Periodontal Diseases among the Adult Population of Georgia and the Impact of Socio-behavioral Factors on Their Prevalence

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Abstract

Background: Georgia is a country with a Human Development Index (HDI) score of 0.733. Significant deterioration in socio-economic conditions in the 1990s caused serious health problems in the population including oral health. Since then, there has not been an epidemiological survey of dental diseases among the adult population in Georgia.
Methods: The pathfinder survey- cluster- stratified method derived by WHO was used for sampling. Overall, 2370 adults including 1289 women and 1081 men in nine regions of Georgia including the residents of a city, town and village in each region and the capital, Tbilisi, were examined. Four age groups were investigated including: I- (20-34), II-(35-44), III-(45-64), IV- (65-74).
Results: Unhealthy periodontal tissues were observed in 66.9% of men and in 57.5% of women. Bleeding on probing occurred in 44.9% of men and 37.2% of women, with periodontal pockets in 46.8% of men and 40.6% of women. Inflammation was seen in 61.2% of men and 54.8% of women. Healthy periodontal tissues were most common (59.2%) in the first age group (20-34); periodontal pockets (0-3mm) were least common (9.8%) at this age. Pockets of ≥4-5mm depth were observed mostly in the 3rd (9.4%) and 4th (10%) age groups.
Conclusion: The high prevalence of periodontal diseases in the adult population of Georgia is explained by a low socio-economic status and low medical education background with a negative attitude towards oral hygiene skills and low levels of dental service accessibility.

Keywords: Periodontal diseases, Prevalence, Georgia

Introduction

Periodontal disease is considered a pathological process affecting periodontal tissues (the tissues that surround and support the teeth). It results in forms of gingivitis or periodontitis.

Unsatisfactory oral hygiene is essential for developing periodontal diseases. Microorganisms in plaque collected at the level of tooth – gingival connection and their metabolism products – influence periodontal tissues, forming periodontal pockets as a result of the complex interaction between pathogenic bacteria and the host's immune response (1, 2). If left untreated, infection spreads to the alveolar bone around the teeth, causing their movement, replacement and subsequent loss.

An increase in dental plaque and inflammation of gingival tissue are closely related to each other (3). Professional plaque removal and regular oral hygiene can reduce the level of gingival inflammation and swelling (4).

There are specific common risk factors determining the human propensity and risk for periodontal diseases including genetic factors, age, ethnicity, gender, tobacco use, socio-economic and demographic status, various chronic general diseases,

obesity, living conditions, and psychological stress (5). Moreover, there is growing evidence that periodontal disease might predispose individuals to various common diseases stemming from systemic circulation of inflammatory mediators and oral pathogens (6). Smoking is the most important behavioral risk factor. Positive results of periodontal treatment are observed more often in non-smokers compared to smokers (7). Moreover, in smokers, alveolar bone loss, tooth mobility, probing pocket depth, and tooth loss are more severe (8). The positive association between good oral hygiene and low prevalence of periodontal diseases is well known (9). The prevalence of periodontal diseases increases with age and is observed more in men than in women (10). Severe periodontitis, which may result in tooth loss, is found in 5–15% of most populations at the age of 35-44(11), while chronic forms are seen in the vast majority of populations worldwide.

Periodontal diseases are some of the most important public health problems in the world due to their high prevalence (12). Pain, discomfort and tooth loss due to periodontal diseases lead to functional and aesthetic disruptions and have significant effects on oral health-related quality of human life (13).

Georgia is a country with a Human Development Index (HDI) score of 0.733 (14). Approximately 4.5 million people live in Georgia, with 53% of them in urban areas (15). Unfortunately, there no past epidemiological data on dental diseases among adults in Georgia are available. The only research which has been conducted was performed among 15 years olds in a number of regions of Georgia. It showed a high prevalence of periodontal diseases: 92% in boys, and 89.8% in girls (16). Therefore, the evaluation and determination of the prevalence of periodontal diseases in Georgia's adult population was important.

Materials and Methods

Our research was carried out based on the WHO selection method: pathfinder survey (17)- stratified -cluster probability sampling technique conducted at national level to cover all important sub-

groups of the population and to provide a reliable baseline for the implementation and monitoring of oral health programs (17).

According to the National Center for Disease Control and Public Health(NCDC) of Georgia, the age distribution of the adult population ranges from 20 to 85 +. The sample was distributed into four age groups – 20-34, 35-44, 45-64, 65-74 and two gender groups –male and female. Two index age groups (35-44and 65-74) were allocated as per the recommendations of the WHO for teeth and periodontal status and dental morbidity assessment (17). Two other age groups (20-34, 45-64) were studied due to their significant size in the adult population of Georgia: 33.6% (20-34) and 36% (45-64) compared to 19.5% (35-44) and 10.9% (65-74) (18).

Adults in the capital and nine regions of the country including those living in urban and rural areas were studied.

The sampling design was multistage. Clusters were chosen first. They consisted of ten geographical units including nine regions (from north-west, south, central, east and south-east) and the capital, Tbilisi. Clusters were internally stratified. The strata were formed based on variables of interest to the study including the index age groups derived by WHO, age groups as defined above, and gender. The country was divided into six strata comprising ten geographical units. According to the WHO, "Sampling adult subjects is often difficult and can be drawn from organized groups, such as offices or factory workers" (17). As such, the second–level clusters were formed by randomized selection of organizations, institutions and households. In the third-level clusters, adults were randomly chosen. A number of different organizations were selected, and adults in the organizations had different socio-economic statuses and educational backgrounds as well as different levels of oral disease and/or intervention needs. Workers in a chemical factory, coal mines, an auto-workshop, a sewing factory, a seaport, a candy factory, teachers and other personnel at a variety of schools and universities (students and personnel), and workers at medical facilities (doctors, assistants, nurses) were sampled. Dental clinic patients

were not selected to avoid obvious selection bias. The sample contained individuals from randomly selected families with different socio-economic and education levels and different employment statuses.

There were 52 sampling sites (6 in Tbilisi and 46 in regions) comprising 12 cities and towns and 18 villages. The sample size within each stratum was calculated taking into account the proportion of the population in the particular stratum in order to form an equal probability sample. The larger the strata, the greater the influence it has on the formation of the average values of the parameters of the general population. Consequently, a larger volume of strata should be submitted in sampling (19). According to Georgian demographic data, (15) different age groups make up differing shares of the population. Therefore, based on the distribution of age groups and proportionality within strata, the volume (number) of elements for each stratum were chosen. The total sample size was 2370.

Self-administered questionnaires were distributed to all participants in order to assess the following risk factors: social status, financial status of the family, existence of common chronic diseases, oral hygiene skills (tooth brushing, dental floss usage, mouth rinsing), dental service accessibility, tobacco use, dairy product and other food consumption.

Family financial status was categorized into low, medium and high self-reported income level. Generally, unemployed people or people whose only income source is a state pension or state social aid considered their income low. People working in different public or private facilities with a salary in the 500-600GEL per month range (mean income in Georgia is 597.6 GEL) (15) thought their income medium. Family income was reported as high only by individuals having jobs as well as other sources of income (e. g a business). Education level was categorized into low (people with primary and secondary education) and high (people with higher education).

Investigation of oral cavity was performed according to WHO recommendations (Oral Health Assessment Form 2013, WHO) under natural lighting conditions using a dental mirror and a periodontal index (CPI) probe for measurements of periodontal pocket depth (17).

Periodontal examination included:

1. Plaque scores – the presence or absence of visible plaque on any surface of the tooth.

2. Calculus scores – the presence or absence of visible calculus deposits on each tooth.

3. Probing depth – measured from the free gingival margin to the base of the sulcus (in mm).

4. Bleeding on probing – the presence or absence of bleeding following probing around the tooth. (20)

Periodontal measurements were performed for the Ramfjord index teeth (teeth numbers: 16, 21, 24, 36, 41, 44) which are representative of the various teeth types (20).

The Oral Hygiene Index-Simplified (OHI-S) (with Debris Index-Simplified (DI-S) and Calculus Index Simplified (CI-S) was used to observe the oral hygiene status of the population. The six surfaces examined for the OHI-S included four posterior 16[17], 26[27], 36[37], 46[47] and two anterior teeth 11 and 31 (21).

The study was conducted by an experienced examiner – a dentist who was assisted by four postgraduate students from the stomatological faculty. They collected information about risk factors by distributing self-administered questionnaires. The administrations of the organizations the research was held in were contacted and informed about the study goals in advance. They assisted in enhancing involvement in the study. The study was conducted from January 2013 to March 2014. Statistical Package for Social Sciences (SPSS) version 21.0 was used for data analysis.

Results

A total of 2370 adults underwent oral examinations. The mean±standard deviation (SD) of OHI-S showed the value of 0.8±1.11 with DI-S scores 0.47±6.6 and CI-S scores 0.33±0.52, indicating rather satisfactory oral hygiene. Assessment of the same variables showed the following data by age and gender (Table 1).

Table 1: Mean values of DI-S, CI-S, OHI-S by gender and age group

	Gender groups (M±SD)			Age groups (M±SD)				
	Female (1289)	Male (1081)	*P* value	20-34 (797)	35-44 (469)	45-64 (855)	65-74 (249)	*P* value
Debris Index (DI-S)	.31±.48	.71±.81	.00	.45±.63	.58±.8	.47±.62	.33±.57	.00
Calculus index (CI-S)	.23±.34	.51±.7	.00	.24±.44	.43±.67	.38±.5	.3±.52	.00
Oral hygiene index (OHI-S)	.54±.76	1.22±1.43	.003	.69±.99	.99±1.36	.85±1.1	.64±1.07	.00

Unhealthy periodontal status was noted in 62% of the total sample. Bleeding was seen in 41% and periodontal pockets in 44%. Loss of attachment was observed in 47% of the population. Non-inflamed damage of periodontal tissues appeared in only 4% of the total sample. Gender and age groups were compared by periodontal status, bleeding, periodontal pocket depth, and loss of attachment (Table 2, 3). Statistical analysis showed a rather high prevalence of periodontal diseases, varying from 55% to 71% of the population in different regions of Georgia. This is related to various risk factors which influence the prevalence of periodontal diseases.

Table 2: Distribution of the adult population of Georgia with different periodontal status by gender

	Female (1289)		Male (1081)		Total number (2370)	
	Frequency	%	Frequency	%	Frequency	%
Periodontal status						
Healthy	547	42.5	358	33.1	905	38
Unhealthy	742	57.5	723	66.9	1464	62
Bleeding	480	37.2	596	44.9	965	41
No bleeding	809	62.8	485	55.1	1405	59
Periodontal pockets						
No pockets	766	59.4	575	53.2	1341	56
0-3mm	470	36.5	425	39.3	895	38
4-5mm	46	3.6	71	6.6	117	5
6-8mm	7	0.5	10	0.9	17	1
Loss of attachment						
No loss	734	56.9	514	47.5	1248	53
0-3mm	499	38.7	483	44.7	982	41
4-5mm	49	3.8	72	6.7	121	5
6-8mm	7	0.5	12	1.1	19	1
Inflammation	707	54.8	662	61.2	1368	58
No inflammation	582	45.2	419	38.8	1001	42
P=0.00						

30.1% of survey participants were tobacco consumers. 39.3% of sampled males and 1.7% of females were rather heavy tobacco consumers (20 or more cigarettes per day) (*P*=0.00). The surveyed population had different kinds of common diseases. 11.5% of population indicated that they experienced endocrine system diseases. 22.4% had digestive organ disorders, and 21.6% complained of cardiovascular diseases. 11.4% had osteochondrosis or arthritis. Data analysis showed that digestive system diseases were mostly seen in the 2nd (23.5%), 3rd (28.3%), and 4th (22.8%) age groups. The same was true of endocrine system diseases-goiter and diabetes (13.5%, 13.2% and 12.8% respectively). These diseases were less common in the 1st age group (8.2%) (*P*=0.00).

Table 3: Distribution of the adult population of Georgia with different periodontal status by age group

Age group (yr)										
	20-34 (797)		35-44 (469)		45-64 (855)		65-74 (249)		Total (2370)	
	n	%	n	%	n	%	n	%	n	%
Periodontal status										
Healthy	472	59.2	178	22.8	195	22.8	60	24.1	905	38
Unhealthy	325	40.8	291	77.1	660	77.1	189	75.9	1464	62
Bleeding	306	38.4	220	46.9	366	42.8	73	29.3	965	41
No bleeding	491	61.6	249	53.1	489	57.2	176	70.7	1405	59
Periodontal pockets										
No pockets	77	90.0	255	54.4	278	32.5	91	36.5	1341	56
0-3mm	78	9.8	202	43.1	484	56.6	131	52.6	895	38
4-5mm	2	0.3	10	2.1	80	9.4	25	10.0	117	5
6-8mm	0	0	2	0.4	13	1,5	2	0.8	17	1
Loss of attachment										
No loss	718	90.1	253	53.9	217	25.4	60	24.1	1248	53
0-3mm	77	9.7	204	43.5	541	63.3	160	64.3	982	41
4-5mm	2	0.3	10	2.1	82	9.6	27	10.8	121	5
6-8mm	0	0	2	0.4	15	1.8	2	0.8	19	1
Inflammation	325	40.8	289	61.6	597	69.7	158	63.5	1368	58
No inflammation	472	59.2	180	38.4	258	30.3	91	36.5	1001	42

P=0.00

Statistical analysis revealed differences in oral health care by gender and age. 98.3% of women and 91% of men brushed their teeth regularly. 65.9% of women brushed their teeth twice a day, while only 32.3% of men reported brushing their teeth twice a day. Dental floss use was reported by 3.8% of men and 8.8% of women, while mouthwash use was reported by 26.2% of women and 8.6% of men (*P*=0.00). Men reported visiting dentists less often than women. 43.7% of women and 28.6% of men used dental services within the last year (*P*=0.00).

Oral hygiene skills and healthcare practices are best in the youngest cohorts and progressively worsen as age increases. Regular brushing was highest (99.7%) in the 1st age group (20-34) and lowest (80%) in the oldest age group (65-74). The same was true of dental floss and mouthwash usage (6.8% and 16.2% in the 1st age group and 1.2% and 7.6% in the 4th age group, respectively). Moreover, the elderly visited dental offices the least. They attributed this to a lack of money and absence of teeth. 84.4% of the elderly did not receive dental care within the last year, while only 55% of the 1st and 2nd age groups (20-34, 35-44) did not use dental services within the last year (*P*=0.00). The reasons provided for not using dental services differed in lower age groups.

Individuals with different levels of education level and family income were compared by prevalence of periodontal diseases to determine whether there was a correlation between these variables. No statistically significant differences (*P*>0.01) were found (Table 4). However, statistically significant differences in oral hygiene skills and healthcare practices by education level and family income (*P*=0.00) were observed (Table 5), even though there were no differences in the prevalence of periodontal diseases among people with different hygiene skills and healthcare practices.

The study aimed to find out whether there was a correlation between eating habits and periodontal problems in the population. Data analysis did not show a statistically significant relation between eating habits and periodontal problems. Still, significant differences were observed between education level and family income, and eating habits (*P*<0.01) (Table 6).

Table 4: Prevalence of periodontal diseases by educational level and family income

	Education		Family income		
	Low	High	Low	Medium	High
Periodontal status					
Healthy	40.0	37.1	38.6	38.2	31.0
Unhealthy	60.0	62.9	61.4	61.8	69.0
	P=0.285			*P*=0.848	
Inflammation of periodontal tissues	56.3	58.6	58.4	57.4	62.1
	P=0.538			*P*=928	
Non-inflamed disease of periodontal tissues	3.7	4.4	3.0	4.5	6.9
	P=0.478			*P*=0.318	

Table 5: Oral hygiene skills and healthcare practices by educational level and family income

Healthcare practices and oral hygiene habits	Education		Family income		
	low	high	low	medium	high
Dental visit rate (last year)					
No visit	79.9	55.8	77.0	57.5	51.7
Once	11.6	20.8	13.7	20.4	13.8
Twice	4.8	13.3	5.2	12.6	17.2
Three times	2.2	5.0	1.9	5.1	3.4
Four times and more	1.5	5.1	2.3	4.5	13.8
	P=0.00			*P* =0.00	
Dental visit purpose					
Check-up	1.2	5.8	0.9	5.3	20.7
Pain or discomfort	98.8	94.2	99.1	94.7	79.3
	P =0.00			*P* =0.00	
Reason for non-use of dental services					
No need	41.2	52.1	33.9	53.2	82.6
Fear	8.4	11.0	6.8	11.9	13.0
No money	49.9	30.8	57.3	29.8	0
No insurance	0.5	6.1	2.0	5.1	1.1
	P=0.00			*P*=0.00	
Plaque and tartar removal rate during a year					
No removal	89.9	64.1	83.3	67.7	34.5
Remove when I notice	7.0	22.0	10.7	19.9	37.9
Once a year	3.2	11.6	5.4	10.8	17.2
Twice a year	0	2.2	0.6	1.7	10.3
	P =0.00			*P* =0.00	
Tooth brushing rate					
No brushing	12.8	1.5	12.4	1.9	0
Brushing once daily	61.7	30.5	55.2	33.6	20.7
Brushing twice daily	23.5	62.3	29.6	59.4	55.2
Brushing three times daily	2.0	5.7	2.7	5.1	24.1
	P =0.00			*P*=0.00	
Dental floss use	1.7	8.7	3.9	7.2	31.0
	P =0.00			*P* =0.00	
Mouthwash use	8.0	22.2	11.3	20.7	41.4
	P =0.00			*P* =0.00	

Table 6: Eating habits by education level and family income

	Education level		Family income		
	Low	**High**	**Low**	**Medium**	**High**
Fruit and vegetable consumption					
No consumption	1.0	0.8	0.9	0.7	3.4
Once a week or rarely	16.3	11.7	15.2	12.7	6.9
2-4 times a week	50.4	46.7	51.8	46.2	20.7
Every day	32.3	40.9	32.2	40.3	69.0
	P =0.00			*P* =0.00	
Food intake rate					
Irregularly			18.5	18.3	13.8
Once a day	-	-	2.3	1.9	0.0
Twice a day	-	-	38.3	31.7	20.7
Three times a day	-	-	34.9	42.0	44.8
4-times a day	-	-	6.0	6.2	20.7
	P =0.32			*P* =0.01	
Meat product intake					
No consumption	2.5	2.0	3.4	1.6	0
Once a week or rarely	51.7	38.3	61.7	35.9	13.8
2-4 times a week	41.4	54.0	32.2	56.5	72.4
Every day	4.3	5.7	2.7	6.0	13.8
	P =0.00			*P* =0.00	
Dairy product intake					
No consumption	6.2	5.7	8.4	4.9	13.8
Once a week or rarely	43.8	28.8	47.1	28.8	6.9
2-4 times a week	39.9	48.9	36.1	49.9	31.0
Every day	10.1	16.5	8.4	16.5	48.3
	P =0.00			*P*=0.00	

Discussion

Statistical analysis showed a high prevalence of periodontal diseases throughout the adult population of Georgia.

Unhealthy periodontal tissues, bleeding on probing, periodontal pockets and loss of attachment, and inflammation and non-inflamed disease of periodontal tissues were found more commonly in men than women. The slightly lower OHI values of men, compared with women, could be related to more positive attitude towards oral hygiene skills and dental care practices among women. Females brushed their teeth more than males and visited dentists more frequently than men. Moreover, more males were heavy tobacco consumers (20 cigarettes or more per day) compared to females. This could be a predictor of the high prevalence of periodontal diseases in men.

For many years, periodontitis was considered a disease of elderly people, but our investigation showed that inflammation and gum bleeding are observable in all age groups but to differing extents. They can be found in young people and even be widespread in this age group. Periodontitis is very much related to individual peculiarities in attitudes towards oral hygiene habits, plaque and calculus control, and prevention and treatment of periodontal diseases. Most of the people in the 3rd and 4th age groups who noted a tooth brushing rate of once a day did not have calculus and/or plaque removal for several years and neglected mouth rinsing or dental floss usage. Moreover, most of the population of the 3rd and 4th age groups did not visit a dentist during the last year, and complained of money shortages or thought dental visits to be useless unless serious problems related to the oral cavity developed.

The results did not show a direct influence of education or family income on the prevalence of periodontal diseases, but different levels of education and material status defined attitudes towards

dental care and oral hygiene skills. People with lower levels of education were less likely to visit a dentist during the last year than people with higher education. Individuals with lower levels of education also complained of a shortage of money as the main obstacle to dental service access. They did not remove plaque and tartar for a year, neglected dental check-ups, brushed their teeth less, and used dental floss and mouthwash less frequently than people with higher education. As for material welfare, people with low income were less likely to visit a dentist during the last year, ignore regular dental check-ups or plaque removal. They explained that they lacked money for such services. Unsatisfactory oral hygiene skills were also more prevalent among those with lower incomes (tooth brushing rate once a day and lowest frequency of dental floss or mouthwash usage).

People with high family income did not name money shortage as the main reason for not using dental services, but rather most people with high family income visited a dentist only in case of need, (pain or discomfort) though much more of them paid attention to regular dental check-ups or oral disease prevention than people with lower income.

It must be noted that regardless of education level or financial status, little attention is paid to prevention among the majority of the adult population of Georgia. This may affect the oral hygiene status of the population, but it is not the absolute determinant of oral health status, as many other risk factors play a significant role. Hence, periodontal diseases are considered multifactorial and often represent the manifestation of a mix of common problems and conditions such as general diseases, living and working conditions, stress and/or other factors. To confirm this fact, we assessed the prevalence of periodontal diseases in people of different regions, with different living and working conditions. We found statistically significant differences in the prevalence of disease. Different regions differ from one another in water, soil content, food, individual structural peculiarities of the human body, climate diversity, and living and working conditions. To a certain extent, these factors influence common and oral health.

It is known that terrain and climate differences affect other geographical components (soil, flora and fauna) (22), and in this way contribute to the diversity of microelement content in food and water in different regions of the country. This impacts health. Moreover, various climatic and geographic conditions influence the development of common diseases and their specific distribution. Hence, they are related to oral health.

Education level and money also influence eating habits. People with high education and family income were more frequent consumers of dairy and meat products, while people of low household income noted the lowest rates of consumption of these products. As for fruit and vegetable consumption, there were no large differences found, but more people of high education and material status consumed fruits and vegetables daily.

As the data demonstrates, eating habits do not directly influence periodontal status, but education level and family income define food selection and in this way contribute to health. They may have an impact on oral health as well.

Conclusion

Findings indicate a high prevalence of periodontal diseases throughout the population of Georgia. Georgians do not receive adequate dental care due to low socio-economic status, low medical education background, and negative attitudes towards oral hygiene skills and dental services.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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