

## Associated Determinants of Anemia and the Effect of Oral Health in Korean Women: The 8th KNHANES

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### Abstract

**Background/Objectives:** Anemia and oral health are serious problems globally. Previous studies of anemia have documented but rare studies with oral health are existing. We aimed to identify the determinants of anemia.

**Methods/Statistical analysis:** To identify on the determinant factors of anemia, we analyzed latest cross-sectional data from 8th (2019) KNHANES. 2,273 female participants aged (20≤) were investigated and to find out the major related factors of anemia, multi-variable-logistic-regression were used with complex-sampling methods by SPSS (ver.21.0). This data was well known for its national representative one with reliability and validity.

**Findings:** The prevalence of anemia was 12.6%. This study results were revealed through multiple logistic regressions that aged (65≤) and aged (35-64) women groups compared to aged (20-34) group, no taking dietary supplements and no physical activity factors were the major determinants of anemia significantly. The next significant factors of anemia were no living with spouse and periodontitis in order. These findings are unique in view of dealing with oral health problems such as periodontitis and chewing difficulty caused of dementia and chronic disease, and anemia. And these results are very valuable to prevent anemia triggering all cause of mortality focusing on various view of points including oral health problems and marital status and so on.

**Improvements/Applications:** Therefore, government, local authorities and community healthcare professionals should do urgently cooperate in preparing various health education programs including oral health to prevent anemia caused of dementia and chronic diseases.

**Keywords:** anemia, ageing, dietary supplements, physical activity, marital status, periodontitis

### 1. Introduction

Anemia is the most common leading health problem in women worldwide. It affects especially to reproductive age of women by national survey data [1]. Recently the relationship between anemia, which occurs cause of insufficient hemoglobin, and periodontal health as oral health problem was ever reported [2] which was well known for being associated with quality of life in elderly [3]. In addition to that, the effect of anemia was identified that it was robustly related with women's health [4] and especially being associated with reproductive age of women's one with iron deficiency [5]. Vitamin D deficiency was reported to be clinically linking with some oral health problems such as oral cancers and jaw osteonecrosis by a comprehensive review study [6]. And zinc adequacy as nutrients was also reported to be related with being maintenance of good oral health as well as good for oro-maxillary disease [7]. Suboptimal biochemical riboflavin, which was associated with lower hemoglobin, was reported to be related with the higher rates of anemia among women in reproductive age [8]. The association of VB12, Folate status as nutrients deficiency and anemia among reproductive age of women was also reported in Southern India [9]. In female adult vegetarians, anemia was reported to be major health problem among 50 and below aged and married one of Malaysia [10]. It was reported that low handgrip-strength was strongly associated with anemia of Korean adults by a cross-sectional study using Korea National Health and Nutrition Examination Survey [11]. The significant connection between anemia and frailty, which was led to worsening to general health of elderly, was also reported among 50 and older adults [12].

In addition to that, risk factors such as contraceptive use, marital status, size of household, literacy and body mass index were reported to be associated with anemia among childbearing age women of Rwanda [13]. And double burden of obesity or overweight and micronutrient-deficiencies or anemia of women in reproductive age was also reported by population-based surveys [14].

The association of anemia and Socio-demographic factors such as mother's occupation, parity and gestational age, was reported among pregnant women in Uganda [15]. The knowledge and perception of systemic diseases in oral diseases was reported more higher awareness in older age than young age Anemia was reported to be deeply associated with periodontal health [16]. And iron deficiency status was reported to have greatly associated with physical activity in general health [17]. And hemoglobin deficiency as the indicator of anemia, which was well known for key essentials of general health, was being reported to be related with quality of life and physical activity [18].

Therefore, we investigated to identify on the associated determinants of anemia and the effect of oral health among Korean women.

## **2. Materials and Methods**

By the data (2019) of 8th Knhanes (Korea National Health and Nutrition Examination Survey), we analyzed 2,273 Korean women ( $20 \leq$ ) who met the criteria of inclusion and or exclusion to identify the associated determinant factors of anemia and the role of oral health in Korean women ( $20 \leq$ ) with complex sampling methods design using multi-logistic-regressions by SPSS (ver. 21.0). This nationwide data we used is ethically proved one.

### **2.1. Study design**

We used a cross-sectional study design data from Korea Nation Health and Nutrition Examination Survey which is composed of health examination, health interview and nutritional survey. The KNHANES data was approved in the Institutional Review Board ( by Korea Centers for Disease Control).

### **2.2. Statistical analysis**

Statistical analysis was made through survey to estimate the nationally representative outcomes. Sociodemographic variables such as age, gender, residence area, household income, marital status and educational level were collected. Age group was divided into 3 groups (20-34, 35-64, 65and over). Income level variable have four groups (lowest, middle-low, middle-high, highest). Education level was divided into 4groups (elementary, middle, high and more than college). General health behavior variables such as smoking, drinking, physical activity, sedentary time, sleeping time were chosen. Sedentary time was set as more than 5 hours sitting or less than 5 hours. Physical activity was defined as more than three times walking for a week. Oral health variables were chewing difficulty and periodontitis. Chewing difficulty was defined into 3 groups (none, moderate, severe). The chi-square for categorized variables was conducted to figure out the differences according to characteristics. Anemia was defined as a doctor's diagnosis one. Multiple logistic regression analysis was used to find out the determinants of anemia of women after adjusting. P-values was presented for significance with less than .05.

## **3. Results and Discussion**

The data of 8th KNHANES was analyzed being based on complex-sampling-analysis methods. 2273 participant characteristics of women ( $20 \leq$ ) in this study are described in Table1. The prevalence of anemia was 12.6%. 35-64 aged women was 62.2% while 20-34% women were 7.1%. Women living in urban area(dong) compared to one of rural area was 78.5%. Women with having no spouse was 23.0%. Not doing physical activity such as walking more than 3 times per week was 34.1%. Women who were not taking dietary supplements was 33.3%. People who were complaining on chewing difficulty was 38.2%. People who have periodontitis was 23.7%.

**Table 1. General characteristics of this study participants**

Variables	N (2273)	%
Gender		
Female	2273	100.0
Age		
20-34	161	7.1
35-64	1414	62.2
65 and over	698	30.7
Residence		
Urban(Dong)	1785	78.5
Rural(Eup, Myeon)	488	21.5
Marital status(spouse)		
No	523	23.0
Yes	1750	77.0
Income level		
Lowest	541	23.8
Middle-low	571	25.1
Middle-high	589	25.9
Highest	572	25.2
Education level		
Elementary	624	27.5
Middle	236	10.4
High	660	29.0
College	753	33.1
Smoking		
No	2182	96.0
Yes	91	4.0
Drinking		
No	402	17.7
Yes	1871	82.3
Physical activity(more than 3 times walking per week)		
No	775	34.1
Yes	1498	65.9
Sedentary time		
Less than 5 hrs.	654	28.8
Over 5 hrs.	1619	71.2
Sleeping time(7-8 hours/day)		
No	1145	50.4
Yes	1128	49.6
Dietary supplement		
No	756	33.3
Yes	1517	66.7
Chewing difficulty		
None	1381	60.8
Moderate	385	16.9
Severe	507	22.3
Periodontitis		
No	1735	76.3

	Yes	538	23.7
Anemia			
	No	1986	87.4
	Yes	287	12.6

\*All values are frequency and percentage

Table 2. depicts the prevalence of association between anemia and determinant factors. The results were presented with significant association between anemia and 35-64 aged (54.0%), alcohol drinking(76.0%), chewing difficulty(43.6%), periodontitis (28.9%), no spouse(32.4%), lowest income level (28.6%), elementary education level (35.6%), no physical activity (43.9%), and no dietary supplements (41.5%).

**Table 2. Prevalence of Association between anemia and determinant factors**

Variables	Anemia		P*
	No N(%)	Yes N(%)	
Age			< .001
20-34	151(7.6)	10(3.5)	
35-64	1259(63.4)	155(54.0)	
65 and over	576(29.0)	122(42.5)	
Residence			.057
Urban(Dong)	1572(79.2)	213(74.2)	
Rural(Eup, Myeon)	414(20.8)	74(25.8)	
Marital status(spouse)			< .001
No	430(21.7)	93(32.4)	
Yes	1556(78.3)	194(67.6)	
Income level			.028
Lowest	459(23.2)	82(28.6)	
Middle-low	507(25.5)	64(22.3)	
Middle-high	517(26.0)	72(25.1)	
Highest	503(25.3)	69(24.0)	
Education level			< .001
Elementary	522(26.3)	102(35.6)	
Middle	203(10.2)	33(11.5)	
High	604(30.4)	56(19.5)	
College	657(33.1)	96(33.4)	
Smoking			.631
No	1905(95.9)	277(96.5)	
Yes	81(4.1)	10(3.5)	
Drinking			.003
No	333(16.8)	69(24.0)	
Yes	1653(83.2)	218(76.0)	
Physical activity			< .001
No	649(32.7)	126(43.9)	
Yes	1337(67.3)	161(56.1)	
Sedentary time			.106
Less than 5hrs	538(29.4)	71(24.7)	
Over 5hrs	1403(70.6)	216(75.3)	
Sleeping time(7-8hours/day)			.857
No	999(50.3)	146(50.9)	

	Yes	987(49.7)	141(49.1)	
Dietary supplements				.002
	No	637(32.1)	119(41.5)	
	Yes	1349(67.9)	168(58.5)	
Chewing difficulty				.278
	None	1219(61.4)	162(56.4)	
	Moderate	331(16.6)	54(18.8)	
	Severe	436(22.0)	71(24.8)	
Periodontitis				.025
	No	1531(77.1)	204(71.1)	
	Yes	455(22.9)	83(28.9)	

\*All values are N(%) . \*Calculated by Chi-square test.

Table 3. Shows the associated determinants of anemia and the effect of oral health. Through analyzing multiple logistic regressions, aged (65≤) group and aged (35-64) group women compared to aged (20-34) group women, no taking dietary supplements and no physical activity factors were reported to be the most determinant one of anemia. Next significant factors were not living with spouse and periodontitis. Participant characteristics of this study are described in Table1. Table 2. Shows the prevalence of association between anemia and determinant factors.

**Table 3. The associated determinant factors of Anaemia by multivariable logistic regression**

Variables	Anemia		P*
	OR	95% CI	
Age			
20-34		reference	
35-64	2.235	1.137-4.395	0.020
65 and over	3.454	1.601-7.450	0.002
Residence			
Urban(Dong)		reference	
Rural(Eup, Myeon)	1.165	0.863-1.575	0.318
Marital status(spouse)			
No	1.394	1.019-1.906	0.038
Yes		reference	
Income level			
Lowest	1.216	0.843-1.754	0.295
Middle-low	1.050	0.732-1.506	0.792
Middle-high	0.869	0.597-1.265	0.464
Highest		reference	
Education level			
Elementary	0.761	0.473-1.225	0.261
Middle	0.658	0.419-1.034	0.070
High	0.553	0.384-0.795	0.001
College		reference	
Smoking			
No		reference	
Yes	0.858	0.429-1.719	0.667
Drinking			
No		reference	
Yes	0.831	0.602-1.147	0.261
Physical activity			

No	1.447	1.112-1.884	0.006
Yes		reference	
Sedentary time			
Less than 5hrs	1.138	0.848-1.528	0.390
Over 5hrs		reference	
Sleeping time			
(<7,8<hrs/day) No	0.921	0.712-1.191	0.529
(7-8hrs/day) Yes		reference	
Dietary supplements			
No	1.451	1.116-1.886	0.005
Yes		reference	
Oral Health			
Chewing difficulty			
None		reference	
Moderate	0.892	0.637-1.249	0.504
Severe	1.118	0.792-1.578	0.525
Periodontitis			
No		reference	
Yes	1.360	1.017-1.818	0.038

Through study analysis, ageing, no dietary supplements and no physical activity were quite evident as the most affecting factors of anemia. And the next factors of anemia were not living with spouse and bad oral health (periodontitis) by analyzing of 2273 women subjects with data (2019) of 8th KNHANES. As results, the prevalence of anemia was 12.6%. This prevalence was lower than that of another study cause of the different sample and size of the study participants which had 201 female students aged 18-25 [19].

Ageing, 65 and over and 35-65 aged women group compared to 20-34 aged women group were found to be more affected in anemia through our study results. And these results were having some common with another study which was dealing with the association between anemia and frailty among 50 and older people even the different study design and sample [12]. Especially anemia, which was reported to be associated with impaired quality of life among Koreans [20], was significantly associated with ageing in this study and these findings were valuable in the point of specified age groups of this study.

Not taking dietary supplements, which was identified as the significant factor of our study, was also presented as the major factor of lower hemoglobin and higher rates of anemia among Malaysian and Canadian women by suboptimal riboflavin status in another study [8]. This result was also supported another study which the high anemia prevalence suggests the urgent need of nutrition of women by national representative data of Nepal even though having the difference which women's age with no significance being anemic [1] Also, this study was in consistent with another latest study on the relationship between iron deficiency and anemia on women's health [17]. Additionally, this study result was supported by the other study which zinc adequacy was essential for optimal oral health and general health [7].

No Physical activity factor was also identified to be major one of anemia of our study, which was, in a sense, in consistent with the result of another study, being reported on the association of being obese and anemia among women of reproductive age in Rwanda [5].

Periodontitis, as the indicator of oral discomfort, which this study explored the determinant factor of anemia, was closely associated with health-related quality of life especially among elderly population [3]. This study result was in consistent with another study which periodontal health cause of gingival bleeding was directly related with anemia cause of gingival inflammation [2]. This study result was additionally supported by another one on the correlation between signs of anemia and chronic periodontitis, low grade inflammation problem of lowering hemoglobin concentration [21].

Not living with spouse was found to be the important variable of anemia of our study and marital status was reported to having association with anemia of another study in Rwanda women even though the difference of study design and target age [13]. This result was supported by another study which anemia was lower in married women [1].

Especially anemia which was reported to be associated with impaired quality of life among Koreans [20]. It is needed and important to understand on biological, social and demographic factors and perceived thinking of the community on anemia triggering maternal and fetal health [22] (Sumera Aziz Ali et al, 2019) and being closely related with depression cause of vitamins deficiency by randomized triple-masked trial [23].

This study has two limitations to handle cautiously. First, this study was not differentiated anemia into iron deficiency anemia, megaloblastic anemia and hemoglobinopathy anemia. Secondly, it is difficult to generalize cause of cross-sectional study design. Therefore, it is further needed to research the scientific links on the findings of this study.

#### 4. Conclusion

In conclusion, ageing, no dietary supplements and no physical activity factors were found as the most affecting factors of anemia among 2273 women (20≤) by the data of 8th Korea National Health and Nutrition Examination Survey. And the next important factors of anemia were bad oral health (periodontitis) and lower education level. This study explored that about 12.6% women (20≤) was anemic. Though our study findings, anemia might be seriously considered as major health problem triggering poor general health. Therefore, government, local authorities and health professionals should be preparing the strategies to prevent anemia resulted in dementia as well as deteriorating general health focusing on Korean women. Further researches might be urgently needed to explore the scientific links between anemia and oral health problems as well as socio-economic variables.

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