



## Original Article

# Effect of worsening family economy due to COVID-19 on gingival bleeding and pain in Korean adolescents

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## ABSTRACT

**Objectives:** This study aimed to determine the effect of COVID-19-induced household economic deterioration on gingival pain and bleeding. **Methods:** Data from the 16th Adolescent Health Behavior Survey 2020 were used. A total of 57,925 adolescents were included in this cross-sectional study. We evaluated the worsening of the COVID-19-induced household economic situation, gingival pain, and bleeding. All surveys were assessed in a subjective non-face-to-face online interview. Data were analyzed using descriptive statistics, chi-squared tests, and logistic regression. **Results:** The overall prevalence of gingival pain and bleeding symptoms in the study population was 19.2%. People with COVID-19 were more likely to suffer from gingival pain and gingival bleeding than those who did not have economic deterioration due to COVID-19. There was no economic deterioration due to COVID-19 (aOR=1.048, 95% CI=1.034-1.227) and worsened very much (aOR=1.358, 95% CI=1.164-1.585). **Conclusions:** There were more cases of gingival pain and gingival bleeding, which are early symptoms of periodontal disease, in patients with COVID-19 compared to cases without deterioration of the household economic situation due to COVID-19. It is necessary to measure and study gingival bleeding objectively rather than relying on self-reports.

**Key Words:** Adolescents, Blood, COVID-19, Gingiva, Pain

## Introduction

COVID-19 is a disease with an extremely high associated mortality rate. It resulted in the widest possible pandemic environment, and approximately 210 countries and regions around the world were occupied by its unbearable influences. Meanwhile, the overall mortality rate due to COVID-19 is approximately 9% in the world according to the international reports on COVID-19 [1]. As part of the response to COVID-19, virtually all OECD countries were severely affected by the virus, and they have introduced strict restrictions to social and economic life, including social distancing and even full lockdowns. The major question is how to manage these restrictions and how to go back to a new normal of living with this pandemic reality, a social life and an economic life that coexist with the virus [2].

However, the fight against the COVID-19 pandemic is still getting exceptionally low levels of success across the world. The epidemic outbreak and the resulting lockdown increase the psychological stress on people [3-5]. On February 23, 2020, the government raised the infectious disease crisis to the highest level and implemented social distancing by expanding the telecommuting system of some companies and institutions. It was also decided to conduct elementary, middle, and school activities online [6].

The constant spread of the disease, the official hard isolation applications, and the closing of educational institutions are expected to affect the mental health of all people [7]. Stress is said to influence the host defenses, having an immunosuppressive effect, increasing one's vulnerability to disease [8-10].

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So, the deterioration of the household economic situation due to COVID-19 causes stress. Stress can also lead to periodontal disease. This study aimed to examine the relationship between gingival pain, bleeding, which are the initial symptoms of periodontal disease, because of the deterioration of the household economic situation due to COVID-19.

## Methods

This study followed the strengthening the reporting of observational studies in epidemiology guidelines [11].

### 1. Data source and study population

This study used data from 16th KYRBS, 2020, conducted by the Ministry of Education, the Ministry of Health and Welfare, and the Korea Centers for Disease Control and Prevention (KCDC). KYRBS is an annual cross-sectional survey aimed at collecting health information from Korean adolescents. To select a nationally representative sample, KYRBS selected 800 sample schools (400 middle and 400 high schools) using the stratified cluster sampling method. The survey was collected health information using an anonymous, by self-administered online method. In the 2020 survey, 57,925 adolescents were selected, and 54,948 participated (response rate: 94.9%). The KYRBS protocol was approved by the institutional review board of KCDC (2020-06EXP-02-P-A), and informed consent was obtained from all participants prior to their participation in the study. Additional information is provided elsewhere [12,13].

### 2. Changes in the household economic situation due to COVID-19

In this study, changes in the household economic situation due to COVID-19 were assessed through the question “Do you think the economic condition of student families has become more difficult than before?”. If the respondents answered ‘very much, so, not so, not at all’ and ‘very much, much’, the economic condition of the household would be considered to have deteriorated.

### 3. Gingival pain and bleeding

The question “In the past 12 months, have you experienced sore or bleeding gums?” was used to rate patients’ experience of gingival pain and bleeding. Response options were “I have never experienced symptoms.” and “I have experienced symptoms.”

### 4. General characteristics

The general characteristics include grade, sex, perceived school record, family structure, perceived economic status, place of residence, current smoking, current alcohol consumption, and physical activities. The current tobacco consumption (smoking) was defined as smoking at least once in the previous 30 days. The current alcohol consumption was defined as consuming at least one alcoholic drink in the previous 30 days. Physical activities were defined as activities resulting in an increase in the heart rate or an experience of shortness of breath regardless of the types of activities, which lasted than 60 min, for more than 5 days in the previous 7 days.

### 5. Statistical analyses

All statistical analyses were performed considering the complex sampling methods and conducted procedures. The general characteristics, household economic changes due to COVID-19, gingival pain, and gingival bleeding were analyzed for frequency. The Rao-Scott Chi-squared test was performed to determine differences in general characteristics, household economic changes due to COVID-19, and gingival pain and bleeding. The multi-logistic regression analyses were conducted to analyze sex, school year, perceived school record, current alcohol consumption, perceived economic status, COVID-19 economic change, physical activities, brushing on the previous day, lunch brushing. All analyses were conducted using SPSS 26.0.0.1 (IBM Corp. IBM SPSS Statistics for Mac, Armonk, NY; IBM Corp.). The threshold for statistical significance in all tests was  $p < 0.05$ .

# Results

## 1. General characteristics

Of the 54,948 participants in 2020 KYRBS, in the past 12 months, and 19.2% experienced gingival pain and bleeding. Among adolescents, the household economic status was 47.5% of the high, 39.9% of the middle, 12.6% of the low, and 19.8% of the economic situation due to COVID-19 are much worse, 12.7% is worse, 20.4% is not worse, 47.1% is very not worse <Table 1>.

**Table 1.** General characteristics

Characteristics	N	%	SE
Sex			
Boy	28,353	51.9	1.2
Girl	26,595	48.1	1.2
School year			
Middle first	10,005	17.9	0.3
Middle second	9,564	16.2	0.3
Middle third	9,392	15.6	0.2
High first	8,907	16.9	0.3
High second	8,907	17.0	0.3
High third	8,173	16.5	0.3
Perceived school record			
High	30,146	36.9	0.3
Middle	16,585	30.1	0.2
Low	18,217	33.0	0.3
Place of residence			
Large cities	23,621	42.2	0.7
Small and middle cities	26,981	51.9	0.8
Towns	4,346	5.9	0.4
Perceived economic status			
High	21,339	39.9	0.4
Middle	26,394	47.5	0.3
Low	7,212	12.6	0.2
COVID-19 economic change			
Much worse	3,256	5.8	0.1
Worse	13,583	24.2	0.2
Not changed	21,841	39.9	0.2
Very not unchanged	16,268	30.1	0.3
Current smoking			
No	3,160	56.8	0.8
Yes	2,470	43.2	0.8
Current alcohol consumption			
No	12,465	68.1	0.4
Yes	5,892	31.9	0.4
Physical activities			
No	21,111	42.5	0.4
Yes	29,223	57.5	0.4
Brushing yesterday			
< 3	28,546	52.3	0.3
≥ 3	26,402	47.7	0.3
Lunch brush			
Very much so	11,583	19.8	0.5
Yes	7,381	12.7	0.2
No	11,240	20.4	0.3
Very not	24,744	47.1	0.6
Periodontal pain and bleeding			
No	44,503	80.8	0.2
Yes	10,445	19.2	0.2

Data are expressed as frequencies and weighted %; SE: Standard error

## 2. Difference in periodontal pain and bleeding according to general characteristics

As a result of identifying gingival pain and bleeding due to changes in the household economic situation due to COVID-19, 23.7% of the cases in which the economic condition very worsened, 21.2% of the worsened cases, 19.0% cases did not worsen, and 17.0% of the cases very not worsening at all. The gingival pain and bleeding symptoms were significantly considerably more serious in the case where the household economic status was highly aggravated than that in the case where the household economic status did not deteriorate at all <Table 2>.

**Table 2.** Difference in periodontal pain and bleeding according to general characteristics

Characteristics	Periodontal pain and bleeding		<i>p</i> <sup>*</sup>
	No	Yes	
Sex			< 0.001
Boy	23,796 (83.6)	4,557 (16.4)	
Girl	20,707 (77.8)	5,888 (22.2)	
School year			< 0.001
Middle first	8,489 (84.8)	1,516 (15.2)	
Middle second	7,964 (83.1)	1,600 (16.9)	
Middle third	7,553 (80.3)	1,839 (19.7)	
High first	7,200 (80.8)	1,707 (19.2)	
High second	6,990 (78.5)	1,917 (21.5)	
High third	44,503 (80.8)	10,445 (19.2)	
Perceived school record			< 0.001
High	16,210 (80.2)	3,936 (19.8)	
Middle	13,678 (82.3)	2,907 (17.7)	
Low	14,615 (80.1)	3,602 (19.9)	
Place of residence			0.439
Large cities	19,170 (80.8)	4,451 (19.2)	
Small and middle cities	21,864 (80.9)	5,117 (19.1)	
Towns	3,469 (79.8)	887 (20.2)	
Perceived economic status			< 0.001
High	17,506 (81.8)	3,833 (18.2)	
Middle	21,479 (81.1)	4,918 (18.9)	
Low	5,518 (76.6)	1,694 (19.2)	
COVID-19 economic change			< 0.001
Very worse	2,470 (76.3)	786 (23.7)	
Worse	10,706 (78.8)	2,877 (21.2)	
Not worse	17,756 (81.0)	4,085 (19.0)	
Very not worse	13,571 (83.0)	4,697 (17.0)	
Current smoking			0.302
No	2,429 (76.7)	731 (23.3)	
Yes	1,903 (77.8)	567 (22.2)	
Current alcohol consumption			0.003
No	9,749 (77.8)	2,716 (22.2)	
Yes	4,468 (75.9)	1,424 (24.1)	
Physical activities			< 0.001
No	16,904 (79.7)	4,207 (20.3)	
Yes	23,738 (81.2)	5,485 (18.8)	
Brushing yesterday			0.045
< 3	23,026 (80.5)	5,520 (19.5)	
≥ 3	21,477 (81.1)	4,925 (18.9)	
Lunch brush			< 0.001
Very much so	9,164 (78.8)	2,419 (21.2)	
Yes	5,969 (80.4)	1,412 (19.6)	
No	9,267 (82.4)	1,973 (17.6)	
Very not	20,103 (81.1)	4,641 (18.9)	

Data are expressed as N (weighted %).

<sup>\*</sup>by complex sample chi-square test

### 3. Effects of household economic deterioration due to COVID-19 on periodontal pain and periodontal bleeding

The experience of gingival pain and bleeding among adolescents decreased significantly from low household economic status to middle household economic status (aOR=0.796, 95% CI=0.715-0.887) and high (aOR=0.769-0.970). As a result, the worse the economic status of a household (aOR=1.149, 95% CI=1.034-1.227) and very much worse (aOR=1.358, 95% CI=1.164-1.585). When the household economic status deteriorated due to COVID-19, it was more likely to cause gingival pain and periodontal bleeding, which are early symptoms of periodontal disease <Table 3>.

**Table 3.** Association between household economic deterioration due to COVID-19 and periodontal pain and periodontal bleeding

Variables	aOR	95% CI	<i>p</i> *
Perceived economic status			< 0.001
Low	1.000		
Middle	0.796	0.715 – 0.887	
High	0.864	0.769 – 0.970	
COVID-19 economic change			< 0.001
Very not unchanged	1.000		
Not changed	1.048	0.948 – 1.158	
Worse	1.149	1.034 – 1.227	
Much worse	1.358	1.164 – 1.585	

Data are expressed as adjusted odds ratios (95% confidence intervals).

Adjusted: sex school year, perceived school record, current alcohol consumption, physical activities, brushing yesterday, and lunch brush

\*by complex sampling binary logistic regression analysis

## Discussion

This study investigated the deterioration of the household economic situation and gingival pain and bleeding caused by COVID-19. Among the adolescents who experienced deterioration in their household economic situation due to COVID-19, 5.8% strongly agreed and 24.2% said agreed. Approximately 30% of Korean adolescents experienced deterioration in their household economic situation due to COVID-19. In addition, 23.1% of adolescents who experienced gingival pain and bleeding due to a deterioration of their family economic situation responded very much yes, and 21.2% responded 'yes'.

The spread of COVID-19 has a significant impact on health, medical care, welfare, social life, and the economic situation. In the local community site, there are realities such as closures, event suspensions, etc. [14]. Because of the spread of COVID-19, the general consumption of goods and services has contracted globally, and the economic situation has slumped. As a result, family income levels have decreased, or employment has become unstable [15]. Also, owing to the closure of the economic situation due to the economic downturn and virtual classes for students, the amount of time spent with family members must have increased. In addition, as the COVID-19 pandemic persists for a long time, family conflicts due to mutual demands or interference within the family may have increased [6].

Thus, it was found that the deterioration of the household economic situation and family relationships due to the spread of COVID-19 causes stress among adolescents. Stress generally negatively affects the effectiveness of immune responses, leading to an imbalance between the host and the infectious agent, resulting in periodontal destruction [16]. Previous studies have also found that stress might play a role in the development of periodontal disease [17]. Periodontal disease is not caused by a single factor but is a condition that occurs and progresses through the complex involvement of several risk factors, with stress being one of them [18]. In this study, it is thought that the deterioration of the household economic situation due to COVID-19 caused stress, thereby causing gingival pain and bleeding, which are the initial symptoms of periodontal disease.

One of the limitations of this study was that KYRBS is a cross-sectional study, and it was difficult to identify temporal relationships between the study variables. In addition, the identification of oral health behaviors on the basis of self-reporting entails a possibility of either overreporting or underreporting due to social desirability bias. However, it has great significance in examining the relationship between periodontal disease and the deterioration of the household economic situation due to COVID-19. The results of this study provide the following insights on the deterioration of the family economic situation and periodontal disease due to COVID-19. It will be necessary to confirm the association between periodontal disease and COVID-19 through objective measurements rather than subjective self-reports.

## Conclusions

This study investigated the deterioration of the household economic situation and gingival pain and bleeding caused by COVID-19. Data from the 16th Adolescent Health Behavior Survey KYRBS (2020) were used.

1. The overall prevalence of gingival pain and bleeding symptoms in the study population was 19.2%. People with COVID-19 were more likely to suffer from gingival pain and gingival bleeding than those who did not have economic deterioration due to COVID-19.
2. There was no economic deterioration due to COVID-19 (aOR=1.048, 95% CI=1.034-1.227), and it worsened very much (aOR=1.358, 95% CI=1.164-1.585).

It has great significance in examining the relationship between periodontal disease and the deterioration of the household economic situation due to COVID-19. The results of this study provide the following insights on the deterioration of the family economic situation and periodontal disease due to COVID-19.

## Conflicts of Interest

The author declare no potential conflict of interest.

## References

1. Worldometer. COVID-19 CORONAVIRUS PANDEMIC[Internet]. Weekly Trends. [cited 2021 Aug 02]. Available from: <http://www.worldometers.info/coronavirus>.
2. OECD Policy Responses to Coronavirus. Testing for COVID-19 : a way to lift confinement restriction[Internet]. [cited 2021 Aug 02]. Available from: <http://www.oecd.org/coronavirus/policy-responses/testing-for-covid-19-a-way-to-lift-confinementrestrictions-89756248>.
3. Person B, Sy F, Holton K, Govert B, Liang A. Fear and stigma: the epidemic within the SARS outbreak. *Emerg Infect Dis* 2004;10(2):358-63. <https://doi.org/10.3201/eid1002.030750>
4. Tao N. An analysis on reasons of SARS - induced psychological panic among students. *Journal of Anhui Institute of Education* 2003;21:78-9.
5. Duan L, Zhu G. Psychological interventions for people affected by the COVID-19 epidemic. *Lancet Psychiatry* 2020;7(4):300-2. [https://doi.org/10.1016/s2215-0366\(20\)30073-0](https://doi.org/10.1016/s2215-0366(20)30073-0)
6. Chin MJ, Sung MA, Son SH, Yoo JE, Lee JR, Chang YE. Changes in family life and relationships during the COVID-19 pandemic and their associations with perceived stress. *Family and Environment Research* 2020;58(3):447-61.
7. Celik B, Ozden K, Dane S. The effects of COVID-19 pandemic outbreak on the household economy. *J Res Med Dent Sci* 2020;8(4):51-6.
8. Rogers MP, Dubey D, Reich P. The influence of the psyche and the brain on immunity and disease susceptibility: a critical review. *Psychosom Med* 1979;41(2):147-64. <https://doi.org/10.1097/00006842-197903000-00008>
9. Ishisaka A, Ansai T, Soh I, Inenaga K, Awano S, Yoshida A, et al. Association of cortisol and dehydroepiandrosterone sulphate levels in serum with periodontal status in older Japanese adults. *J Clin Periodontol* 2008;35(10):853-61.
10. Goyal S, Jajoo S, Nagappa G, Rao G. Estimation of relationship between psychosocial stress and periodontal status using serum cortisol level: a clinico - biochemical study. *Indian J Dent Res* 2011;22(1):6-9. <https://doi.org/10.4103/0970-9290.79966>
11. Elm VE, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Bull World Health Organ* 2007;85(11):867-72. <https://doi.org/10.2471/blt.07.045120>



12. Kim YJ, Choi SH, Chun CM, Park SY, Khang YH, Oh KW. Data resource profile: the Korea youth risk behavior web - based survey (KYRBS). *International Journal of Epidemiology* 2016;45(4):1076-e.
13. Bae JS, Joung HJ, Kim JY, Kwon KN, Kim YT, Park SW. Test - retest reliability of a questionnaire for the Korea Youth Risk Behavior Web-based Survey. *Journal of Preventive Medicine and Public Health* 2010;43(5):403-10.
14. Nemoto M, Yim DK. Exposure to social and economic vulnerabilities due to COVID-19 and rule of social economic organization : case of chungbuk region. *Korean Journal of Local Government & Administration Studies* 2020;34(4):237-53.
15. World Bank. The global economic outlook during the COVID-19 pandemic: a changed world[Internet]. [cited 2021 Jul 03]. Available from: <http://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world>.
16. Song JI, Lee GH, Kim ME, Kim KS. Study on short term smoking cessation treatment in dental hospitals in Korea. *Journal of Oral Medicine and Pain* 2010;35(4):245-58.
17. Taylor R, Denham J, Ureda J. Health promotion: principles and clinical applications. Norwalk, CT: Appleton-Century-Crofts; 1982: 1-16.
18. Ha JE, Yeo BM, Roh HY, Paik DI, Bae KH. Periodontal condition and pathogens distribution of pregnant women. *Journal of Korean Academy of Oral Health* 2010;34(4):587-94.

## 우리나라 청소년의 COVID-19로 인한 가정경제악화가 치은 출혈 및 통증에 미치는 영향

### 초록

**연구목적:** 본 연구는 우리나라 청소년의 코로나바이러스감염증-19로 인한 가정경제 악화가 치은 통증 및 출혈에 미치는 영향을 알아보고자 하였다. **연구방법:** 제16회 청소년건강행태조사 KYRBS(2020) 자료를 사용하였다. 이 연구는 단면 연구로서 총 57,925명의 청소년을 대상으로 하였다. 코로나바이러스감염증-19로 인한 가정경제악화와 치은 통증 및 출혈의 관련성을 파악하였다. 모든 설문조사는 비대면 온라인 설문조사 방법으로 평가되었으며, 분석방법은 기술통계, 카이제곱 검정 및 로지스틱 회귀분석을 사용하여 분석하였다. 통계프로그램은 SPSS 26.0을 사용하였다. **연구결과:** 우리나라 청소년의 치은 통증 및 출혈 증상의 전반적인 유병률은 19.2%이었다. 코로나바이러스감염증-19로 가정경제의 악화가 없는 경우보다 가정경제가 악화된 청소년에서 치은 통증과 치은 출혈을 겪을 가능성이 더 높았다. COVID-19로 인한 가정경제악화가 없는 경우를 기준으로 악화된 경우(aOR=1.048, 95% CI=1.034-1.227), 매우 악화된 경우(aOR=1.358, 95% CI=1.164-1.585)으로 갈수록 치은 출혈 및 통증이 나타날 확률이 높았다. **결론:** 코로나바이러스감염증-19로 인한 가정경제악화가 없는 경우에 비해 COVID-19로 인해 가정경제가 악화 청소년에서 치주질환의 초기 증상인 치은 통증 출혈이 더 많았다.

**색인:** 청소년, 출혈, 치은, 코로나바이러스감염증-19, 통증