Tikrit Journal for Dental Sciences 1(2012)51-58 https://doi.org/10.25130/tjds.2.1.9

The Relation of Salivary Constituents (Urea, Calcium and Phosphorous) to Root Caries among Overweight and Obese Adults Aged 55-65 Year-Old at Textile Factory in Mosul City

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Key words
overweight, obesity, root caries , salivary urea, calcium and phosphorous.

Abstract

The purpose of this study was to disclose the relationship of salivary urea, calcium and phosphorous levels with root caries occurrence among overweight and obese adults aged 55-65 year-old at Textile Factory in Mosul City. All subjects aged 55-65 year-old (thirty five subjects) at Textile factory in Mosul city who fitted the study criteria took part in the current study. Weight status was determined by using the Body Mass Index (BMI). Root caries was recorded according to the criteria of WHO (1997). Unstimulated whole saliva was collected then salivary samples were subjected for biochemical analysis. Salivary urea, calcium, and phosphorous were determined colorimetrically by using the spectrophotometer. Results revealed that salivary urea and phosphorous levels were higher among obese and overweight subjects than non-obese with highly significant difference. Also calcium level was significantly elevated among obese compared with non-obese. Sound root surface value was higher among obese than non-obese and overweight subjects with significant difference. On the other hand overweight and obese subjects revealed lower decayed root surface value than non-obese though statistical difference was not significant. As a conclusion obese subjects with good general health might experience reduced root caries severity that might partly be due to changes in salivary constituents. Therefore future studies should address which factors specific to obese might be protective against root caries. Also there is a need for further studies with larger sample size and another sample distribution that include underweight, normal weight, overweight and obese to get more precise and clear results.

Introduction

Overweight and obesity have become a global problem [(1)].Body composition changes with advancing age with an increase in fat mass and loss in muscle mass which is termed sarcopenic obesity [(2)]. Overweight also defined as having more body fat than is optimally healthy but it is considered as a state of pre obesity [(3)]. Obese people are at higher risk for heart diseases, diabetes mellitus, cancer, joint diseases, and psychological problems, etc [(4)]. In old people it is difficult to establish an ideal BMI that

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minimizes risk of mortality or morbidity. The Nutrition Screening Initiative recommended a Body Mass Index between (22-27 kg/m^2) in the elderly [5]. Regarding oral diseases, overweight and obesity were found to influence many aspects of oral health [6]. Root surface caries can be defined as soft progressive lesion that is found anywhere on the root surface that has lost epithelial tissue attachment and is exposed to the oral environment; however, root caries is not necessarily a sequel of gum recession in all persons [7,8].The etiologic mechanism of root caries doesn't, in principle, differ from coronal caries [9]. Occasionally, the composition of bacterial plaque flora on root surfaces differs from that on enamel surfaces in that Actinomyces and Lactobacilli are the main root caries pathogens in addition to acidogenic microorganisms [10]. Root lesions usually progress more quickly than do enamel lesions, this is due to the low degree of mineralization of root cementum, and also because of the difficulties in keeping root surfaces clean with routine brushing of teeth [11]. Several studies among children and adolescents found that overweight and obese subjects are more likely to have dental caries than the non-obese ones [12-14]. Another study among adults found that obesity could increase the risk for dental caries probably because obese subjects tend to neglect their oral health [15] also they used to eat frequent sugary snacks [16]. Pannunzio et al [17] added that changes in salivary constituents among obese provided a favorable condition for dental caries. They carried out a study among school children and found a significant elevation in salivary protein with a significant reduction of phosphate level in saliva of obese and overweight children compared with control. However, calcium level revealed no significant difference among the three groups. No studies could be found regarding root caries among overweight and obese adults. Also there is no previous Iraqi studies concerning the relation of certain salivary elements (urea, calcium and phosphorous) with root caries among overweight and obese individuals, therefore, this study was conducted.

Subjects and Methods

The sample consisted of all subjects of both genders aged 55-65 year-old at Textile factory in Mosul city. They should be non-smoker, with no medical history that compromises salivary secretory mechanism (depending on the medical report supplied by the medical unit at the factory), shouldn't take any medications with xerogenic effect or any nutritional supplementation, and shouldn't wear any fixed or removable dental prostheses.The collection of unstimulated salivary samples was performed according to the instructions cited by Tenovuo and Lagerlöf **[18].** Then salivary samples were subjected for biochemical analysis at the College of Veterinary and College of Dentistry, University of Mosul. Salivary urea, calcium, and phosphorous were determined colorimetrically by using ready kits supplied by (BioMérieux sa, France) using the spectrophotometer (Cecil Instrument Limited CE 1021, England). Root caries was recorded according to the criteria of WHO (1997) [19]. Weight status was determined by using the Body Mass Index (BMI) which can be obtained by dividing weight in Kilogram by height in meter squared [1]. BMI was divided into three categories which include non-obese (<25 Kg/m^2), overweight (≥25-<30 Kg/m^2), and obese (≥30 Kg/m^2) [20]. Data analysis was conducted through the application of the Statistical Package for Social Science (SPSS version 12). Analysis of variance (ANOVA) test, Least Significant Difference (LSD) test and Multiple Linear Regression (MLR) test were applied. The confidence limit was accepted at 95% ($P < 0.05$).

Results

Sample distribution is shown in Table 1. Non-obese and obese subjects revealed equal percentage (37.14%) while the percentage of overweight subjects was (25.71%). Table 2 reveals highly significant difference in mean salivary urea level among BMI categories ($F = 8.42$; $P<0.01$). Whereas calcium showed

statistically non significant difference among BMI categories (P>0.05). Concerning phosphorous level, it revealed highly significant difference among the three categories (F= 7.84; P<0.01) Further investigation using Least Significant Difference (L.S.D.) test as shown in Table 3 revealed that urea level was higher among obese than non-obese with highly significant difference (m.d.=-21.13, P<0.01) also it was higher among obese than overweight with significant difference (m.d.=-12.90, P<0.05). Furthermore Least Significant Difference (L.S.D.) test showed that calcium level was significantly higher among obese than non-obese (m.d.=-1.78, P<0.05) and overweight individuals (m.d.=-1.82, P<0.05). Also phosphorous level was higher among obese than non-obese with highly significant difference (m.d.=-5.75, P<0.01) also phosphorous was significantly higher among obese than overweight (m.d.=-4.02, P<0.05).Root caries according to BMI categories is seen in Table 4. Sound root surface value (SS) showed significant difference among the three categories (F=3.80; P<0.05). On the other hand decayed root surface mean value (DS) was lower among overweight and obese than non-obese though statistical difference was not significant. In addition Least Significant Difference (L.S.D.) test showed that sound root surface value was significantly higher among obese than non-obese (m.d.=-18.77, P<0.05) and overweight individuals (m.d.=-24.16, P<0.05) (Table 5).Results of Multiple Linear Regression (MLR) test for sound root surface (SS) (dependent variable) explained by salivary constituents (independent variables) is seen in Table 6. Among non-obese subjects a complete correlation coefficient R between them was 0.61 with coefficient of determination R^2 value of 0.37 indicating that 37% of changes occurred in (SS) are explained by salivary constituents (urea, calcium, phosphorous). For all entered constituents βeta coefficient slops were not statistically significant (P>0.05). Among overweight a complete correlation coefficient R between them was 0.72 with coefficient of determination R^2 value of 0.51 indicating that 51% of changes occurred in (SS) are explained by salivary constituents (urea, calcium, phosphorous). Also for all entered constituents βeta coefficient slops were not statistically significant (P>0.05). Whereas among obese subjects complete correlation coefficient R was 0.85 with coefficient of determination R^2 of 0.72 indicating that 72% of changes occurred in (SS) are explained by salivary constituents (urea, calcium, phosphorous). The only highly significant βeta coefficient was found for calcium with positive trend of effect. Results of Multiple Linear Regression (MLR) test for decayed root surface (DS) (dependent variable) explained by salivary constituents (independent variable) is shown in Table 7. Among non-obese subjects a complete correlation coefficient R between them was 0.41 with coefficient of determination R^2 value of 0.16 indicating that 16% of changes occurred in (DS) are explained by salivary constituents (urea, calcium, phosphorous). For all entered constituents βeta coefficient slops were not statistically significant (P>0.05). No statistics was computed for overweight because they had no root caries (see Table 4). For obese subjects complete correlation coefficient R was 0.83 with coefficient of determination R^2 value of 69%. The only significant βeta coefficient was recorded for calcium with positive trend of effect.

Discussion

Saliva is essential for preserving oral health [21]. Regarding the protection against dental caries, salivary flow rate, buffer capacity (e.g. urea), calcium, phosphorous and fluoride concentration are essential [22]. Obesity is currently a rapidly growing form of malnutrition [23]. Inadequate nutritional status may influence saliva composition, which in turn affects the process of tooth demineralization [17]. Findings of the current study revealed higher salivary urea among obese and overweight than non-obese with highly significant difference. No study could be found regarding salivary urea level among obese and overweight to compare the results with.

However, since urea is a byproduct of protein metabolism [24] the study result is partially agreed with Pannunzio et al [17] study among school children .It was found that obese subjects are more likely to have either lower blood concentrations or lower bioavailability of minerals and/or vitamins so they need multivitamin and mineral supplementation [25]. However, in the current study results revealed that calcium was significantly higher among obese than overweight and non-obese groups. This finding disagreed with Pannunzio et al [17] results. Higher calcium level among obese in the current study probably related to the fact that obese subjects experience metabolic and hormonal disturbances like an increase in parathyroid hormone release which in turn leads to increased release of calcium from bone and reduction of calcium loss from kidneys so that blood calcium level rises [26] so as salivary calcium level since saliva is considered as a mirror of serum [27]. Salivary phosphorous level in this study was higher among obese and overweight than non-obese with highly significant difference. This finding is contradicted with Pannunzio et al [17] study. This variation with other studies probably related to differences in sample size, criteria of sample selection and classification, collection method of saliva, age group, geographic location and diet [28]. Also in this study no dietary analysis was performed especially regarding calcium, phosphorous, protein and lipid intake. Concerning root caries experience obese subjects revealed significantly higher sound root surface mean value than non-obese on the other hand they showed lower decayed root surface value than non-obese but with no significant difference. This finding disagreed with other studies [12-15]. Contradiction with these studies probably because our study sample was healthy with no systemic diseases and not used any medications that affect saliva secretion and consequently oral health [29] so they had less decayed root surfaces value but higher sound root surfaces value. Another explanation is higher salivary urea, calcium and phosphorous among obese that were reported to have a protective effect against dental caries by several studies [30-33] thereby reducing the susceptibility of the exposed root surfaces and increasing their resistance to dental caries. This is probably because salivary urea as a buffer system causes pH rise thereby enhancing tooth surface remineralisation [34]. Also it has the ability to modify the cariogenic potential of the oral environment by fostering an environment less conducive to the emergence of acidogenic and aciduric species but more inductive to mineral deposition [32]. Also salivary calcium plays an essential role in increasing resistance of the outer enamel surface to acid dissolution and enhancing remineralization of the initial carious lesion [18]. In addition phosphorous might enhance remineralization and increases tooth resistance to acid attack also it acts as buffer system [35]. This is further supported by highly significant ßeta coefficient for calcium on sound root surface with positive trend of effect that is found in the current study. It could be concluded that obese subjects with good general health might experience reduced root caries severity that might partly be due to changes in salivary constituents which favor less root caries severity. Therefore, future studies should address which factors specific to obese might be protective against root caries. It is worth to mention that non-obese category includes normal weight and underweight. Therefore, it is recommended to carry out further study with larger sample size and another sample distribution that include underweight, normal weight, overweight and obese to get more precise and clear results.

Table(1):- Sample distribution according to body weight categories.

BMI categories	No.	%
Non-obese (<25 Kg/m$^{2)}$	**13**	**37.14**
Over weight (≥25-<30 Kg/m^2)	**9**	**25.71**
Obese (≥30 Kg/m^2)	**13**	**37.14**
Total	**35**	**100**

Table (2):- Salivary constituents (Mean ±S.D.) according to body weight categories.

Variable	Non-obese (<25 Kg/m$^{2)}$			Over weight (≥25 -<30 Kg/m^2)			Obese (≥30 Kg/m^2)			ANOVA test d.f.=2	
	No.	Mean	±SD	No.	Mean	±SD	No.	Mean	±SD	F-value	P-value
Urea	13	44.46	15.81	9	52.69	12.86	13	65.59	10.26	8.42	0.001**
Calcium	13	8.67	1.92	9	8.64	1.21	13	10.45	2.44	3.30	0.050
Phosphorous	13	9.48	3.88	9	11.22	2.89	13	15.24	4.18	7.84	0.002**

** Highly Significant

Table(3):- Least Significant Difference (L.S.D) of salivary constituents according to body weight categories.

Variable	BMI categories	Mean difference (m.d.)	Standard Error	Significancy
Urea	Non-obese-Obese	-21.13	5.18	0.00**
	Over weight-Obese	-12.90	5.73	0.03*
	Non-obese-Over weight	-8.23	5.73	0.16
Calcium	Non-obese-Obese	-1.78	0.78	0.03*
	Over weight-Obese	-1.82	0.867	0.04*
	Non-obese-Over weight	0.03	0.867	0.97
Phosphorous	Non-obese-Obese	-5.75	1.48	0.00**
	Over weight-Obese	-4.02	1.64	0.02*
	Non-obese-Over weight	-1.73	1.64	0.30

*Significant ** Highly Significant

Table (4):- Root caries (Mean ±S.D.) according to body weight categories.

Root Caries	Non-obese (<25 Kg/m$^{2)}$			Over weight (≥25-<30 Kg/m^2)			Obese (≥30 Kg/m^2)			ANOVA test df=2	
	No.	Mean	±SD	No.	Mean	±SD	No.	Mean	±SD	F-value	P-value
SS	13	25.61	12.60	9	20.22	27.00	13	44.38	25.91	3.80	0.03*
DS	13	0.46	0.52	9	0.00	0.00	13	0.31	0.75	1.83	0.18

*Significant

Table (5):- Least Significant Difference (L.S.D) of root caries according to body weight categories.

Root Caries	BMI categories	Mean difference (m.d.)	Standard Error	Significancy
SS	Non-obese- Obese	-18.77	8.71	0.04*
	Over weight-Obese	-24.16	9.63	0.02*
	Non-obese-Over weight	5.39	9.63	0.58
DS	Non-obese-Obese	0.15	0.22	0.49
	Over weight-Obese	-0.31	0.24	0.21
	Non-obese-Over weight	0.46	0.24	0.07

*Significant

Table (6):- Multiple Linear Regression of sound root surface (SS) explained by certain salivary constituents according to body weight categories.

Salivary constituents	Non-obese (<25 Kg/m$^{2)}$				Over weight (≥25 -<30 Kg/m^2)				Obese (≥30 Kg/m^2)			
	ß (slope)	S.E.	t	P-value	ß (slope)	S.E.	t	P-value	ß (slope)	S.E.	t	P-value
Urea	0.26	0.48	0.54	0.60	-3.71	2.37	-1.57	0.18	-1.16	0.93	-1.24	0.25
Calcium	0.22	2.66	0.08	0.94	-23.38	22.53	-1.04	0.35	7.63	1.92	3.99	0.003**
Phosphorous	0.91	2.36	0.39	0.71	16.69	10.28	1.62	0.17	3.81	2.31	1.65	0.13
	R=0.61 R^2=0.37				R=0.72 R^2=0.51				R=0.85 R^2=0.72			

** Highly Significant

Table (7):- Multiple Linear Regression of decayed root surface (DS) explained by certain salivary constituents according to body weight categories.

Salivary constituents	Non-obese (<25 Kg/m$^{2)}$				Obese (≥30 Kg/m^2)			
	ß (slope)	S.E.	t	P-value	ß (slope)	S.E.	t	P-value
Urea	0.0007	0.02	0.03	0.98	-0.06	0.03	-2.16	0.06
Calcium	-0.14	0.13	-1.12	0.29	0.16	0.06	2.70	0.02*
Phosphorous	0.02	0.11	0.21	0.84	0.04	0.07	0.58	0.58
	R=0.41 R^2=0.16				R=0.83 R^2=0.69			

* Significant

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