



## Social capital and oral health: The association of social capital with edentulism and chewing ability in the rural elderly



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### ABSTRACT

**Objective:** The association between social capital and oral health had been reported in various ways, but still remains unclear. We investigated the association between the social capital of the elderly living in a rural region and their edentulism and chewing ability.

**Methods:** A total of 241 elderly aged  $\geq 70$  years living in a rural city of Korea participated in this cross-sectional study. Their social capital was surveyed by questionnaire assessing its network and trust dimensions. Their edentulism and chewing ability were assessed by oral examination and chewing gum whose color changes based on the mastication performance.

**Results:** The mean age of the participants was 82.7 (ranged 71 to 101) years and 68.8% of them were female. In the binomial regression analysis, the general network aspect of the network dimension was significantly associated with chewing ability, of which the prevalence ratio was 1.88 (95% CI: 1.16–3.06) in the age, sex, education and marital status-adjusted model.

**Conclusion:** Our findings suggest that social capital, such as a poor social network, is associated with poor chewing ability in the elderly living in rural areas.

### 1. Introduction

Social capital, which was defined by Robert Putnam as “connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them” is suggested to be independently associated with general health (Montanye & Putnam, 2001; Herian, Tay, Hamm, & Diener, 2014). Studies conducted in Canada, the United Kingdom, Russia, and Sweden have reported that a higher level of social capital is associated with better self-reported health status (Rose, 2000; McCulloch, 2001; Bolin, Lindgren, Lindström, & Nystedt, 2003; Shields, 2008). For example, the level of group membership and mistrust were reported to be correlated with the mortality rate (Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997). Moreover, some kinds of social capital, such as individual social ties, neighborhood social capital, etc., were reported to be related to health outcome (Kawachi & Berkman, 2000; Poortinga, Dunstan, & Fone, 2008). However, along with these efforts to analyze the influence of social factors on health, some studies suggested the existence of an association between social capital and

oral health (Rickardsson & Hanson, 1988; Aida et al., 2011).

Oral diseases such as caries and periodontitis are recognized as being influenced by various determinants including biological, psychological and socio-economic factors (Williams, 2011). According to previous studies, lower levels of social support or participation are related to having fewer teeth in older adults (Takeuchi, Aida, Kondo, & Osaka, 2013; Koyama et al., 2016). Also social capital was reported to be related to subjective oral health and oral health to be related to quality of life (Rouxel, Tsakos et al., 2015; Rouxel, Heilmann, Aida, Tsakos, & Watt, 2015b). Concerning this relationship, Kawachi et al. suggested some hypothesized pathways, including health-related behavior, psychological distress, accessibility to dental services and policy development (Kawachi & Berkman, 2000). For example, those who have high levels of social capital, such as neighbors, friends or family, are likely to have stress-buffering ability, which may have a positive effect on their dental health or motivate them to visit dental services (Boyapati & Wang, 2007; Rickardsson & Hanson, 1988).

However, in previous studies most studies assessed oral health by

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examining edentulism or tooth loss or self-rated oral health, which might be insufficient to reflect the overall oral function such as chewing ability according to dental prosthesis or denture status. We make a hypothesis that oral function such as chewing ability as well as edentulism is likely to be susceptible to social capital. So, we examined the chewing ability objectively using chewing gum whose color changes according to the mastication performance.

Also social network is a commonly used social capital indicator that cover structural dimension and its association with oral health is controversy (Rouxel, Heilmann et al., 2015; Rouxel, Tsakos et al., 2015). On the other hand, trust is social capital indicator that covers cognitive dimension, of which association with oral health among elderly is rarely reported. Given that there is no agreement in measurement of social capital, we intended to measure social capital comprehensively by assess both structural and cognitive dimension of social capital.

Therefore, we attempted to evaluate the association between the network and trust dimensions of social capital and oral health by examining objectively the edentulism and chewing ability among the elderly living in a rural area.

## 2. Methods

### 2.1. Study participants

Elderly people over 70 years old registered at the public health center of a rural area in Korea were screened. We had selected random samples of elderly stratified by age to yield 100 elderly in each 10-year age group, altogether 3 age groups (70–79 years; 80–89 years; 90 years or above). And a total of 258 elderly agreed to participate in this study. The response rate to invitations was roughly 86.0%. Trained nurses enrolled the participants who met the following criteria: (1) agreed to participate in the study, (2) could understand and comply with the protocol of the study, and (3) had no infectious diseases. Those who did not provide written informed consent or whose guardian did not agree with their participation in the study were excluded. Finally, a total of 241 participated in this cross-sectional study. This study was conducted in full accordance with the World Medical Association Declaration of Helsinki and approved by the institutional review board (KNUH 2015-07-007-001).

### 2.2. Measurements

Trained examiners visited the homes of the participants and interviewed them about their socio-demographic characteristics and general health status using a structured questionnaire. Information on their age, sex, education, marital status, smoking, drinking, and treated diseases was surveyed.

Social capital was assessed using a questionnaire including the network and trust dimensions. The network dimension was assessed using the Korean-translated abbreviated version of the Lubben Network Scale which consisted of a total of 6 questions about the general network, friend network, and supportive network (Hong, Casado, & Harrington, 2011). The general network aspect was assessed using 2 questions, “How many relatives do you see or hear from at least once a month?” and “How many friends do you see or hear from at least once a month?”. The friend network aspect was assessed using 2 questions, “How many relatives do you feel at ease with that you can talk to about private matters?” and “How many friends do you feel at ease with that you can talk to about private matters?”. The supportive network aspect was assessed using 2 questions, “How many relatives do you feel close to such that you could call on them for help?” and “How many friends do you feel close to such that you could call on them for help?” The answers included the following options: (1) none (2) 1, (3) 2, (4) 3 ~ 4, (5) 5 ~ 8, and (6) 9 people or more. The responses for each question were added up. The trust dimension was assessed using the locally adapted simplified version of the Social Capital Integrated

Questionnaire (SC-IQ), which consisted of a total of 7 questions about 4 aspects, viz. general trust, trust in neighbors, trust in organizations, and social participation (Kim & Bae, 2012). General trust was assessed using 1 question, “Do you tend to trust most people”. The answer included the following options: (1) I tend to trust people easily, (2) I have a normal level of trust, and (3) I tend not to trust people. Trust in neighbors was assessed using 2 questions, “Are your neighbors willing to help you if you are in trouble?” and “Do some of your neighbors tend to take advantage of you?” The answers included the following options: (1) yes absolutely, (2) yes, (3) sometimes, (4) no, and (5) no, not at all. Trust in organizations was assessed using 2 questions, “How much do you trust city officials?” and “How much do you trust central government officials?”. The answers included the following options: (1) I trust them very well, (2) I trust them well, (3) I do not trust them, and (4) I do not trust them at all. Social participation was assessed using 2 questions, “Are you willing to invest financial resources for the sake of the public interest of the social community?”, “Are you willing to invest your time for the public interest of the social community?” The answers included the following options: (1) yes and (2) no. According to each aspect of the trust dimensions, the scores of the responses were added up and a higher score represents higher level of social trust. The oral examination was conducted by trained nurses. Edentulism was examined visually and the chewing ability was assessed using chewing gum (XY-LITOL, 70 × 20 × 1 mm, 3.0 g; Lotte, Saitama, Japan) whose color changes in 5 steps (blue, yellow, pale pink, pink, dark pink) according to the chewing performance (Kamiyama, Kanazawa, Fujinami, & Minakuchi, 2010). After the elderly had chewed the gum for 2 min, the trained nurses immediately recorded the color of the gum based on the color standards provided by the manufacturer. Those who had no teeth and whose gum color was blue or yellow were classified as edentulous and having poor chewing ability, respectively.

### 2.3. Statistical analysis

Those who were edentulous or had poor chewing ability were compared among the groups based on their socio-demographic and general health characteristics and social capital using the Chi-square test and T-test. To evaluate the association between social capital and edentulism or poor chewing ability, binomial regression analyses were done to calculate prevalence ratio because of relatively high prevalence of edentulism or poor chewing ability. Covariates such as sex, age, education and marital status were adjusted in the regression analyses. The statistical significance level was set at 0.05. All statistical analyses were conducted using SPSS version 17 for Windows (SPSS Inc, Chicago, IL, USA).

## 3. Results

The mean age of the participants was 82.7 (ranged 71 to 101) years, and the majority of them were female (66.8%), lived alone (63.5%), and were uneducated (54.8%). The numbers of participants who were edentulous or had poor chewing ability was 87 (36.1%) and 78 (32.4%), respectively (Table 1). The oral health of the study participants according to their general characteristics is described in Table 1, in which the age and education were significantly related to both edentulism and poor chewing ability. A comparison of edentulism and poor chewing ability according to social capital is shown in Table 2. Among the various aspects of social capital, only general network was significantly associated with both edentulism and poor chewing ability (Table 2).

The results of the binomial regression analysis conducted to assess the association between social capital and oral health, in which the risks of edentulism and chewing ability according to social capital were analyzed, are shown in Tables 3 and 4, respectively. The prevalence ratios (PRs) and 95% confidence intervals (CIs) of the crude (model 1), age and sex-adjusted (model 2), and age, sex, education and marital

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