenetic essence is the phenomenon of insulin resistance [5-9]. In the last decade, studying the relationship between metabolic syndrome and periodontal diseases has drawn the attention of many scientists [10-15]. Disorders that are components of the metabolic syndrome underlie the mechanism of development of many pathological processes, such as hypertension, coronary heart disease, obesity, gout, and others [16-20]. Organs and structures of the oral cavity, including the periodon-

tium, are also involved in the pathological process [21-25]. At the same time, inflammatory-dystrophic changes in the periodontium are directly dependent on such factors as age, disease severity, conducted therapy [26-29]. On this basis, it is relevant and necessary to study the features of the clinical manifestation of periodontal diseases in the early stages of metabolic syndrome for timely and successful pathogenetic therapy.

The purpose of our study was investigation and analysis of prevalence and intensity of periodontal disease in people with metabolic syndrome.

### Material and Methods

To solve this goal, we surveyed 190 people with metabolic syndrome who were registered at the endocrinological

clinic in Chernivtsi, and they formed the main group. The comparison group included 90 people without metabolic disorders. The age of surveyed people ranged from 25 to 55 years. To determine metabolic syndrome, endocrinologists used the criteria proposed by the World Health Organization (WHO) in 1998. According to this criteria, metabolic syndrome includes a violation of tolerance to glucose or type 2 diabetes and/or insulin resistance, combined with two or more of the following criteria: increase in blood pressure to 160/90 mmHg; increased plasma triglycerides levels (greater than 1.7 mmol/l) and/or low levels of high-density lipoprotein cholesterol (less than 0.9 mmol/l in men and less than 1.0 mmol/l in women) [9].

The diagnosis of periodontal diseases was classified by MF Danilevsky in 1994.

## Results

The results of the prevalence of periodontal diseases in people with metabolic syndrome are presented in Table.

1. According to the data, periodontal disease was detected in 155 of 190 patients with metabolic syndrome, which was  $81.58 \pm 2.82\%$ . In 90 patients without endocrinological pathology, the prevalence of periodontal disease was 1.2 times lower ( $65.56 \pm 5.04\%$ ;  $p < 0.01$ ).

Generalized periodontitis prevailed in the structure of periodontal diseases in patients with metabolic syndrome (Figure 1).

The highest percentage was found in the advanced stages of the disease:  $26.45 \pm 3.56\%$  cases were in the second stage of generalized periodontitis (GP), and  $21.94 \pm 3.33\%$  in the third stage of GP,  $p < 0.01$ .

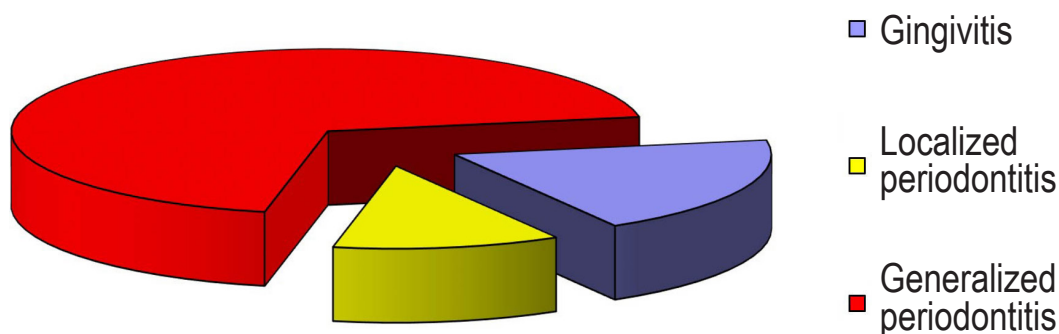
In the group of people without metabolic disorders, the situation was the opposite: the initial stages of periodontal disease were diagnosed in the largest percentage of the patients (Figure 2).

Thus, gingivitis was detected in  $27.12 \pm 5.84\%$  of patients in the comparison group, which was 1.4 times more than in the main group,  $p < 0.01$  (Table 2). Localized periodontitis was found in  $23.73 \pm 5.59\%$  of the patients in the comparison group,  $p < 0.05$ . The number of cases in the initial stage of generalized periodontitis in the compar-

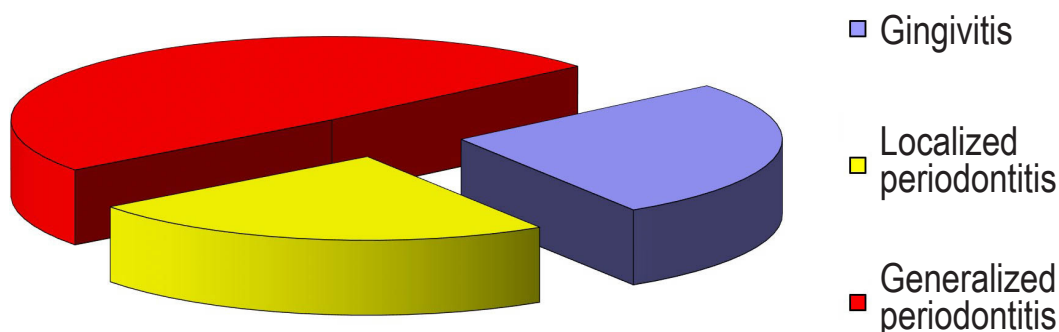
**Table 1:** Prevalence of periodontal disease in the observation groups.

Periodontal condition	Main group n = 190		Comparison group n = 90	
	Abs. number	%	Abs. number	%
Intact periodontal tissue	35	$18.42 \pm 2.82$	31	$34.44 \pm 5.04^*$
Periodontal disease	155	$81.58 \pm 2.82$	59	$65.56 \pm 5.04^*$

Note: \* the significance of the difference between the main group and the comparison groups ( $p < 0.01$ ).



**Figure 1:** Nosological forms of periodontal diseases in the main group.



**Figure 2:** Nosological forms of periodontal diseases in the comparison group.

**Table 2:** Structure of periodontal diseases in the observation groups.

Periodontal condition	Main group n = 190		Comparison group n = 90	
	Abs. number	%	Abs. number	%
Gingivitis	30	19.35 ± 3.18	16	27.12 ± 5.84**
Localized periodontitis	18	11.61 ± 2.58	14	23.73 ± 5.59*
GP initial stage	32	20.65 ± 3.26	13	22.03 ± 5.44**
GP stage I	41	26.45 ± 3.56	11	18.65 ± 5.11**
GP stage II	34	21.94 ± 3.33	5	8.47 ± 3.66**
GP stage III	155	100	59	100

Note: \* the significance of the difference between the main group and the comparison group ( $p < 0.01$ ).

**Table 3:** Prevalence of periodontal disease in the observation groups depending on age.

Age groups (years)	Number of surveyed	Main group		Comparison group		
		With periodontal diseases	%	Number of surveyed	With periodontal diseases	%
25 – 34	53	34	64.15 ± 5.63	21	10	47.62 ± 11.12*
35 – 44	65	54	83.08 ± 3.12	33	21	63.64 ± 7.10*
45 – 55	72	67	93.05 ± 3.12	36	28	77.78 ± 6.40*
Total	190	155	81.58 ± 4.61	90	59	65.56 ± 4.20*

Note: \* the significance of the difference between the main group and the comparison groups ( $p < 0.01$ ).

ison group was 1.06 times higher than in the main group ( $p < 0.01$ ). However, the number of cases in the second stage of generalized periodontitis in patients without metabolic disorders was  $18.65 \pm 5.11\%$  and was 1.4 times lower than in patients with metabolic syndrome ( $p < 0.01$ ). The lowest percentage in the structure of periodontal diseases in the comparison group ( $8.47 \pm 3.66\%$ ) were in the third stage of generalized periodontitis. In contrast, in the main group, the percentage of people in the third stage of GP was 2.6 times higher ( $21.94 \pm 3.33\%$ ,  $p < 0.01$ ).

One of the objectives of our study was the investigation of the prevalence and intensity of periodontal tissue diseases in patients with metabolic syndrome regarding the age aspect (Table 3). In the 25-34 age range, periodontal diseases were found in  $64.15 \pm 5.63\%$  of patients with metabolic syndrome, which was 1.3 times more than those without metabolic disorders ( $47.62 \pm 11.12\%$ ,  $p < 0.01$ ). In the age range of 35-44 years, the number of persons with periodontal diseases in the main group increased to  $83.08 \pm 3.12\%$ .

In the comparison group, an increase in the percentage of patients with periodontal pathology was observed. However, the number of patients was 1.3 times lower than in the main group ( $p < 0.01$ ). With increasing of age up to 44-55 years,  $93.05 \pm 3.12\%$  of cases of periodontal diseases were observed in patients with metabolic syndrome, which was 1.4 times more than in persons without metabolic disorders ( $77.78 \pm 6.40\%$ ,  $p < 0.01$ ).

On average, periodontal disease was observed in  $81.58 \pm 2.82\%$  of patients with periodontal metabolic syn-

drome, while in patients without metabolic disorders, the percentage of periodontal disease was 1.2 times lower ( $65.56 \pm 4.20\%$ ),  $p < 0.01$ ).

Intact periodontal was detected only in  $18.42 \pm 2.82\%$  of patients with metabolic syndrome.

## Discussions

To study the prevalence and intensity of periodontal disease in people with metabolic syndrome, we surveyed 190 people with metabolic disorders who were registered at the endocrinological clinic in Chernivtsi. These patients formed the main group. The comparison group included 90 people without metabolic disorders. The age of the surveyed patients ranged from 25 to 55 years. According to the obtained data, periodontal disease was detected in 155 of 190 patients with metabolic syndrome, which was  $81.58 \pm 2.82\%$ . In 90 patients without endocrinological pathology, the prevalence of periodontal disease was 1.2 times lower ( $65.56 \pm 5.04\%$ ;  $p < 0.01$ ). Generalized periodontitis prevailed in the structure of periodontal diseases in patients with metabolic syndrome, with the highest percentage being found in advanced stages of the disease:  $26.45 \pm 3.56\%$  of cases were in the second stage of GP,  $21.94 \pm 3.33\%$  in the third stage of GP,  $p < 0.01$ . With increasing age, the percentage of people with periodontal disease with metabolic syndrome increased to  $93.05 \pm 3.12\%$ .

## Conclusion

Thus, higher prevalence and intensity of periodontal tissue diseases were observed in patients with metabolic syndrome than in patients without metabolic disorders. Regarding the structure of periodontal diseases, severe stages of periodontal diseases prevailed in patients with metabolic syndrome. The progression of periodontal lesions was faster compared to patients without metabolic disorders. Therefore, the presence of metabolic syndrome, as a condition with a high risk of diabetes, creates the conditions for the formation and rapid progression of inflammatory-destructive periodontal lesions.

## Conflict of Interest

The authors declare that there is no conflict of interest.

## References

- Amirkalali B., Fakhrzadeh H., Sharifi F. et al. Prevalence of Metabolic Syndrome and Its Components in the Iranian Adult Population: A Systematic Review and Meta-Analysis // Iran Red. Crescent. Med. J. – 2015. – Vol. 17, N 12; doi: 10.5812/ircmj.24723.
- World Health Organization (WHO). [Electronic resource]. - Access mode: www.euro.who.int.
- Srikanthan, K., Feyh, A., Visweshwar, H., Shapiro, J. I., & Sodhi, K. (2016). Systematic review of metabolic syndrome biomarkers: a panel for early detection, management, and risk stratification in the West Virginian population. *International journal of medical sciences*, 2016.13(1), 25.
- Ranasinghe, P., Mathangasinghe, Y., Jayawardena, R., Hills, A. P., & Misra, A. Prevalence and trends of metabolic syndrome among adults in the asia-pacific region: a systematic review. *BMC public health*.2017.17(1),101.
- Iqbal, J., Al Qarni, A., Hawwari, A., Alghanem, A. F., & Ahmed, G. (2018). Metabolic syndrome, dyslipidemia and regulation of lipoprotein metabolism. *Current diabetes reviews*, 14(5), 427-433.
- Srikanth, S., & Deedwania, P. Management of dyslipidemia in patients with hypertension, diabetes, and metabolic syndrome. *Current hypertension reports*, 2016.18(10), 76.
- Rask Larsen, J., Dima, L., Correll, C. U., & Manu, P. The pharmacological management of metabolic syndrome. *Expert review of clinical pharmacology*, 2018. 11(4), 397-410
- Ramon-Arbues, E., Martinez-Abadia, B., Gracia-Tabuenca, T., Yuste-Gran, C., Pellicer-García, B., Juarez-Vela, R., & Sáez-Guinoa, M. Prevalence of overweight/obesity and its association with diabetes, hypertension, dyslipidemia and metabolic syndrome: a cross-sectional study of a sample of workers in Aragon, Spain. *Nutricion hospitalaria*, 2019.36(1), 51-59.
- Ricci, G., Pirillo, I., Tomassoni, D., Sirignano, A., & Grappasonni, I. Metabolic syndrome, hypertension, and nervous system injury: Epidemiological correlates. *Clinical and experimental hypertension*, 2017.39(1), 8-16.
- Balarini C. M. Editorial: New Translational Insights on Metabolic Syndrome: Obesity, Hypertension, Diabetes and Beyond / C.M. Balarini, V.A. Braga // *Front. Physiol.* 2016.Vol. 7.P.229.
- Lamster, I. B., & Pagan, M. Periodontal disease and the metabolic syndrome. *International dental journal*, 2017. 67(2), 67-77.
- Musskopf, M. L., Daudt, L. D., Weidlich, P., Gerchman, F., Gross, J. L., & Oppermann, R. V. Metabolic syndrome as a risk indicator for periodontal disease and tooth loss. *Clinical oral investigations*, 2017. 21(2), 675-683.
- Kaye, E. K., Chen, N., Cabral, H. J., Vokonas, P., & Garcia, R. I. Metabolic syndrome and periodontal disease progression in men. *Journal of dental research*, 2016. 95(7), 822-828
- Membreño, I. A. J. (2018). Relationship between Severe Periodontitis and Metabolic Syndrome. *Australian Dental Journal*, 55(3), 252-259.
- Cullinan M. P., Ford P.J, Seymour , G.J. Periodontal disease and systemic health: current status. *Aust. Dent. J.* 2009. 54, Suppl.1: 62-69.
- Navarro, B. G., Salas, E. J., López, J. L., Sánchez, A. R., Corbella, X., & Sala, X. P. Relationship between metabolic syndrome and oral/dental pathology. *Atherosclerosis*. 2018. 275, e113.
- Chen, X., Xie, L., Liu, Y., Chen, D., Yu, Q., Gan, X., & Yu, H. (2016). Metabolic syndrome and periodontal disease among civilian pilots. *Aerospace medicine and human performance*, 87(12), 1016-1020.
- Anand, P., Sukul, S., Kamra, P. Periodontal Diseases and Systemic Conditions: A Comprehensive Review. *Journal of Advanced Medical and Dental Sciences Research*, 2018;6(7):73-75.
- Day K. Metabolic syndrome, or what job will: definitions and epidemiology. *Diab. Vasc. Dis. Res.* 2007; 4(1): 32–38.
- Fina L. F., Vega G. L., Leonard D., Grundy S. M. Fasting glucose, obesity, and metabolic syndrome as predictors of type 2 diabetes: the Cooper Center Longitudinal Study. *J. Investig. Med.* 2012. 60, (8): 1164-1168.
- Souza, M. L., Massignan, C., Peres, K. G., & Peres, M. A. Association between metabolic syndrome and tooth loss: A systematic review and meta-analysis. *The Journal of the American Dental Association*, 2019. 150(12), 1027-1039.
- Org, E., Blum, Y., Kasela, S., Mehrabian, M., Kuusisto, J., Kangas, A. J., Laakso, M. Relationships between gut microbiota, plasma metabolites, and metabolic syndrome traits in the METSIM cohort. *Genome biology*, 2017.18(1), 70.
- Rodríguez-Monforte, M., Sánchez, E., Barrio, F., Costa, B., & Flores-Mateo, G. Metabolic syndrome and dietary patterns: a systematic review and meta-analysis of observational studies. *European journal of nutrition*, 2017. 56(3), 925-947.
- Nascimento, G. G., Leite, F. R., Peres, K. G., Demarco, F. F., Corrêa, M. B., & Peres, M. A. Metabolic syndrome and periodontitis: a structural equation modeling approach. *Journal of periodontology*, 2019. 90(6), 655-662.
- Sousa S. M. Norman R.J. Metabolic syndrome, diet and exercise. *Best Pract. Res. Clin. Obstet. Gynaecol.* 2016; doi: 10.1016/j.bpobgyn.2016.01.006.
- Kumar, N., Bhardwaj, A., Negi, P. C., Jhingta, P. K., Sharma, D., & Bhardwaj, V. K. Association of chronic periodontitis with metabolic syndrome: A cross-sectional study. *Journal of Indian Society of Periodontology*, 2016. 20(3), 324.
- Mongraw-Chaffin, M., Foster, M. C., Anderson, C. A., Burke, G. L., Haq, N., Kalyani, R. R., & Vaidya, D. Metabolically healthy obesity, transition to metabolic syndrome, and cardiovascular risk. *Journal of the American College of Cardiology*, 2018. 71(17), 1857-1865.
- Catanzaro, R., Cuffari, B., Italia, A., & Marotta, F. Exploring the metabolic syndrome: Nonalcoholic fatty pancreas disease. *World journal of gastroenterology*, 2016. 22(34), 7660.
- Ford E. S., Li C. Metabolic syndrome and health-related quality of life among U.S. adults. *Ann. Epidemiol.* 2008. 18 (3): 165-171.