creative commons
COMMONS DEED

저작자표시-비영리-변경금지 2.0 대한민국

이용자는 아래의 조건을 따르는 경우에 한하여 자유롭게

- 이 저작물을 복제, 배포, 전송, 전시, 공연 및 방송할 수 있습니다.

다음과 같은 조건을 따라야 합니다:

저작자표시. 귀하는 원저작자를 표시하여야 합니다.

비영리. 귀하는 이 저작물을 영리 목적으로 이용할 수 없습니다.

변경금지. 귀하는 이 저작물을 개작, 변형 또는 가공할 수 없습니다.

- 귀하는, 이 저작물의 재이용이나 배포의 경우, 이 저작물에 적용된 이용허락조건을 명확하게 나타내어야 합니다.
- 저작권자로부터 별도의 허가를 받으면 이러한 조건들은 적용되지 않습니다.

저작권법에 따른 이용자의 권리는 위의 내용에 의하여 영향을 받지 않습니다.

이것은 이용허락규약(Legal Code)을 이해하기 쉽게 요약한 것입니다.

Disclaimer

dCollection

치의학석사 학위논문

Association between obesity and flow rate of unstimulated whole saliva among elderly Koreans.

한국 노인에서 비만과 비자극성 전타액 분비율의 연관성

2013 년 2 월

서울대학교 치의학대학원

치의학과

문 선 희

Association between obesity and flow rate of unstimulated whole saliva among elderly Koreans.

지도 교수 김 현 덕

이 논문을 치의학석사 학위논문으로 제출함
2012 년 11 월

서울대학교 치의학대학원
치의학과
문 선 희

문선희의 치의학석사 학위논문을 인준함
2013 년 2 월

위 원 장 박 경 표 (인)
부위원장 김 현 덕 (인)
위 원 한 동 헌 (인)

Abstract

Association between obesity and flow rate of unstimulated whole saliva among elderly Koreans.

Moon Sun Hee
Seoul National University
School of Dentistry

1. Objectives

The prevalence of obesity continue to increase in all ages and ethnicities worldwide. Obesity is associated with increased risk of chronic inflammatory diseases such as type 2 diabet, atherosclerosis, cancer, and respiratory disorders. In addition, several studies have reported that obesity is related to several aspects of oral health, such as caries, periodontitis and dry mouth. There have been few studies on the relationship between obesity and hyposalivation. Moreover, very few studies on old ages have been found in the literature. Dry mouth is a common symptom in the older people that can produce serious negative effects on the patient’s quality of life. Although the increased prevalence of

hyposalivation caused by diseases and intake of drugs in aged patients is well known, it is possible that obesity is also a determinant of dry mouth. Therefore, we performed this study to provide additional evidence of an association between obesity and salivary flow rate among Korean adults.

2. Methods

In Korea, the Sun-Chang longevity cohort started in 2009. All 514 subjects (177 males and 337 females), selected from the Sun-Chang longevity cohort at baseline survey, participated voluntarily and provided written informed consent. Their ages ranged from 48 to 93 years, with a mean of 70.5 years. Unstimulated saliva was collected in a relaxed position and was passively drained for 10min into a test tube. We classify into 3 groups; those with very low SFR (UWSFR <0.1 ml/min); those with low SFR (UWSFR = 0.1-0.19 ml/min); and those who have normal SFR (UWSFR ≥ 0.2 ml/min). For evaluating obesity, trained examiners measured weight, height, hip circumference and waist circumference. Obesity was defined as a BMI ≥25kg/m^2 and overweight was defined as a BMI between 23 and 25 kg/m^2. Regarding WC, obesity was defined as a WC≥90cm for men and ≥85cm for women. Considering WHR, obesity was defined as a WHR≥0.90 for men and ≥0.80 for women. In order to obtain information about socio-demographic status, general health-related behaviors, the subjects were interviewed by a trained interviewer using structured questionnaires. To determine the strength of association and the dose-effect relationship between the salivary flow rate and the obesity indicator scores, analysis of covariance (ANCOVA) was performed. To determine the association between obesity and salivary flow rate, odds ratios with 95% confidence intervals were estimated by logistic regression analysis adjusting for age, gender, smoking, drinking, physical activity, number of teeth, denture wearing state, interaction of gender and obesity.

3. Results

Unstimulated salivary flow rate ranged from 0.001ml/min to 0.968ml/min, with a mean of 0.13ml/min. Obesity is significantly correlated with age, gender, smoking, number of remained teeth, denture wearing state. We found that salivary flow rate significantly decreased with age and females had a lower flow rate than males. The people who smokes present and drinks 1-5 times monthly presented a significant higher salivary flow rate than non-smoker and non-drinking patients respectively. Physical activity, remained teeth and denture wearing state were not significantly correlated with salivary flow rate.

In the analysis of covariance adjusted for age, gender, smoking, drinking, physical activity, number of teeth, denture wearing, none of the BMI, WC and WHR did not significantly correlated with salivary flow rate.

In the multivariate logistic regression model adjusted for age, gender, smoking, drinking, physical activity, number of teeth, denture wearing, and interaction of obesity indices and gender, the

prevalence of very low salivary flow rate in obese group was 11.5 times significantly higher than that of normal group (OR=11.54, 95% CI: 1.04-128.02). However, WC and WHR did not show the significant association with salivary flow rate.

In conclusion, it is suggested that obesity may play a significant role in the control of salivary secretion, but the population bias to some of the rural elderly and obesity and salivary flow has been limited to less overall significant association. Further studies are needed to reappraise the interaction obesity and salivary flow rate in large and diverse population.

Keywords : obesity, salivary flow rate, hyposalivation
Student Number : 2009-22676

Index

Table Index

Figure Index

I. Introduction

The prevalence of obesity continue to increase in all ages and ethnicities worldwide (Ogden et al., 2002). The Korean National Health and Nutrition Survey (KNHANES) showed that the prevalence of obesity[body mass index (BMI) $\geq$25kg/m^2] has increase among the adults from 26% in 1998(Korea Ministry of Health and Welfare, 1999) to 30.8% in 2010(Korea Ministry of Health and Welfare, 2011). Obesity and in particular abdominal obesity is associated with increased risk of chronic inflammatory diseases such as type 2 diabetes, atherosclerosis, cancer, and respiratory disorders (Fontaine et al., 2003).

Dry mouth is a common symptom in the older people that can produce serious negative effects on the patient' s quality of life (Gupta et al., 2006). Although the increased prevalence of hyposalivation caused by diseases and intake of drugs in aged patients is well known (Ship et al., 2002), it is possible that obesity is also a determinant of dry mouth. In addition, several studies have suggested that obesity is related to some aspects of oral health, such as caries, periodontitis and dry mouth. Several studies showed a positive association between overweight and/or obesity and periodontits (Dalla Vecchia et al., 2005; Han et al., 2010; Saito et al., 2001; Saito et al., 2005; Wood and Johnson, 2008). But very few studies have examined the relationship between obesity and hyposalivation. Although very low saliva flow rate has been demonstrated to be associated with younger adults(<50 years) only BMI >25 (Flink et al., 2008) there is limited knowledge concerning saliva flow rate in obese subjects in relation to healthy controls. Some studies based on limited number of obese subjects show normal salivary pattern compared with normal-weight individuals (Epstein et al., 1996; Powers et al., 1982).

Moreover, there are no data concerning the association between obesity and salivation among Korean adults. Therefore, we performed this study to provide additional evidence of an association between obesity and salivary flow rate (SFR) among Korean adults.

II. Material & Method

1. Study population

In Korea, the Sunchang longevity cohort started in 2009, focusing on longevity, lifestyle and systemic diseases. The dental health area covers several topics, including investigation about association of obesity and salivation.

This cross-sectional study was approved by the IRB of SNUSOD(#S-D20090003). All 514 subjects (177 males and 337 females), selected from the Sunchang longevity cohort(SLC) at baseline survey, participated voluntarily and provided written informed consent. Their ages ranged from 48 to 93 years, with a mean of 70.8 years. This survey included oral examination, saliva sampling for laboratory procedures, and questionnaires for confounders.

2. Determination of salivary flow rate

The saliva collection procedure was performed in the morning and food restriction was given to the subjects.

Unstimulated whole saliva was collected, with the participant in a relaxed position leaning slightly forward. After swallowing, saliva was passively drained for 10min into a test tube. The amount of saliva was determined after collection and unstimulated whole salivary flow rate (UWSFR) rate was expressed as ml/min. There is no general agreement about UWSFR that distinguishes normal patients from those with hyposalivation; the value has ranged between 0.1 and 0.2 ml/min(Fenoll-Palomares et al., 2004; Longman et al., 1995; Marton et al., 2008; Navazesh et al., 1992; Sreebny and Valdini, 1987). As a result, we followed previous classification of SFR: very low SFR (UWSFR <0.1 ml/min); low SFR (UWSFR = 0.1-0.19 ml/min); and normal SFR (UWSFR ≥ 0.2 ml/min) (Flink et al., 2008).

3. Assessment of obesity

For evaluating weight, height, hip circumference (HC) and waist circumference (WC), trained examiners measured the subjects wearing light clothing and no shoes. BMI was calculated as the weight (kg) divided by the square of height (m^2). Waist hip ratio (WHR) was calculated as the ratio of WC to HC (WHR=WC/HC).

Obesity was defined as a BMI ≥25kg/m^2 and overweight was defined as a BMI between 23 and 25 kg/m^2 (WHO Expert consultation, 2004). Regarding WC, obesity was defined as a WC≥ 90cm for men and ≥85cm for women (Lee et al., 2006).

Considering WHR, obesity was defined as a WHR≥0.90 for men and ≥0.80 for women (Suk et al., 2003).

4. Assessment of confounders

Demographic status and general health-related behaviors, dental status were selected as confounders. Age, gender were selected as demographic factors. General health-related behaviors included smoking, drinking, physical activity. Dental status including the number of teeth, denture wearing state was evaluated by dentists using the oral examination. In order to obtain information regarding other potential confounders, the subjects were interviewed by a trained interviewer using structured questionnaires.

5. Statistical analysis

Salivary flow rate was an outcome variable, and obesity was a main explanatory variable. Confounders such as age, gender, smoking, drinking, the frequency of physical activity, number of teeth and denture wearing state were placed into models.

The distribution of obesity and SFR were described according to the characteristic variables. To determine the dose-effect relationship between the salivary flow rate (continuous variable) and the obesity indicator scores (continuous variable), correlation analysis and analysis of covariance (ANCOVA) were performed. Multivariable norminal logistic regression analysis was also used to evaluate the adjusted odds ratio (AOR) between hyposalivation (category with two groups) and the obesity indicators (category with three groups). Statistical analysis was performed using SPSS for Windows release 19.0 (SPSS Inc., Chicago, IL, USA).

III. Results

UWSFR of subjects ranged from 0.001ml/min to 0.97ml/min, with a mean of 0.13ml/min. BMI score is significantly correlated with age, gender, smoking, number of remained teeth, denture wearing state (Table 1). We found that salivary flow rate significantly decrease with age(p=0.001) and females had a lower flow rate than did males(p=0.006). The people who smokes present and drinks one to five times monthly presented a significant higher salivary flow rate than non−smoker and non−drinking patients respectively (p=0.003, 0.025). Physical activity, remained teeth and denture wearing state did not show the difference in SFR.

All the obesity indices significantly correlated each other: In Pearson’s correlation coefficient (r) was 0.664 (p<0.01) between BMI and WC, 0.261 (p<0.01) between BMI and WHR, 0.739 (p<0.01) between WC and WHR. In crude association of UWSFR with BMI, WC and WHR, UWSFR was not significantly associated with any of the obesity indicators (Fig. 1). Although UWSFR fluctuated according to the severity of obesity defined by BMI, ANCOVA did not reveal any significant influence of obesity on the salivary flow rate after adjusting for age, gender, smoking, drinking, physical activity, number of teeth and denture wearing status (Table 2). In the multivariable norminal logistic regression model adjusted for age, gender, smoking, drinking, physical activity, number of remained teeth, denture wearing and interaction term between obesity and gender, the prevalence of very low salivary flow rate in obese group was 11.5 times significantly higher than that of controls (OR=11.54, 95% CI: 1.04−128.02). The tendency toward a higher odds ratio(OR) for very low salivary flow rate or low salivary flow rate with increasing BMI was observed. But this was not statistically significant. In the analysis according to WHR, there were similar association between obesity and SFR, however the associations were not statistically significant. Interestingly, obese group analyzed by WC had a preventive association both for very low flow rate and low flow rate than normal group, which were not statistically significant.

IV. Discussion

The association between obesity and salivary pattern is still controversial. Several studies showed an association between salivary flow rate and obesity (Flink et al., 2008; Sawair et al., 2009; Yamamoto et al., 2009), although other studies showed no such association (Epstein et al., 1996; Powers et al., 1982). Hence present study was aimed to investigate whether obesity is associated with SFR in elderly Koreans.

For evaluating the association between obesity and salivary flow rate, we used both visceral adiposity (WC, WHR) and total body adiposity (BMI) as indicators of obesity. We also included several demographic factors, general health-related behaviors and dental status in the models. The results from the present study showing that obese people has higher risk for very low salivary flow rate. The link between obesity and salivary secretion rate is correspond well with the finding of an association between overweight and prevalence of very low salivary flow rate previous reported among adults (Flink et al., 2008). These results may be explained by the effect of inflammation. Most salivary gland inflammatory diseases have in common an associated salivary hypofunction (Beale and Madani, 2006; Dawson et al., 2006).

Obese subjects have been reported to exhibit enlargement of parotid gland probably by an increased storage of adipocyte in the parotid parenchyma, while the submandibular glands show no signs of enlargement (Bozzato et al., 2008; Heo et al., 2001). There are several signaling pathways involved in the control of secretion that can be affected by proinflammatory cytokines (IL−β_1, IL−6, TNF−α) and prostaglandins (Tanda et al., 1998 Weinstein et al. 2000; Yamakawa et al., 2000; Yu, 1986) Based on that, proinflammatory cytokines derived from adipocytes as well as macrophages, accumulated in adipose tissue (Weisberg et al., 2003) may negatively affect the function of salivary glands due to chronic low−grade inflammation in the gland.

Obesity is linked to chronic inflammation and a number of adipose−related proinflammatory cytokines, so called adipokines, are enhanced in plasma from obese subjects contributing to enhanced inflammatory response in many body organs (Lyon et al., 2003). The immune system modulates central nervous system function particular by cytokines and the hypothalamic−pituitary−adrenal axis is reported to be dysregulated in subjects with abdominal obesity (Pasquali et al., 2006). Altered function of the hypothalamic−pituitary−adrenal axis may affect the neuroendocrine regulation of salivary glands which seems to be the case in Sjogren's syndrome, characterized by diminished salivary gland secretion (Johnson et al., 2006).

Unstimulated salivary flow is produced primarily by the submandibular glands (65−70%), with the parotid and sublingual glands providing 20% and 7% to the flow, respectively (de Almeida Pdel et al., 2008). In contrast to parotid gland, submandibular gland is not affected by the obesity as was shown by some investigators (Bozzato et al., 2008; Heo et al., 2001). This may be one reason for the weak association between obesity and hyposalivation.

Limitation of this study included the lack of specific information about the medications that are the most common cause of hyposalivation. The use of medications increases with age, with more than 75% of people aged 65 and older taking at least 1 prescription medication (Chrischilles et al., 1992); therefore, the prevalence of medication−induced xerostomia is high in the elderly (Narhi). Another limitation was the population biases that our subjects were localized in Sunchang county. The cross−sectional design of the study makes it impossible to determine a direction of causality. In addition, the influence of residual and unmeasured confounding cannot be excluded in observational studies. Therefore, some of the confounders may be imprecisely measured, and there might be additional confounders that are not accounted for in the observed relationship between obesity and salivary secretion.

V. Conclusion

In conclusion, this novel finding is that old age obesity (BMI $\geq$ 25) is associated with reduced flow rate of unstimulated whole saliva. However, WC and WHR did not show the significant association with salivary flow rate. Further longitudinal studies including the status of diseases and drug use in large and diverse population are needed to increase our understanding of the hyposalivation.

Reference

Beale T, Madani G (2006). Anatomy of the salivary glands. *Seminars in ultrasound, CT, and MR* 27(6):436-439.

Bozzato A, Burger P, Zenk J, Uter W, Iro H (2008). Salivary gland biometry in female patients with eating disorders. *European archives of oto-rhino-laryngology : official journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS) : affiliated with the German Society for Oto-Rhino-Laryngology - Head and Neck Surgery* 265(9):1095-1102.

Chrischilles EA, Foley DJ, Wallace RB, Lemke JH, Semla TP, Hanlon JT *et al.* (1992). Use of medications by persons 65 and over: data from the established populations for epidemiologic studies of the elderly. *Journal of gerontology* 47(5):M137-144.

Dalla Vecchia CF, Susin C, Rosing CK, Oppermann RV, Albandar JM (2005). Overweight and obesity as risk indicators for periodontitis in adults. *Journal of periodontology* 76(10):1721-1728.

Dawson LJ, Fox PC, Smith PM (2006). Sjogrens syndrome--the non-apoptotic model of glandular hypofunction. *Rheumatology (Oxford, England)* 45(7):792-798.

de Almeida Pdel V, Gregio AM, Machado MA, de Lima AA, Azevedo LR (2008). Saliva composition and functions: a comprehensive review. *The journal of contemporary dental practice* 9(3):72-80.

Epstein LH, Paluch R, Coleman KJ (1996). Differences in salivation to repeated food cues in obese and nonobese women. *Psychosomatic medicine* 58(2):160-164.

Fenoll-Palomares C, Munoz Montagud JV, Sanchiz V, Herreros B, Hernandez V, Minguez M *et al.* (2004). Unstimulated salivary flow rate, pH and buffer capacity of saliva in healthy volunteers. *Revista espanola de enfermedades digestivas : organo oficial de la Sociedad Espanola de Patologia Digestiva* 96(11):773-783.

Flink H, Bergdahl M, Tegelberg A, Rosenblad A, Lagerlof F (2008). Prevalence of hyposalivation in relation to general health, body mass index and remaining teeth in different age groups of adults. *Community dentistry and oral epidemiology* 36(6):523-531.

Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB (2003). Years of life lost due to obesity. *JAMA : the journal of the American Medical Association* 289(2):187-193.

Gupta A, Epstein JB, Sroussi H (2006). Hyposalivation in elderly patients. *Journal (Canadian Dental Association)* 72(9):841-846.

Han DH, Lim SY, Sun BC, Paek DM, Kim HD (2010). Visceral fat area-defined obesity and periodontitis among Koreans. *Journal of clinical periodontology* 37(2):172-179.

Heo MS, Lee SC, Lee SS, Choi HM, Choi SC, Park TW (2001). Quantitative analysis of normal major salivary glands using computed tomography. *Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics* 92(2):240-244.

Johnson EO, Kostandi M, Moutsopoulos HM (2006). Hypothalamic-pituitary-adrenal axis function in Sjogren's syndrome: mechanisms of neuroendocrine and immune system homeostasis. *Annals of the New York Academy of Sciences* 1088(41-51.

Korea Ministry of Health and Welfare (1999). The Report of the Korean Nationwide Health and Nutritional Examination Survey in 1998. In: KMoHa Welfare editor. Seoul, South Korea.

Korea Ministry of Health and Welfare (2011). The Report of the Korean Nationwide Health and Nutritional Examination Survey in 2010. In: KMoHa Welfare. editor. Seoul, South Korea.

Lee SY, Park HS, Kim SM, Kwon SS, Kim DY, Kim DJ *et al.* (2006). Cut-off points of waist circumference for defining abdominal obesity in the Korean populations. *Journal of Korean Society for the Study of the Obesity* 15(1):1-9.

Longman LP, Higham SM, Rai K, Edgar WM, Field EA (1995). Salivary gland hypofunction in elderly patients attending a xerostomia clinic. *Gerodontology* 12(12):67-72.

Lyon CJ, Law RE, Hsueh WA (2003). Minireview: adiposity, inflammation, and atherogenesis. *Endocrinology* 144(6):2195-2200.

Marton K, Madlena M, Banoczy J, Varga G, Fejerdy P, Sreebny LM *et al.* (2008). Unstimulated whole saliva flow rate in relation to sicca symptoms in Hungary. *Oral diseases* 14(5):472-477.

Narhi TO (1994). Prevalence of subjective feelings of dry mouth in the elderly. *Journal of dental research* 73(1):20-25.

Navazesh M, Mulligan RA, Kipnis V, Denny PA, Denny PC (1992). Comparison of whole saliva flow rates and mucin concentrations in healthy Caucasian young and aged adults. *Journal of dental research* 71(6):1275-1278.

Ogden CL, Flegal KM, Carroll MD, Johnson CL (2002). Prevalence and trends in overweight among US children and adolescents, 1999-2000. *JAMA : the journal of the American Medical Association* 288(14):1728-1732.

Pasquali R, Vicennati V, Cacciari M, Pagotto U (2006). The hypothalamic-pituitary-adrenal axis activity in obesity and the metabolic syndrome. *Annals of the New York Academy of Sciences* 1083(111-128.

Powers PS, Holland P, Miller C, Powers HP (1982). Salivation patterns of obese and normal subjects. *International journal of obesity* 6(3):267-270.

Saito T, Shimazaki Y, Koga T, Tsuzuki M, Ohshima A (2001). Relationship between upper body obesity and periodontitis. *Journal of dental research* 80(7):1631-1636.

Saito T, Shimazaki Y, Kiyohara Y, Kato I, Kubo M, Iida M *et al.* (2005). Relationship between obesity, glucose tolerance, and periodontal disease in Japanese women: the Hisayama study. *Journal of periodontal research* 40(4):346-353.

Sawair FA, Ryalat S, Shayyab M, Saku T (2009). The unstimulated salivary flow rate in a jordanian healthy adult population. *Journal of clinical medicine research* 1(4):219-225.

Ship JA, Pillemer SR, Baum BJ (2002). Xerostomia and the geriatric patient. *Journal of the American Geriatrics Society* 50(3):535-543.

Sreebny LM, Valdini A (1987). Xerostomia. A neglected symptom. *Archives of internal medicine* 147(7):1333-1337.

Suk SH, Sacco RL, Boden-Albala B, Cheun JF, Pittman JG, Elkind MS *et al.* (2003). Abdominal obesity and risk of ischemic stroke: the Northern Manhattan Stroke Study. *Stroke; a journal of cerebral circulation* 34(7):1586-1592.

Tanda N, Ohyama H, Yamakawa M, Ericsson M, Tsuji T, McBride J *et al.* (1998). IL-1 beta and IL-6 in mouse parotid acinar cells: characterization of synthesis, storage, and release. *The American journal of physiology* 274(1 Pt 1):G147-156.

Weisberg SP, McCann D, Desai M, Rosenbaum M, Leibel RL, Ferrante AW, Jr. (2003). Obesity is associated with macrophage accumulation in adipose tissue. *The Journal of clinical investigation* 112(12):1796-1808.

WHO Expert consultation (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet* 363(9403):157-163.

Wood N, Johnson RB (2008). The relationship between smoking history, periodontal screening and recording (PSR) codes and overweight/obesity in a Mississippi dental school population. *Oral health & preventive dentistry* 6(1):67-74.

Yamakawa M, Weinstein R, Tsuji T, McBride J, Wong DT, Login GR (2000). Age-related alterations in IL-1beta, TNF-alpha, and IL-6 concentrations in parotid acinar cells from BALB/c and non-obese diabetic mice. *The journal of histochemistry and cytochemistry : official journal of the Histochemistry Society* 48(8):1033-1042.

Yamamoto K, Kurihara M, Matsusue Y, Imanishi M, Tsuyuki M, Kirita T (2009). Whole saliva flow rate and body profile in healthy young adults. *Archives of oral biology* 54(5):464-469.

Yu JH (1986). Modulating effects of prostaglandins on parasympathetic-mediated secretory activities of rat salivary glands. *Prostaglandins* 31(6):1087-1097.

Table 1. Distribution of obesity and salivary flow rate according to demographic, behavioral and oral factors

	Total	BMI	p	salivary flow	p
	N	Mean±SD		Mean±SD	
Age(years)			<0.001 †		0.001 †
45−64	103	24.28±3.54[a]		0.15±0.12[a]	
65−74	268	23.33±3.06[b]		0.14±0.12[a]	
≥75	143	22.20±2.48[c]		0.10±0.07[b]	
Gender			0.02*		0.006*
Male	177	22.77±2.62		0.15±0.13	
Female	337	23.44±3.30		0.12±0.10	
Smoking			0.005 †		0.003 †
no	327	23.52±3.29[a]		0.12±0.10[a]	
past smoking	131	22.80±2.65[ab]		0.14±0.11[b]	
present smoking	56	22.30±2.64[b]		0.17±0.16[b]	
Alcohol drinking (drinks/month)			0.207 †		0.025 †
no	372	23.35±3.21		0.12±0.10	
1−5	102	22.92±2.94		0.15±0.15	
≥6	40	22.61±2.28		0.12±0.11	
Physical activity			0.251 †		0.551 †
no	394	23.08±0.98		0.13±0.11	
1−4	40	23.55±3.71		0.13±0.10	
daily	80	23.65±03.09		0.14±0.12	
Remained teeth			<0.001*		0.096*
<20	345	22.85±2.89		0.12±0.11	
≥20	169	23.94±3.37		0.14±0.11	
denture wearing			0.025*		0.863*
no	229	23.55±3.30		0.13±0.10	
yes	285	22.93±2.90		0.13±0.12	

* p−values are calculated by independent t−test.
† p−values are calculated by one−way ANOVA.
SD denotes standard deviation.
Superscripts denote the same group in post hoc multiple comparison test of Scheffe at p=0.05.

Table 2. Distribution of salivary flow rates according to obesity indicators

Indicator of obesity		salivary flow rate			
	N	Crude mean±SD	p†	Adjusted mean*± SE	p‡
BMI			0.285		0.07
normal	260	0.130±0.113		0.133±0.007	
overweight	118	0.114±0.102		0.108±0.010	
obese	136	0.136±0.117		0.128±0.010	
WC			0.593		0.177
normal	308	0.126±0.114		0.123±0.006	
obese	206	0.131±0.108		0.131±0.008	
WHR			0.780		0.434
normal	91	0.131±0.113		0.121±0.015	
obese	423	0.127±0.112		0.130±0.005	

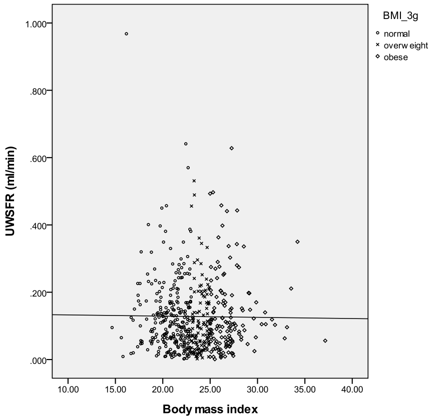
* Obtained from ANCOVA adjusted for age, gender, smoking, alcohol drinking, physical activity, remained teeth, denture wearing.
† p-values are calculated by one-way ANOVA.
‡ p-values are calculated by ANCOVA.
SD denotes standard deviation.
SE denotes standard error.

Table 3. Adjusted associations between obesity and salivary flow rate by multivariable norminal logistic regression model

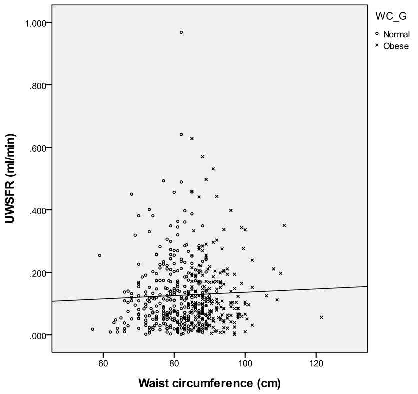
Indicator of obesity	N(%)	OR(95% CI)*	
		very low (<0.1ml/min)	low (0.1−0.19ml/min)
BMI			
normal	260 (50.6)	1	1
overweight	118 (23.0)	1.16 (0.17−7.88)	1.55 (0.19−12.54)
obese	136 (26.5)	11.54 (1.04−128.02)	3.76 (0.26−52.94)
Trend p−value			0.994
WC			
normal	206 (40.1)	1	1
obese	308 (59.9)	0.43 (0.14−1.35)	0.27 (0.08−0.88)
WHR			
normal	423 (82.3)	1	1
obese	91 (17.7)	1.80 (0.47−6.89)	1.77 (0.40−7.86)

* OR: very low=2 vs. low=1 vs. normal =0, adjusted for age, gender, smoking, alcohol drinking, physical activity, remained teeth, denture wearing and interaction between each obesity indicator and gender.

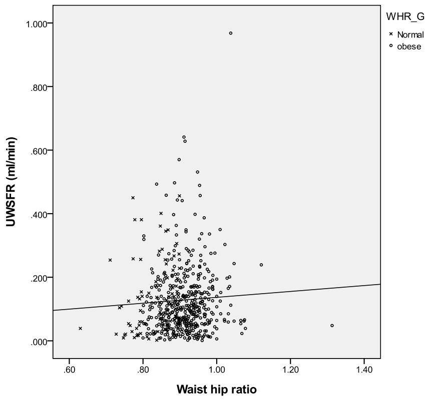
Figure 1. Crude association of obesity indicators and unstimulated whole salivary flow rates



(pearson r = −0.010, p=0.822)



(pearson r = 0.041, p=0.353)



(pearson r = 0.055, p=0.213)

초 록

1. 연구목적

비만은 전세계적으로 증가 추세에 있으며 제2형 당뇨와 동맥경화, 암, 호흡기 질환 등 만성 염증성 질환의 발병에 중요한 역할을 한다. 뿐만 아니라 치아우식, 치주질환 그리고 구강건조와 같은 구강질환과도 관련이 있음이 밝혀졌다. 비만과 타액분비율의 관련성에 대해서는 비교적 적은 연구들이 진행되어 있으며 노인을 대상으로 한 연구는 더욱더 제한되어 있다. 구강건조는 높은 비율의 노령인구가 겪고 있는 구강 질환으로 삶의 질에도 많은 영향을 끼치는 질환이다. 노인의 구강건조는 주로 전신적 질환과 약물 복용성의 증가 때문인 것으로 설명되고 있으나 비만과의 관련성도 생각해볼 수 있다. 따라서 본 연구에서는 한국 노인을 대상으로 비만과 타액분비의 관계를 파악하고자 한다.

2. 연구대상 및 방법

2009년 시작 된 순창 장수코호트(longevity cohort) 대상자 중 2009년과 2010년에 조사한 순창주민 514명을 대상으로 연구를 수행하였다. 대상자는 남자 177명, 여자 337명으로 구성되어 있으며 조사 대상자의 연령은 48세에서 93세에 분포하였고, 평균 연령은 70.47세이었다. 타액분비율은 편안한 상태에서 저자극성 전타액을 10분간 conical tube에 수집하여 기록하였고, 0.1ml 이상 0.2ml/min 미만을 저타액증, 0.1ml/min 미만을 최저타액증으로 진단하였다. 비만도 분석을 위해 신장, 체중, 허리둘레와 엉덩이둘레를 측정하였다. 비만은 BMI 25kg/m^2 이상, 과체중은 23-25kg/m^2으로 각각 정의한다. 허리둘레(WC)에 대해서는 남성 90cm이상, 여성은 85cm 이상을 허리/엉덩이둘레 비율(WHR)은 남성 0.90 이상, 여성 0.80 이상을 각각 비만으로 정의하였다. 사회

인구학적인 요인, 건강관련 행동요인, 구강 상태, 전신건강 등에 관한 정보는 규격화된 설문지를 이용한 면접조사법을 통하여 확보하였다. 비만지수와 타액분비율 간의 양-반응 관계를 분석하기 위해 나이, 성별, 흡연, 음주, 운동량, 현존 영구치 수, 의치 장착 여부를 보정하여 공분산분석을 시행하였다. 비만 유무와 저타액증 유무의 연관성은 나이, 성별, 흡연, 음주, 운동량, 현존 영구치 수, 의치 장착 여부를 보정한 로지스틱 회귀분석을 시행하여 odds ratio(OR) 및 95% confidence interval(95% CI)을 통해 평가하였다.

3. 결론

비자극성 타액분비율의 평균은 0.13ml/min이었고 분포는 최소 0.001ml/min, 최대 0.97ml/min이었다. 타액분비율은 연령이 증가할수록 감소하였으며 남성에 비해 여성에서 0.03ml/min 낮았으며, 현재 흡연자는 비흡연자보다 타액분비율이 높게 나타났으며 월 1-5회의 음주를 하는 사람이 음주를 하지 않는 사람에 비해 높은 타액분비율을 보였다. 육체적 활동, 잔존치아수, 의치장착여부와 타액분비율은 연관성이 나타나지 않았다. BMI로 분석한 비만도는 연령이 증가할수록 감소하였으며 남성에 비해 여성이 높았으며 흡연자에 비해 비흡연자가 높았고, 현존 영구치가 20개 이상인 사람과 의치를 장착한 사람이 각각 영구치가 20개 미만인 사람과 의치를 장착하지 않은 사람에 비해 높았다. 음주와 운동량은 비만과 연관성이 나타나지 않았다.

나이, 성별, 흡연, 음주, 운동량, 현존 영구치 수, 의치 장착 여부를 보정한 공분산 분석에서 비만 지수인 BMI, WC, WHR와 비자극성 타액분비율의 연관관계는 나타나지 않았다.

나이, 성별, 흡연, 음주, 운동량, 현존 영구치 수, 의치 장착 여부 그리고 성별과 BMI의 상관관계를 보정한 다변량 로지스틱 회귀분석 결과,

최저타액분비율(<0.1ml/min)과 정상타액분비율(≥0.2ml/min) 비교 모형에서 BMI로 분석된 비만군은 정상군에 비해 최저타액분비율자가 될 가능성이 11.5배 높았다(OR=11.54 95% CI: 1.04-128.02). 그러나 WC와 WHR로 분석된 비만군에서는 유의한 연관성을 보이지 못하였다. 특히 저타액분비율(0.1ml/min-0.19ml/min)과 정상 타액분비율의 비교에서는 BMI, WC, WHR로 분석한 모든 비만군에서 유의한 연관성을 보이지 못하였다.

총괄적으로 보아 비만과 타액분비량은 유의한 연관성을 보였으나, 본 연구의 대상자가 일부 농촌 노인층으로 제한되었으며 유의한 연관성이 전반적이지 못한 한계를 가지고 있으므로 추후 보다 많은 대상자를 대상으로 한 연구로 재평가할 필요가 있다고 검토되었다.

주 요 어 : 비만, 타액분비율, 저타액증

학　　번 : 2009-22676