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Oral health behaviours according to demographic characteristics in Korean adolescents: a national representative sample

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Objectives: To provide information on how to teach correct oral health behaviour to youths and to develop programmes to that end, this study examined the oral health behaviour and demographic characteristics of adolescents. **Methods:** The raw data of 'The Third 2007 Youth Health Behavior Online Survey' carried out by the Korea Center for Disease Control and Prevention were analysed. Independent *t*-test, one-way ANOVA, and chi-squared analyses were used to assess the relationships between oral health behaviours and demographic characteristics. **Results:** The oral health behaviour of the adolescents who were investigated differed significantly depending on their demographic characteristics ($P < 0.001$). Tooth brushing frequency differed significantly depending on gender and student grade ($P < 0.001$) and the frequency of visits to a dental clinic differed depending on the gender, student grade, type of residential area (urban/rural), and type of school (middle or high) ($P < 0.001$). School grade, type of residential area, and type of school also affected the likelihood of receiving preventive dental treatment ($P < 0.001$). **Conclusions:** Adolescents who were in lower grades, female, and lived in large urban communities visited dental clinics more frequently and received more preventive dental treatment than adolescents who were in higher grades, male and resided in small urban and rural areas. These results highlight the need for the further development and dissemination of oral health programmes.

Key words: *Adolescents, oral health behaviour, demographic characteristic*

Adolescence is a physical and mental transitional period from childhood to adulthood that is formative for health-related behaviours such as diet, eating habits, smoking, lack of exercise, and oral health care. The adolescent population has unique social and psychological needs with regard to the latter because of the high prevalence of dental caries, trauma, periodontal disease, interest in appearance, loss of teeth, uneven teeth, and dental fear in this age group[1–3]. The oral health and oral health behaviours formed in adolescence during the course of the socialisation process become lifestyle habits, which are hard to modify and may contribute to the contraction of an adult chronic disease. Therefore, adolescence is a critical period that determines one's health for life. The study of Broadbent *et al.*[4] on oral health reported that adolescents who bear the correct beliefs regarding oral health maintain a healthy oral health status as they get older. Therefore, to ensure a lifetime of oral health, it is essential to practice preventive dental care. The dictionary meaning of prevention is to ensure that illness or accidents do not to happen. It is well-known that missing the preventative period sharply increases the cost and pain, so it is very important to prevent the onset of oral disease. Oral disease can be prevented through adequate dietary intake and oral health care.

In Korea, however, people tend to regret their lack of care and start taking care of their oral health only after oral disease has started[5]. However, once an oral disease occurs, it is impossible to return to the initial condition. Moreover, when oral disease is detected, it must be treated immediately and this must be followed with continuous preventive maintenance to prevent recurrences. It is well-known that primary prevention, which prevents disease onset, is more cost effective than secondary prevention approaches such as early detection or early treatment of oral diseases because oral diseases are so time-consuming and costly to treat. Thus, prevention of disease should be the first and foremost priority. To prevent oral diseases, regular dental clinic visits, the proper use of fluoride, the use of dental fillings such as fissure sealants, refraining from

the consumption of sugar-containing foods, and the proper brushing of teeth are necessary.

If the knowledge about how to maintain oral health is properly transmitted and adopted, a healthy oral status can be maintained and oral diseases can be prevented[6]. In South Korea, the decayed/missing/filled teeth (DMF) rate increased with age, the caries rate being 73.7, 75.5, and 77.1% in 14-, 15-, and 16-year-olds, respectively[7]. In addition, more than 70% experienced pain, bad breath and other oral symptoms. Moreover, the rate of tooth brushing after lunch, which is a leading indicator of oral health behaviour, was <50%, which indicates how poor teenage oral health and oral health behaviours are in Korea[8]. This is likely to have long-term consequences since, according to the 2005 National Health and Nutrition Survey data[9], the prevalence of dental caries and periodontal disease, which are major oral disease for Korean adults (≥19 years), correlates closely with demographic characteristics and health behaviours. In particular, the Survey reported that dental caries prevalence, education level, income level, type of health care and the frequency of snacking correlated with periodontal disease prevalence, age, education level, income level, and stress factors. Thus, to ensure oral health in adulthood, it is better that preventive oral health behaviours or activities are taught and adopted in adolescence than that attempts are made in adulthood to reverse established oral disease[10,11]. This is also likely to be a more productive approach because the oral health habits of adolescents are not as firmly formed as they are in adults.

These observations indicate that it is very important to determine the degree to which adolescents have adopted oral health practices in Korea, as this will best show how to encourage positive oral health behaviours. This study analyses the data provided by 'The Third 2007 Youth Health Behavior Online Survey'[8], which was carried out by the Korea Center for Disease Control and Prevention, regarding the oral health behaviour of adolescents and their societal characteristics. Ultimately, the aim is to establish programmes and plans that can lead adolescents to proper oral health habits.

METHODS

The web-based Korea 'Youth Health Behavior Online Survey'

The study participants were selected on the basis of the 2006 National School statistics[12] of the Korea Education Development Institute, who had collected data on 80,000 students from 2,400 classes in 800 schools. The schools ranged from junior middle school to senior high school. For the Third 2007 Youth Health Behavior Online Survey, students who were frequently absent from school, needed special care, or were illiterate were excluded. Youths not attending school were not included. The students in the sample classes, which had internet-accessible school computer classrooms, were asked to complete the self-recording online questionnaire over a single 1-hour class period. Personal information was not required.

Questionnaire

The questionnaire was based on research focus areas that were selected on the basis of international papers investigating youth health behaviour and/or the opinions of the General Advisory, Executive, and Section Advisory Committees on Health Behavior Areas. The research tool was continuously used and was based on the raw data of the 1st Korea Youth Risk Behavior web-based survey. The demographic characteristics that were investigated were gender, grade, address and type of school (middle or high school). These served as independent variables. The participants were then asked questions relating to oral health behaviour, namely whether they brushed their teeth after lunch at school, how many dental visits they had made in the last year (these included visits for dental check-ups, treatment, and orthodontics), whether they had undergone preventive dental treatments (namely, fissure sealing, fluoride treatment, and scaling) in the last year, whether they had had symptoms of oral disease in the last year, and whether they had received annual oral health education. These parameters served as dependent variables.

Statistical analysis

The continuous variables were expressed as means with standard deviation while the categorical variables were expressed as percentages. The association between demographic characteristics and tooth brushing after lunch at school was tested by independent *t*-test and one-way ANOVA, while the association between demographic characteristics and the number of dental visits and preventive dental treatments in the last year was assessed by using the chi-squared test. The type 1 error was used and statistical significance was set at ≤0.05. The statistical analyses were performed by using the SPSS 15.0 (SPSS Inc., Chicago, IL, USA) statistical package.

RESULTS

Demographic characteristics

In total, there were 74,698 participants, of whom 52.8% were male and 47.2% female. Middle school

junior grade students constituted the biggest group, accounting for 17.5% of all participants, while high school senior grade students constituted the smallest group, accounting for 15.4% of the study population. The participation rate of high school students was higher than that of middle school students. In total, 51.7% resided in metropolitan areas.

Association between tooth brushing and gender and grade

The participants were asked to score the frequency with which they brushed their teeth after lunch at school by using a 4-point-scoring system where 1 is 'rarely' and 4 is 'always'. The average scores of the different genders and grades were then calculated. The female students had significantly higher tooth brushing scores (2.32 ± 1.28) than the male students (1.83 ± 1.11; $P < 0.001$). In addition, the highest grade students (3rd grade in high school) had significantly higher tooth brushing scores (2.69 ± 1.25) than the lowest grade students (1st grade in middle school, 1.55 ± 0.93; $P < 0.001$).

Association between demographic characteristics and the number of dental visits in the last year

The participants were asked how many times in the last year they had visited the dentist. As shown in *Table 1*, 45.2% of the boys and 36.4% of the girls answered that they had not visited the dentist at least once in that period. However, 17.6% of the school girls said they had visited the dentist four or more times in the last year, whereas this was true for only 11.2% of the school boys. These differences between boys and girls were statistically significant ($P < 0.001$). In addition, high school students were more likely to record that they had not visited the dentist once in the last year as their grade increased (first grade, 35.9%; second grade, 45.1%; third grade, 50.6%); this was statistically significant ($P < 0.001$). For students living in rural areas, small and medium-sized cities, and large urban communities who had not visited the dentist at least once in the last year, the figures were 45.9%, 41.2%, and 39.7% respectively. These differences were statistically significant ($P < 0.001$). Finally, the high school students were significantly more likely to answer that they had not visited the dentist once in the last year than middle school students (43.6% *vs.* 38.7%; $P < 0.001$).

Association between demographic characteristics and preventive dental treatment

Those adolescents who answered that they had visited a dentist more than once last year were asked whether they had received preventive dental treatment, namely, fissure sealing, fluoride treatment, and scaling (*Table 2*). Girls were significantly more likely to have undergone fissure sealing in the last year than boys (51.9% *vs.* 48.1%, $P = 0.001$) and for both middle and high school, the proportion receiving fissure sealing dropped as the children rose in grade ($P < 0.001$). Moreover, middle school students were significantly more likely to undergo fissure sealing than high school students (55.4% *vs.* 44.6%, $P < 0.001$). There was also a strong effect of residence on the use of fissure sealing (metropolitan, 51.9%; cities, 34.0%; rural, 14.1%; $P < 0.001$).

Fluoride application is the most common preventive treatment in dentistry and it accounted for 64.5% of the preventive treatments received by the adolescents who had visited a dentist more than once in the last year. Scaling was the most common treatment for metropolitan youth (55.8%). As with fissure sealing, the school grade, place of residence, and whether the student was in middle school or high school all

Table 1 Relationship of socioeconomic characteristics and the number of dental visits during last year

Item	Variables	The number of dental visits during last year					*P*-value*
		No visit	Once	Twice	Three times	Over four times	
Gender	Boy	17,857 (45.2)	9,812 (24.9)	5,137 (13.0)	2,227 (5.6)	4,433 (11.2)	<0.001
	Girl	12,810 (36.4)	8,600 (24.4)	5,082 (14.4)	2,524 (7.2)	6,216 (17.6)	
Grade	Middle school 1st	3,896 (29.9)	3,919 (30.1)	2,302 (17.7)	1,104 (8.5)	1,814 (13.9)	<0.001
	Middle school 2nd	5,213 (40.6)	3,121 (24.3)	1,844 (14.4)	951 (7.4)	1,720 (13.4)	
	Middle school 3rd	5,928 (45.8)	2,686 (20.8)	1,713 (13.2)	794 (6.1)	1,815 (14.0)	
	High school 1st	4,594 (35.9)	3,686 (28.8)	1,844 (14.4)	718 (5.6)	1,967 (15.4)	
	High school 2nd	5,235 (45.1)	2,641 (22.8)	1,301 (11.2)	635 (5.5)	1,784 (15.4)	
	High school 3rd	5,801 (50.6)	2,359 (20.6)	1,215 (10.6)	549 (4.8)	1,549 (13.5)	
Residence type	Metropolis	15,304 (39.7)	9,890 (25.6)	5,546 (14.4)	2,462 (6.4)	5,381 (13.9)	<0.001
	City	10,565 (41.2)	6,228 (24.3)	3,456 (13.5)	1,674 (6.5)	3,746 (14.6)	
	Rural area	4,798 (45.9)	2,294 (22.0)	1,217 (11.7)	615 (5.9)	1,522 (14.6)	
School type	Middle school	15,037 (38.7)	9,726 (25.1)	5,859 (15.1)	2,849 (7.3)	5,349 (13.8)	<0.001
	High school	15,630 (43.6)	8,686 (24.2)	4,360 (12.1)	1,902 (5.3)	5,300 (14.8)	

Data are expressed as *N* (%).
**P*-value determined by chi-squared test.

Table 2 Relationship of socioeconomic characteristics and preventive dental treatment

Item	Variables	Sealant			Fluoride application			Scaling		
		Yes	No	*P*-value*	Yes	No	*P*-value*	Yes	No	*P*-value*
Gender	Male	8,597 (48.1)	13,012 (49.7)	0.001	2,429 (50.2)	19,180 (48.9)	0.093	5,552 (49.3)	16,057 (49.0)	0.549
	Female	9,262 (51.9)	13,160 (50.3)		2,408 (49.8)	20,014 (51.1)		5,705 (50.7)	16,717 (51.0)	
Grade	Middle school 1st	3,664 (20.5)	5,475 (20.9)	<0.001	1,475 (30.5)	7,664 (19.6)	<0.001	1,930 (17.1)	7,209 (22.0)	<0.001
	Middle school 2nd	3,184 (17.8)	4,452 (17.0)		906 (18.7)	6,730 (17.2)		1,827 (16.2)	5,809 (17.7)	
	Middle school 3rd	3,053 (17.1)	3,955 (15.1)		740 (15.3)	6,268 (16.0)		1,877 (16.7)	5,131 (15.7)	
	High school 1st	3,199 (17.9)	5,016 (19.2)		687 (14.2)	7,528 (19.2)		2,144 (19.0)	6,071 (18.5)	
	High school 2nd	2,539 (14.2)	3,822 (14.6)		584 (12.1)	5,777 (14.7)		1,779 (15.8)	4,582 (14.0)	
	High school 3rd	2,220 (12.4)	3,452 (13.2)		445 (9.2)	5,227 (13.3)		1,700 (15.1)	3,972 (12.1)	
Residence type	Metropolis	9,277 (51.9)	14,002 (53.5)	<0.001	2,432 (50.3)	20,847 (53.2)	<0.001	6,280 (55.8)	16,999 (51.9)	<0.001
	City	6,072 (34.0)	9,032 (34.5)		1,556 (32.2)	13,548 (34.6)		3,749 (33.3)	11,355 (34.6)	
	Rural area	2,510 (14.1)	3,138 (12.0)		849 (17.6)	4,799 (12.2)		1,228 (10.9)	4,420 (13.5)	
School type	Middle school	9,901 (55.4)	13,882 (53.0)	<0.001	3,121 (64.5)	20,662 (52.7)	<0.001	5,634 (50.0)	18,149 (55.4)	<0.001
	High school	7,958 (44.6)	12,290 (47.0)		1,716 (35.5)	18,532 (47.3)		5,623 (49.9)	14,625 (44.6)	

Data are expressed as *N* (%).
The frequencies are expressed relative to the total number of dental visits in the last year (n = 44,031).
**P*-value determined by chi-squared test.

significantly affected the rates as they did with scaling ($P < 0.001$). In particular, the grade with the highest fluoride rate was middle school junior (30.5%), while the grade with the lowest rate was high school senior (9.2%, $P < 0.001$). However, there was no difference between the genders with regard to fluoride application or scaling.

DISCUSSION

The end of the 20th century has seen a marked increase in the efforts of countries around the world to improve the oral health of their nationals. However, the social cost of oral diseases such as dental caries and periodontal disease remains high, with those from lower demographic backgrounds continuing to carry a disproportionate share of the burden[13]. For example, in Sweden, social inequalities still exist 20 years after the inception of national dental insurance in 1974, despite the introduction of several relatively effective prevention programmes[14]. Another study has also shown that, at the international level, there is a close relationship between the rate of caries and demographic factors[15]. Crucial factors include the consumption of sugar, the degree of urbanisation, the number of dentists per 100,000 people, and the GDP-adjusted health budget. Another study showed that oral health is also strongly affected by eating habits, smoking and stress[16]. Demographic factors such as age, gender and race also strongly influence oral health.

These observations suggest that unlike systemic diseases, oral diseases are more easily influenced by external factors such as oral health behaviours[17]. Therefore, more attention should be paid to those public oral health agencies and individuals who promulgate the importance of good oral health behaviour. The demographic factors that are associated with poor oral health behaviour should also be addressed. However, to develop effective oral disease prevention education programmes, it is necessary to understand how many of the oral health practices are currently being regularly followed by the community. For this reason, Korean adolescents were asked to complete an online oral health behaviour questionnaire that was limited to the demographic elements of gender, school grade, and type of residential area.

The present study showed that school girls were more likely to brush their teeth after lunch at school than school boys (their average tooth brushing scores were 2.32 ± 1.28 and 1.83 ± 1.11, respectively). This phenomenon has also been observed by Park *et al.*, who found 47.7% of school girls brush their teeth more than twice a day as compared to 36.9% of the boys[18]. Similarly, Petersen *et al.* reported that 88% of girls and 67% boys brush their teeth twice a day[19]. The present study also showed that high school students brushed their teeth more frequently than the middle school students. By contrast, Jung *et al.* found that high school students brushed their teeth more frequently as they rose in the grades[20], which conflicts with our own observations. Since tooth brushing is the most basic and effective way to prevent periodontal disease and dental caries, it is important that adolescents are encouraged to brush their teeth after each meal.

The present study also showed that 45.2% and 36.4% of the male and female students had not visited the dentist once in the past year. These rates are higher than those reported by Stella *et al.*, who found that 32.0% of American young people had not visited the dentist in the past year[21]. In contrast, Mak and Day reported that only 37.9% of adolescents in Hong Kong had visited the dentist in the past year[22]. These observations suggest that the frequency with which adolescents visit the dentist may be affected by cultural differences. However, economic difficulties experienced by the parents and the fact that many students do not have enough time to visit the dentist are likely to be more influential reasons. In any case, it can be presumed that the parents of babies and elementary school students in Korea do not consistently care for their children's oral health and that the most likely source of oral health education is school. It is thus very important that both middle and high schools should continue to educate their students about oral health behaviours.

With regard to the effect of the type of residential area on the frequency with which adolescents visit a dental clinic, we found that 45.9%, 41.2% and 39.7% of the adolescents from rural communities, small and medium-sized cities, and large cities had not visited a dental clinic in the last year, respectively. Similarly, Honkala *et al.* reported that urban adolescents have better oral hygiene than youngsters in urban areas[23]. Petersen *et al.* also found this[19]. This disparity between types of residential areas reflects the fact that it is easier to visit dental clinics in large cities than in smaller sized cities or rural districts.

When those adolescents who said they had visited dental clinics more than once in the past year were asked about whether they had received preventive treatments in the last year, it became clear that girls were more likely to receive fissure sealing. We also observed that as the children progressed in school grade, the likelihood of receiving fissure sealing, fluoride treatment and scaling dropped significantly. Petersen and Torres found that fluoride treatment rose with progressing grade whereas fissure sealing first decreased and then increased as the grade rose[24]. The type of place of residence also significantly affected the proportion of children who received fissure sealing, fluoride treatment and scaling ($P < 0.001$). Similarly, research on Chinese adolescents by Zhu *et al.* also found that youngsters in cities receive more medical check-ups and fissure sealing than youngsters in rural areas[25]. However, they also observed that those who live in rural areas were more likely to receive scaling and topical fluoride treatment than those in cities. These observations reflect the continued existence of social inequalities in terms of medical services, which is due to the fact that such services are concentrated in large cities. Technically, however, dentists are not always necessary for the delivery of preventive dental treatments; moreover, the cost of dental preventive treatment is much lower than uninsured treatments such as crowns and implants. Thus, to ameliorate some of the continuing discrepancies in terms of access to medical services, it is recommended that preventive dental treatment be included in the national health insurance. Moreover, a highly cost-effective strategy would be to establish a system of school oral health rooms that are staffed by dental hygienists, who can provide preventive dental treatments.

CONCLUSION

In summary, analysis of online juvenile health behaviour data (2007) in Korea has revealed that girls and adolescents in higher grades were more likely to brush their teeth than boys and adolescents in lower grades, respectively. Moreover, lower grade students, girls, and those who lived in large cities had more dental clinic visits per annum and received more preventive dental treatments than higher grade students, boys, and those who lived in smaller cities or rural districts. The social inequities in terms of dental care that are revealed by this study strongly support the notion that a national preventive dentistry programme should be formulated and implemented in Korea.

This research was limited by the fact that it was not possible to analyse and apply weights to the subjects based on the raw data such that the result might tend to be biased. It was also difficult to compare the relationship between oral condition and oral diseases. In addition, information regarding family income and the economic level of the respondents was not acquired. This information, together with research into local dental service facilities, would help to illuminate the observations of the present study. Follow-up studies are also needed to identify why dental services are not used as the school grade progresses.

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