Periodontal status of Białystok citizens aged 65–74 years: A pilot study

Stan przyzębia mieszkańców Białegostoku w wieku od 65 do 74 lat – badania wstępne

Magdalena Sulewska^{1, B–D}, Jan Pietruski^{2, C, E, F}, Edyta Sulima^{3, B, D}, Rafał Świśłocki^{2, B, D}, Agnieszka Paniczek^{4, B}, Ewa Duraj^{1, B}, Małgorzata Pietruska^{1, A, C, E, F}

¹ Department of Periodontology, Medical University of Białystok, Białystok, Poland

² Private Practice, Białystok, Poland

³ Individual Medical Practice Edyta Sulima, Wasilków, Poland

⁴ Non-public Healthcare Institute “Agmed”, Białystok, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;

D – writing the article; E – critical revision of the article; F – final approval of article

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Address for correspondence

Magdalena Sulewska

E-mail: cholewa.magda@gmail.com

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Abstract

Background. Routine epidemiology examinations of the periodontium in adults (regional and supragingival) are necessary to evaluate their health and to undertake proper preventative actions (prophylactic and therapeutic) pertaining to periodontitis.

Objectives. The aim of the study was to evaluate the oral hygiene and periodontal status of citizens aged 65–74 years residing in a big city in the Podlaskie province.

Material and methods. The study included 72 randomly chosen Białystok citizens (51 women and 21 men). While recording the patients' medical history, special attention was paid to cigarette smoking. The condition of oral hygiene and periodontal status were evaluated. The following parameters were tested: API (approximal plaque index), PI (plaque index), BOP (bleeding on probing), PD (probing depth) and CAL (clinical attachment level). Moreover, the mean number of preserved teeth, the percentage of persons with at least 20 preserved natural teeth and the percentage of edentulism were evaluated.

Results. Mean API was $66.16\% \pm 47.33$, PI – $57.82\% \pm 49.39$ while BOP – $26.74\% \pm 44.27$. PD was estimated at $2.13 \text{ mm} \pm 1.62$, while the loss of CAL was found in 61.08 ± 27.43 sites. The coefficient of nicotine addiction was 675 ± 475.13 . The mean number of preserved teeth was 13.36 ± 8.18 , while maintained chewing function was found in 27.78% of the individuals and edentulism in 12.5% of the cases.

Conclusions. The periodontal status of Białystok citizens aged 65–74 years is unsatisfactory. The percentage of persons with preserved chewing function is low and thus the need for periodontal treatment and rehabilitation of the masticatory apparatus is high.

Key words: epidemiology, periodontal status, gerontology

Słowa kluczowe: epidemiologia, stan przyzębia, gerostomatologia

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Periodontitis may affect as much as 90% of the world population and thus is considered a civilizational disease.¹ Both the evaluation of periodontal disease incidence and the presence of correlations between periodontal disorders and general health condition are one of the main objectives of epidemiological studies. Periodic examinations on the individuals aged 65–74 years included in the retired group are conducted in all developed countries. The observations of both periodontitis and the number of teeth in this age group reflect the outcomes of the prophylactic actions and dental treatment performed so far, but they may also explain the clinical course of a number of civilization diseases, e.g. diabetes, atherosclerosis or osteoporosis.²

Demographic data indicates that 15% of the world's population in 2025 will be over 60 years of age.³ According to WHO, there will be 2 billion people over 60 years of age in 2050, 80% of which will comprise the population of developing countries.⁴ In Poland in 1989, 10% of society was over 60 years of age.⁵ According to statistical data by GUS (Central Statistical Office of Poland), in 2020, 22.4% of Polish society will be over 60 years of age and 1/3 of this amount will be over 75 years of age.⁶ The ageing of society will be accompanied by the increase in health needs, including those pertaining to the oral cavity. Therefore, monitoring the status of oral health is extremely important for establishing pro-health activities aimed at improving the health of the oral cavity.

Due to the increasing ratio of seniors, every gerostomatologic examination, which includes the number of preserved teeth, the percentage of persons with at least 20 natural teeth and the percentage of edentulism, is of great value.⁷ The comparison of current monitoring outcomes with earlier results allows us to evaluate the changes in dental status.⁸

The 65–74 years age group in Poland was first included in epidemiology studies in 1998. Further national research was carried out in 2002 and 2009.^{8,9} The presented research constituted a part of a national project conducted in the years 2013–2014 and was aimed at the evaluation of the oral cavity health status as well as periodontal status in a large urban agglomeration in the Podlaskie province.

Material and methods

The study was conducted in the area of Białystok city and included randomly chosen citizens aged 65–74 years. The invitation for the examination was sent to 1,000 people, yet only 72 persons including 51 women and 21 men reported for the examination (mean age 68.57 ± 3.22).

The exclusion criteria for periodontal examination were general contraindications (e.g. history of bacterial endocarditis) and local ones (e.g. acute odontogenic conditions).

Medical history included the data pertaining to cigarette smoking. Smoking coefficient calculated as the

product of the number of cigarettes smoked per day and the duration of the addiction was used for the evaluation.

A clinical study was performed with the use of periodontal probe (PCPUNC 15, Hu-Friedy, USA) with a scale in millimeters. The examining personnel (dentists) had undergone standard calibration training. The study was conducted using a program financed by the Ministry of Health Evaluation to investigate the health condition of the oral cavity in the Polish population aged 35–44 and 65–74 years and was approved by the Bioethics Commission of the Medical University of Białystok (R-I-002/266/2009).

The physical examination included the evaluation of oral hygiene and periodontal status with the use of the following parameters: plaque index (PI) by O'Leary,¹⁰ apical plaque index (API) by Lange et al.,¹¹ bleeding on probing (BOP) by Ainamo & Bay,¹² probing depth (PD) and clinical attachment level (CAL). PI, BOP, PD and CAL were assessed at 4 aspects: buccal, palatal/lingual, mesial and distal. PD was defined as the distance between gingival margin and sulcus/pocket bottom detected with the probe. CAL was defined as the distance between sulcus/pocket bottom identified with the probe and cemento-enamel junction.

Moreover, the number of pockets with PD > 5 mm and the sites with the loss of attachment CAL $\geq$ 3 mm and CAL > 5 mm were determined. The percentage [%] of individuals with CAL $\geq$ 3 mm and CAL > 5 mm as well as individuals with PI, API < 25% and BOP less than 20% were established. Also, the mean number of preserved teeth, the percentage of persons with at least 20 preserved natural teeth and the percentage of edentulism were evaluated.

Third molars were not taken into consideration in the research. In the case of teeth with permanent prosthetic restorations, the reference point was apical margin of the prosthetic restoration. The obtained values were presented in numbers rounded to the nearest millimeter.

The statistical analysis was performed with the use of STATISTICA 12.0 StatSoft (StatSoft, Tulsa, USA) software. Non parametric U Mann-Whitney test was used for the comparison between the groups. Spearman's rank order correlation coefficient was also determined. The results were considered statistically significant at p -value < 0.05.

Results

The results indicate that Białystok citizens aged 65–74 years exhibit a poor oral cavity health. It was observed that oral hygiene is unsatisfactory, which may be confirmed by the high mean values of the evaluated hygiene coefficients.

According to observations, mean API value was $66.16\% \pm 47.33$, which is indicative of quite poor oral hygiene. The percentage of persons with proper oral hygiene (API < 25%) was 12.7% and was independent of gender.

Mean PI value was $57.82\% \pm 49.39$ and was slightly higher in the group of women (0.59 ± 0.49) as compared to the group of men (0.57 ± 0.49). The percentage of in-

Table 1. Qualitative and quantitative data in the study group of Białystok citizens aged 65–74 years (mean $\pm$ standard deviation)

Parametr	Mean	$\pm$ Standard deviation
Age	68.57	± 3.22
Number of teeth	13.36	± 8.18
API	0.66	± 47.33
PI	57.82	± 49.39
BOP	26.74	± 44.27
PD	2.13	± 1.62
Number of pockets with PD > 5 mm	0.79	± 1.74
The sites with loss of CAL	61.08	± 27.43
The sites with loss of CAL ≥ 3	27.51	± 15.62
The sites with loss of CAL > 5 mm	3.08	± 4.71
The percentage of persons with API < 25%	12.70%	
The percentage of persons with PI < 25%	14.29%	
The percentage of persons with BOP < 20%	46.03%	
The percentage of persons with PD > 5 mm	28.57%	
The percentage of persons with CAL ≥ 3 mm	100%	
The percentage of persons with CAL > 5 mm	57.14%	
The percentage of persons with loss of CAL	100%	
The coefficient of nicotine (n = 6)	675	± 47.13

* The group excluding the individuals with edentulism: 72–9 = 63; n – number of people.

dividuals who effectively brushed their teeth was 14.29% (Table 1 and 2).

According to estimations, the mean BOP value was $26.74\% \pm 44.27$. No correlation between this parameter and gender was observed. The percentage of persons with mild symptoms of inflammation, which is BOP < 20%, was 46.03% and was not related to gender.

In the elderly group, the mean PD value was 2.13 mm ± 1.62 and was not related to gender. According to observations, men had deeper pockets (2.19 ± 1.08) than women (2.10 ± 1.21). The number of deep pockets of PD > 5 mm was 0.79 ± 1.74 .

Mean number of sites with the loss of attachment was 61.08 ± 27.43 , 45.39 ± 32.45 in women and 70.61 ± 26.58 in men ($p = 0.0009$). In 100% of the group CAL was found to be ≥ 3 and > 5 mm in 57.14%.

According to observations, smoking coefficient was 675 ± 475.13 and was higher in women (912.5 ± 352.07) than in men (200 ± 282.84). In the case of seniors, active smokers constituted 8.33% of the examined individuals (6 persons) (Table 1 and 2).

Nine (8 women and 1 man) out of 72 individuals aged 65–74 years, which was 12.5%, were edentate. The mean number of teeth present in the mouth was 13.36 ± 8.18 while the persons with maintained chewing function (with over 20 left) constituted 27.78% of the study group (20 individuals). In the case of women, the number of preserved teeth was significantly lower (11.35 ± 8.11) as compared to men (17.65 ± 6.64) (Table 2 and 3).

Table 2. Qualitative and quantitative data of Białystok citizens aged 65–74 years depending on gender (mean $\pm$ standard deviation)

Parameter	Female (n = 49)		Male (n = 23)		p-value
Age	69	± 3.20	67.62	± 3.13	0.0976
Number of (preserved) teeth	11.35	± 8.11	17.65	± 6.64	0.0009
API	0.66	± 0.47	0.67	± 0.47	0.0174
PI	0.59	± 0.49	0.57	± 0.49	0.6117
BOP	0.28	± 0.45	0.25	± 0.43	0.3022
PD	2.10	± 1.21	2.16	± 1.08	0.0983
Number of pockets with PD > 5 mm	0.78	± 1.80	0.82	± 1.68	0.9343
CAL	2.69	± 1.56	2.72	± 1.50	0.5708
The sites with loss of CAL	45.39	± 32.45	70.61	± 26.58	0.0009
The sites with loss of CAL ≥ 3 mm	20.73	± 15.91	31.17	± 18.12	0.023
The sites with loss of CAL > 5 mm	2.22	± 3.91	3.69	± 5.56	0.2615
The percentage of persons with API < 25%	12.19%		13.63%		0.8749
The percentage of persons with PI < 25%	12.19%		18.18%		0.5482
The percentage of persons with BOP < 20%	41.46%		54.54%		0.3334
The percentage of persons with PD > 5 mm	29.27%		27.27%		0.8697
The percentage of persons with CAL ≥ 3 mm	100%		100%		
The percentage of persons with CAL > 5 mm	56.10%		59.09%		0.8229
The percentage of persons with loss of CAL	100%		100%		
The coefficient of nicotine (n = 6)	912.5	± 352.07	200	± 282.84	0.087

* The group excluding the individuals with edentulism: 51 – 8 = 43. ** The group excluding the individuals with edentulism: 21 – 1 = 20. n – number of people.

Discussion

The aim of the study was to evaluate oral cavity hygiene and selected periodontal parameters in a group of Białystok citizens aged 65–74 years. Considering the increasing number of people over 60 years of age in the population, the study seems to be very up-to-date. The ageing of the population will be accompanied by increased health needs, including those pertaining to oral cavity health.^{3–6,13–15} The study presents issues related to the next couple of decades. Assuming that the estimation of API is the most objective evaluation of the effectiveness of the conducted hygienic procedures, it was observed that the study group showed an average oral hygiene while proper hygiene was found only in 12.7% of the individuals. However, the obtained own results are quite optimistic compared to the study carried out in 2012 on a group of male patients aged 65–74 years living in Białystok.³ In that study API value was higher by 7% and amounted to 74.0% while optimal hygiene was found only in 8.8% of persons.³

In a Kraków study on patients aged 71–80 years, the mean oral hygiene index (OHI) value of 2.2 was found to be unsatisfactory and required the improvement of hygienic habits.¹⁶ In own research, 14.29% of study group was found with good oral hygiene.

Epidemiology research on elderly groups in large cities in Poland were conducted in 1998, 2002 and 2009 with the use of CPITN (community periodontal index of treatment needs) which provides a general evaluation of both periodontal status and related therapeutic needs.^{8,9} One of the major limitations of this parameter is the lack of the possibility to establish the incidence of periodontitis. Therefore, more accurate parameters evaluating the status of periodontal tissues were used in own study.^{17,18} The analysis included the currently preferred probing depth measurement and clinical attachment level.^{19,20} Studies with the use of these parameters have been carried out in Poland only since 2013 on the age group of 65–74 years and thus there are certain limitations to comparing them to earlier observations.^{2,7}

In own research, the mean BOP value was estimated to account for $26.74\% \pm 44.27$, with a high percentage – 46.03% of patients with mild inflammatory symptoms (BOP < 20%). The value of these parameters cannot be compared to the calculations performed in the previous studies of CPITN. CPI1 indicates the presence of bleeding on probing, yet this symptom may also be present in CPI2, CPI3 and CPI4. The interpretation of the presence of bleeding based exclusively on CPI1 may lower its value while adding up the values of CPI2, CPI3 and CPI4 may overly increase it.

In the case of the examined population of Białystok citizens aged 65–74 years, the mean value of probing depth was $2.13 \text{ mm} \pm 1.62$, while the number of pockets over 5 mm deep was 0.79 ± 1.74 . The monitoring of periodon-

Table 3. Dental status of Białystok citizens aged 65–74 years

Parameter	Study group (n = 72)			
	n	%	female (n = 51)	male (n = 21)
Maintained ≥ 20 natural teeth	20	27.78	8	12
Edentulism in the maxilla	10	13.89	10	0
Edentulism in the mandible	2	2.78	2	0
Edentulism (maxilla + mandible)	9	12.5	8	1

n – number of people.

tal status in 1998, 2002 and 2009 revealed the presence of deep pockets of at least 6 mm in 9.9, 2.3 and 1.6% at the analyzed intervals, respectively.⁸ In the study conducted in 2012 by Szpak et al. evaluating the periodontal status and therapeutic needs among 106 male patients aged 65–74 years living in Białystok, a healthy periodontium was found (CPI0) in 6 persons, which constituted 5.7% of the group.³ In the highest percentage of patients (20.8%), shallow pockets were observed (CPI3), while male patients with over 6 mm deep pockets constituted 19.8% of the examined individuals.

According to own research, the percentage of persons with PD > 5 mm was estimated to be 28.57%. Loss of attachment was present in 100% of individuals, with CAL > 3 mm and CAL ≥ 5 mm value 100% and 57.14%, respectively. The obtained results correlate with American observations NHANES, where the percentage of CAL > 5 mm was observed in 67.1% of individuals over 65 years of age.²¹ A stronger correlation was found between CAL and age compared with PD and age, which was previously noticed by Thornton-Evans et al. in 2013.²² These observations are confirmed by a number of epidemiology studies which indicate a higher incidence of periodontitis in older persons.^{22–24} These correlations are based on both biological processes, which accompany body aging as well as the accumulating effects of dental plaque and environmental factors, which include risk factors.

In the case of Białystok seniors, active smokers constituted 8.33% of the patients while 29 individuals were smokers in the past. Past and present smokers were found to be a large group of 35 people (48.6% of the examined population). Smoking is very common in Poland and affects 33% of men and 20% of women.²⁵ The highest percentage of smokers can be found in the age group of 40–59 years with vocational education. In terms of smoking, Poland has the 9th (men) and 8th (women) place in European rating.^{21,25} Smoking tobacco is a generally acknowledged risk factor in developing periodontitis and its influence is manifested by a worse response to periodontal treatment.²⁶ In NHANES study in 2009–2010, the incidence of periodontitis among smokers amounted to 64.2% compared to 39.8% in non-smokers.²² Pockets of PD over 5 mm were present in 34.1% of smokers and 14.5% of non-smokers.²⁷ Despite greater tissue damage, inflammation symptoms (bleeding) are less visible in

smokers, which are related to the constriction of vessels caused by nicotine. The described phenomenon may be responsible for the high percentage of persons (46.03%) with mild inflammatory symptoms in the study group.

A comparative analysis of a supraregional study of the periodontal status in Poland indicates that the periodontal status has deteriorated in the recent studies: only 1.2% of people with CPI0 and considerably higher percentage – over 41% of people with pockets over 3.5 mm². A healthy periodontium expressed by CPI0 value in the analyzed age group in 1998, 2002 and 2009 was detected in 3.7, 4.8 and 7.8% of patients, respectively while the percentage in periodontitis patients (CPI3 and 4) in 39.1, 14.0 and 9.2%, respectively.⁸ These results were influenced by an increasingly higher number of preserved teeth at this age.

Compared to the studies carried out in 2002 and 2009, a considerable – over 2-fold increase in the number of preserved teeth in Polish people in the analyzed age group can be observed. Poland reached European level in these terms. In this study, the mean number of preserved teeth in Białystok citizens was 13.36 and was lower compared with Szczecin (15.2) or Warszawa (13.8), with the national mean being 13.7.⁷ The mean number of teeth was higher only as compared to Toruń (12.6). The national mean number of teeth in large cities was 14.3 and was higher compared to smaller towns (12.8).² In the analysis of this parameter in correlation to gender, 14.4 teeth in men and 12.6 in women were observed.² Recent Polish studies have shown a higher number of remaining teeth in men as compared to women (2), while in our study this difference was more pronounced – 6 teeth.² The mean numbers were 17.65 in men and 11.25 in women.

These observations are very optimistic compared to the national research from 1998 and 2002. At that time, the epidemiological situation related to the number of preserved teeth in Polish citizens aged 65–74 years was very poor. According to monitoring research in 1998, the mean number of teeth in the citizens of all provincial cities in the analyzed age group was 9.1 while edentulism amounted to 32.2%. In 2002 this situation considerably deteriorated, as the mean number of teeth was 8.1, while edentulism amounted to 35.6%.²⁸

Another beneficial observation for this age group of Polish citizens is a significant decrease in the number of edentulism patients. In 2002 the percentage of edentulism was almost 44% while recent reports indicated 29%.^{2,7} Despite such a great improvement, the value of almost 29% of edentulism cases in Polish population aged 65–74 years still remains one of the highest in Europe.²

Own research showed a considerably lower edentulism percentage (12.5%) compared to the national mean value. It is undoubtedly a positive phenomenon, yet considering the low reportability for epidemiology study, the obtained results ought to be interpreted very carefully.

The presence of at least 20 preserved natural teeth, which is indicative of a maintained masticatory function,

was found in 27.78% of patients. The obtained result was higher than the Polish mean value, which was estimated at 25.15%.² This result is 3-fold lower than the goals of oral cavity health set by WHO for 2010 (the assumptions were 75% with minimum 20 preserved teeth).²⁹ It is difficult to compare this outcome with this age group of Polish citizens in 2002 and 2009, since in those studies the maintained masticatory function was defined as at least 20 natural or artificial teeth in functional contact.⁸ In the available literature only one considerably up-to-date (2004) research of the Hungary population at this age was found and it showed 21 or more teeth in 22.6% of the individuals.^{2,30}

The prosthetic needs of the examined group were 2-fold smaller (12.5%) compared to those in the study by Szpak et al.³ In the male group from Białystok, 24.5% of persons needed full dentures, 36.8% showed edentulism in the maxilla while 27.4% in the mandible. According to our own research, a considerably higher number of patients (13.89%) required rehabilitation of masticatory apparatus with the use of full dentures in the upper arch compared with edentulism in the mandible (2.78%). In 1995 the percentage of both men and women from Białystok aged 60 years or more requiring full denture in the maxilla was 40.4% while in the mandible 36.2%.³¹ In 1991, in the population of men and women of the north-eastern region of Poland aged 65–74 years, 35.2% of persons required full dentures in the maxilla and the same percentage in the mandible.³² The analysis of the described correlations in the northeastern region of Poland indicates an improvement in prosthetic treatment among seniors, yet it is still unsatisfactory considering WHO guidelines for 2020 or even for 2010.^{29,33}

Based on the analysis of a number of epidemiology studies, WHO considerably changed the goals regarding oral cavity health in the age group 65–74 years for 2020 compared to 2010. Current guidelines are more general: decreasing the number of extracted teeth due to caries and periodontitis, decreasing the percentage of persons with edentulism, increasing the number of preserved natural teeth and increasing the percentage of persons with at least 20 preserved teeth as well as decreasing the development of tissue infections and oral mucosa disorders.³³

The major limitation of the presented study was the low percentage (7.2%) of reportability of randomly chosen individuals. In the case of the study of Health in Pomorania, the percentage of reportability of randomly chosen persons was 72.9 and 65.2 for women as well as 66.2 and 74.3% for men in the age groups of 40–49 and 60–69, respectively.³⁴ Another limitation was related to the use of CPI and lack of reference to the observations related to the currently preferred measurement of probing depth (PD) and clinical attachment level (CAL) in study design.^{19,20} Despite the described limitations, the conducted epidemiology study of periodontal status in Białystok citizens proves that periodontitis constitutes a social disease.

According to the number of own observations as well as that of other authors, significant causes impeding the improvement of oral health are as follows: lack of supporting policy and legal regulations in undertaking significant preventative and pro-health actions in Poland, low awareness of the importance of oral cavity health as well as cultural and social barriers.⁸ Therefore, scheduled periodontal prophylactic-therapeutic actions and accurately defined periodontal treatment in screening groups, e.g. diabetic patients or persons with past history of cardiovascular incident are necessary. Also, a change in pro-health habits of adult Poles (improved oral hygiene, fighting smoking) is needed. Establishing such guidelines is undoubtedly necessary.

Conclusions

Białystok citizens show improper oral hygiene and periodontal status. It is necessary to improve the effectiveness of dental health care system for elderly people.

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