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The influence of dyslipidemia on periodontitis

Wpływ dyslipidemii na zapalenie przyzębia

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DOI: http://dx.doi.org/10.20883/df.2021.8

ABSTRACT

Dyslipidemia is a common metabolic disorder which is characterized by abnormal serum lipid levels. The cause of this condition may be genetic, enviromental or both, many systemic disorders have an influence on the developement of dyslipidemia. Changes in serum lipid levels are considerated as a proinflammatory factor which may have an impact on manytissues and organs. Periodontitis is a worldwide spread disease of the tooth supporting tissues caused mostly by the local inflammatory process but also other factors play a role in its developement. The aim of this study was the review of the articles in which has been investigated the influence of dyslipidemia on periodontitis. In all of the chosen articles dyslipidemia was positively corelated with periodontal parameters which confirm the presence of inflammation. The exact relationship between dyslipidemia and periodontitis is still unclear, but many authors try to explain this mechanism.

Keywords: dylipidemia, periodontitis, hyperlipidemia, triglicerydes, cholesterol.

STRESZCZENIE

Dyslipidemia jest częstym zaburzeniem metabolicznym charakteryzującym się nieprawidłowym poziomem lipidów w surowicy krwi. Przyczyną mogą być podatność genetyczna, wpływ środowiska jak i oba czynniki razem. Wiele zaburzeń ogólnoustrojowych wpływa na rozwój dyslipidemii. Zmiany w poziomie lipidów są uważane za możliwy czynnik prozapalny, który może mieć wpływ na wiele tkanek oraz narządów. Zapalenie przyzębia jest chorobą dotykającą ludzi na całym świecie. Dotyczy ona tkanek podpierających zęby i jest głównie spowodowana przez miejscowy stan zapalny, ale również inne czynniki biorą udział w jej rozwoju.
Celem pracy był przegląd piśmiennictwa dotyczący wpływudyslipidemii na zapalenie przyzębia.
We wszystkich wybranych badaniachdyslipidemia pozytywnie korelowała ze wskaźnikami świadczącymi o zapaleniu przyzębia. Dokładna zależność między dyslipidemią a zapaleniem przyzębia jest wciąż badana, wielu autorów próbuje wyjaśnić ten związek.

Słowa kluczowe: dyslipidemia, zapalenie przyzębia, hiperlipidemia, triglicerydy, cholesterol.

Introduction

Dyslipidemia is a metobolic disorder characterized by high serum lipid level.It's occurance is increasing worldwide during the last decades [1, 2, 3]. The main changes in the blood serum during dyslipidemia are high total cholesterol (TC), high triglycerides (TG), elevated low-density lipoprotein (LDL)and decreased high-density lipoprotein (HDL) [4]. The cause of dyslipidemia may be genetic, enviromental or both.

The age of conducting routine lipidogram is controversial, however according to the guidelines (USPSTF – United States Preventive Services Task Force) clinicans should screen men aged≥35 years and women aged≥45 years and ealier for those people who has increased risk for cardiovascular disease or familial hiperlipidemia in history [5]. Lipidograms in ealier age should be also considerated in the following clinical conditions: diabetes, gestational diabetes, obesity, hiperthension, presence of peripherial arthery disease,kidney diseases, autoimmune deseases (like rheumatoid arthritis, systemic lupus erythematosus or psoriasis), antiretroviral therapy, xanthomas. The risk of dyslipidemia also may increase while poor eating habits, sedentary lifestyle, hormonal changes during sexual maturation process, hypothyroidism, liver diseases, tabacco and alcohol use [2, 6].

It is supposed that dyslipidemia causes hyperactivity of white blood cells which leads to higier

production of reactive oxygen species (ROS) and lipid peroxydation [7, 8, 9]. Lipids may also directly stimule macrophages by changing macrophage gene expression to produce pro-inflammatory cytokines such as tumornecrosis factor-alpha (TNF -alpha) and interleukin1 beta (IL-Iβ) by polymorphonuclear (PMN) cells [10].

Periodontitis is a chronic multifactorial inflammatory disease and it is one of the most often occuring conditon affecting the teeth. It is associated with dysbiotic plaque biofilms and it is characterized by progressive destruction of the tooth supporting tissues (periodontium). The primary causative agent of inflammation of tooth surrounding tissues – gingivitis and periodontitis are mixed bacterias in dental plaque [11, 12]. The aim of inflammation is to defend the host against the bacterial challenge, but prolonged and/or excessive inflammation results in surrounding tissue loss [13]. The progression of gingivitis to periodontitis mostly depends on host immune response [14]. Also other factors likeplaque and calculus, genetics, environmental factors, systemic health of the patient, lifestyle habits and various social determinants play a role in periodontitis developemnt [14, 15, 16]. Clinical examination of periodontium involves estimation of local factors, dental plaque accumulation, bleeding on probing, assessment of probing depths, determination of furcation involvement, recessions, determination of clinical attachment level and teeth mobility [17]. The primary features of periodontitis are manifested through clinical attachment loss (CAL), radiographically assessed alveolar bone loss, presence of periodontal pocketing and gingival bleeding [16].

Existing reasearch studies on impact of high total cholesterol on a periodontitis risk are limited. Although there are quite a lot of publications which indicates that periodontitis causes increse of serum lipid levels, few cases in literature report that dyslipidemia negatively affects periodontal tissues [18, 19, 20, 21, 22, 23].Emerging publications show a possible coincidence of dyslipiemia and periodontitis which was a starting point to write this systematic review.

Aim

The objective is the systemic review of literature which assess the influence of dyslipidemia on periodontitis.

Material and methods

A review of the studies on the relationship between dyslipidemia and periodontal desease was conducted based on available databases covering articles in the field of medicine and biological sciences: PubMed and Wiley Online Library. The key words were: periodontitis, dyslipidemia, hiperlipidemia, triglicerydes, cholesterol in many combinations. The search was restrict to full-text articles in english or polish published during last 15 years. Literature reviews and systematic reviews had been excluded **(Figure 1)**.

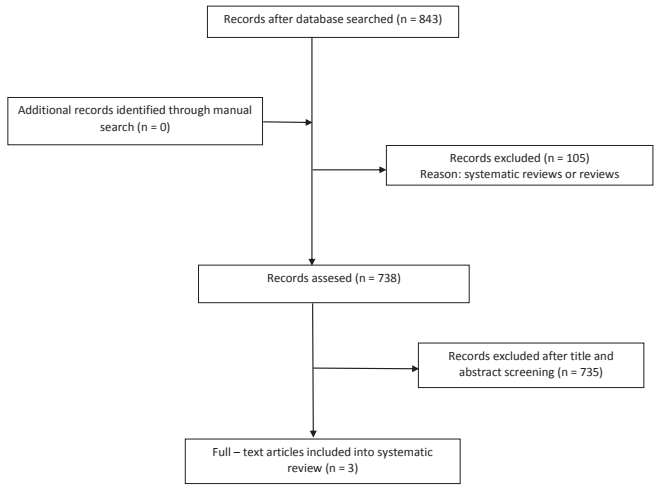

Figure 1. Flow chart of literature search and study selection

Rycina 1. Zasady selekcji artykułów w publikacji

Results

The inclusion criteria in chosen articles were strict: 1) no history of systemic disease that affects lipid metabolism, such as: impaired glucose tolerance, diabetes mellitus or other endocrine diseases, nephrotic syndrome, chronic renal disease, and cardiovascular disease, 2) no drug treatment for hyperlipidemia, 3) no pregnancy at the time of study, 4) no periodontal treatment within 3 moths (Awartani et al.) or 6 months(others), 5) no history of systemic atibiotic administration within the last 3 months, 6) no smoking.

All of the chosen studies [19, 21, 22] involved normolipidemic and hiperlipidemic groups in which periodontal status was evaluated. Clinical periodontal examination consisted of the following periodontal parameters: PI – plaque index, PD – pocket depth, CAL – clinical attachment loss, BoP – bleeding on probing. The totoal number of examined patients was 318, including 140 normolipidemic patients (control groups) and 178 hiperlipidemic patients.

The awarage age of patients was 48. There were no differenece in social status between groups **(Table 1)**.

Table 1. Changes in the lipid profile in people with periodontitis compared to the control group
Tabela 1. *Zmiany profilu lipidowego u pacjentów periodontologicznych w porównaniu z grupą kontrolną*

	Hiperlipidemic group			Control Group		
	Fentoğluet al. (21) (n=51)	Awartani et al. (19) (n=30)	Yıldırım et al. (22) (n=97)	Fentoğluet al. (21) (n=47)	Awartani et al. (19) (n=30)	Yıldırım et al. (22) (n=63)
Age	49,41 +/- 6,00	47,7+/-5,00	51,0+/-8,1	47,30+/-8,13	46,3+/-4,37	47,7+/-7,9
Females/males	35/16	30/0	no data	20/27	30/0	no data
BMI	28,81+/-4,12	29,3+/-5,7	26,3+/-2,4	26,57+/-4,34	24,1+/-4,3	25,0+/-2,6
Lipid parameters						
TC (mg/dl)	251,02+/-29,31	253+/-53	250,7+/-31,8	181,79+/-23,89	154+/-14	176,9+/-24,1
TG (mg/dl)	176,10+/-74,46	148+/-58	170,0+/-78,9	103,91+/-23,89	144+/-37	116,8+/-43,3
LDL-C (mg/dl)	160,73+/-26,68	211+/-53	165,3+/-32,4	105,55+/-21,24	118+/-9	100,1+/-18,3
HDL-C (mg/dl)	54,29+/-11,03	42+/-12	53,0+/-12,9	55,49+/-11,88	48+/-5	53,5+/-15,0
Periodontal parameters						
PI	1,80+/-0,46	-	1,2+/-0,5	1,46+/-0,74	-	1,1+/-0,4
PD (mm)	2,98+/-0,83	2,76+/-1,20	2,8+/-0,5	2,28+/-0,35	2,17+/-1,25	2,5+/-0,3
CAL (mm)	2,42+/-0,79	2,71+/-1,5	3,1+/-0,7	1,81+/-0,57	2,19+/-0,99	2,6+/-0,4
BoP (%)	62,0+/-19,0	34,06	41,0+/-25,6	15,0+/-13,0	29,68	31,2+/-21,4

Legend: BMI – body mass index – weight (in kg)/ height^2 (in m^2), TC – total cholesterol,
TG – triglyceride, LDL-C – low density lipoprotein cholesterol, HDL-C – high lipoprotein cholesterol;
PI – plaque index, PD – pocket depth, CAL – clinical attachment loss, BoP – bleeding on probing

Table 1 illustrates changes in the lipid profile in people with periodontitis compared to the control group. According to available publications 3 papers were included to the comparison [19, 21, 22]. In all of these studies total cholesterol, plasma trigliceryde, LDL – C and BMI were higer in dyslipidemic groups than in control groups, whereas HDL-C levels were lower in dyslipidemic groups. The clinical periodontal parameters such as BoP, PD and CAL were positively correlated with dyslipidemia. PI did not have a corelation with serum lipid levels. Also BMI was positively corelated with LDL levels, PD and BoP. Above results may indicate that people with dyslipidemia have a pronounced tissue response and are more susceptible to periodontal disease.

Discussion

The exact mechanism of relationship between dyslipidemia and periodontitis is still unclear. Although above articles indicates that serum lipid levels may alter periodontal parameters it is known that this proces is coplex. Also other autors investigated that corelations.

Interesting conclusions drew Lutfioğlu M et al. [7] who analyzed gingival cervicular fluid and changes in oxidative status in patients with and without hiperlipidemia and with and without periodontitis. PI, GI, BoP were not associated with serum lipid levels whereas PD and CAL were higier in patients with hiperlipidemia but these differences where not statistically significant. They also found that in patients with hiperlipidemia GCF PC (gingival cervical fluid protein carbonyl) and MDA (malondialdehyde) are positively corelated with all periodontal measurments and GCF TAOC (gingival cervical fluid total antioxidant capacity) is negatively corelated with periodontal parameters. That indicates that oxidative status is elevated in hyperlipidemic patients which causes alterations in periodontal tissues [7]. Fentoglu et al. in her work in 2015 proved that patients with hyperlipidemia and periodontitis have a harmful oxidative status. Participants with high serum lipid levels and periodontal disease had elevated levels of malondialdehyde (lipid peroxidation marker), and 8-hydroxydeoxyguanosine (oxidative DNA damage marker) [8].

Fentoglu et al in 2008 confirmed that dyslipidemia and type 2 diabetes have a dysregulatory effect on immune system cells and on wound healing which increase the susceptibility to periodontitis and other infections [24]. It is considerated that dys-

lipidemia due to hiper-responsive monocytic fenotype may be more important than hyperglycemia when it comes to periodontal disease [21, 25, 26].

Nepomuceno et al. in 2017 investigated the expression of genes belonging to the IL10 and interferon-alphaand – gamma pathways in patients affected by type 2 diabetes mellitus, dyslipidemia, and periodontitis.Interestingly dyslipidemia seems to has an increased impact on systemic expression of important pro- and anti-inflammatory genes in personsaffected by the multifactorial diseases liketype 2 diabetes mellitus, dyslipidemia, and periodontitis [18]. Other studies which examined dyslipidemic subjects have reported reduced levels of the anti-inflammatory IL-10 and higher levels of proinflammatory cytokines [1–6, 16, 18–20, 24, 27–29]. However the mechanism of this proces in still unclear.

Obesity may be also an independent risk factor for periodontitis.It was observed that patients with elevated BMI have a higher prevalance of periodontal disease.Also the researches in Korea proved that high waist circumferance which is an indicator of central obesity is positively coralated with periodontitis [30]. It seems that coralation between obesity and periodontitis may be determined by the race and the geographic area. Adipose tissue cells – adipocytes secrates adipocytokine which may directly destroy periodontium [31].

An important enviromental factor of dyslipidemia may be high-fat diet which may cause functional abnormalities in polymorphonuclear leukocytes (PMNL). Lipids and endotoxines in high-fat diet may stimulate PMNL what can lead to higer susceptibility of periodontium to inflammation and teeth surrounding tissue loss [21, 32].

Conclusion

According to the above studies in patients with hyperlipidemia periodic periodontal checkup and periodontal care should be carried-out more frequently.Emarging studiesindicate that abnormal lipid levels may have an influace on periodontium. The precise mechanism is unclear and more studies with larger number of participants should be conducted to confirm this corelation.

Acknowledgements

Conflict of interest statement

The authors declare no conflict of interest.

Funding sources

There are no sources of funding to declare.

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Acceptance for editing: 28.06.21
Acceptance for publication: 29.09.21

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