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Selected salivary antioxidants and gingival health condition among a group of obese females aged 20-22 years in Baghdad, Iraq

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Abstract

Background: Obesity and periodontal disease are diseases of multifactorial etiology closely related to dietary habits and sociodemographic background of the individuals. The aim of this study was the assessment of selected salivary antioxidants and gingival health condition among a group of obese females aged 20-22 years in comparison with normal weight females.

Materials and methods: The study group included 40 obese females, with an age range 20-22 years old. The control group included 40 normal weight females of the same age. Body weight was assessed by using the Body Mass Index (BMI). Collection of unstimulated salivary samples was carried out under standardized conditions. Plaque and gingival indices were used for recording the oral hygiene and gingivitis. Salivary flow rate was measured then salivary samples were analyzed to determine the concentration of salivary antioxidants (total protein and uric acid).

Results: The data analysis of the present study found that the level of salivary total protein was lower among the obese females compared to the normal weight females with statistically highly significant difference ($p<0.01$), while salivary uric acid was statistically highly significantly higher among the obese than the normal weight females ($p<0.01$). Salivary analysis demonstrated that the salivary flow rate was statistically highly significantly higher among the obese females ($p<0.01$).

The mean values of plaque index and gingival index were lower among obese females compared to the normal weight females with statistically highly significant difference for plaque index ($p<0.01$).

Conclusions: The result of this research revealed that salivary antioxidant (uric acid) and salivary flow rate were higher among obese females than normal weight females which may play a role in protection oral tissue from oral diseases in addition to the oral cleanliness effect.

Key words: Obesity, gingival health, salivary antioxidants, salivary flow rate.

Introduction

Obesity is defined as a medical condition characterized by excess fat accumulation that adversely affects the health of individual [(1)]. It is a metabolic disorder in which a body mass index (BMI) $\geq$30 Kg/m^2 [(2)].

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Obesity is a major public health problem in both developed and developing countries and there is a dramatic increase in rates of obesity during the last three decades [3]. Additionally, obesity is a multifactorial disorder, which a result of a joint effect of genetic and environmental factors [4] and it is a risk factor for several chronic diseases, most notably hypertension, type 2diabetes, dyslipidemia and coronary heart disease [5]. It is a well-known fact that reactive oxygen species cause membrane destruction by oxidation of polyunsaturated fatty acids contained in the phospholipids portion of the cell membrane through a process known as lipid peroxidation [6]. The imbalance between the production of free radicals and the ability of the body to neutralize their harmful effects through antioxidants generation is termed oxidative stress [7]. Over-expression of oxidative stress damages cellular structures, leading to the development of obesity-related complications [8] (Marseglia et al, 2015). In addition to that, oxidative stress implicated in the pathogenesis of oral diseases [9].

Several aspects of oral health are related to obesity including periodontal disease. Periodontal diseases are common chronic inflammatory diseases of multifactorial etiology; however, the most common type of periodontal disease that can be seen in population is gingivitis [10]. Gingivitis is inflammatory condition confined to the tissues of the marginal gingiva in the absence of loss of the bony support of teeth [11]. Regarding the effect of obesity on gingival health condition, there is a controversy in relation between gingivitis and obesity, as several studies reported that subjects with higher BMI had more gingival inflammation [12,13], while other studies found an opposite result [14, 15].

Saliva is a biological fluid in oral cavity composed of mixture of secretary products from major and minor salivary glands which essential for oral health through various mechanisms such as salivary flow rate, buffer capacity and defense function through antibacterial factor and salivary antioxidant system [16]. The specific role of antioxidant is to neutralize rampaging free radical and thus reducing its capacity to damage [17]. It was found that the salivary antioxidants inhibit the oxidation reaction and provide protection against reactive oxygen species induced damage of gingival tissues [18]. As far as it is known, there was no previous Iraqi study concerning the relation of selected salivary antioxidants (total protein and uric acid) with gingival health condition among obese adult females, therefore, this study was carried out.

Materials and methods

The sample for this study consisted of all subjects (eighty females) aged 20-22 years at College of Islamic Sciences/Baghdad University. They were divided into two groups: the study group which included forty obese females and the control group which included forty normal weight females. A number of females were excluded from the study due to pregnancy, mensuration, presence of any systemic disease which may affect oral health condition, current use of any drugs or medications which may affect gingival health condition, smoking, use of dietary supplements and wearing fixed or removable dental prostheses. Anthropometric measurements included measurement of weight and height according to Trowbidge [19] using electronic scale and height measuring tape. Body Mass Index (BMI) is a number calculated from person's weight and height,

according to this formula **BMI (Kg/m^2)=Body weight (Kg)/(height)^2 (m)** [20]

Females were chosen for BMI measurements according to World Health Organization [2] which identify the obesity at BMI≥30 kg/m^2 while the normal weight at BMI between 18.5-24.9 Kg/m^2. The collection of unstimulated salivary sample was performed under standardized condition following the instructions cited by Navazesh and Kumar [21]. Plaque index [22] (PII) and gingival index [23] (GI) were used for recording the oral health condition. Salivary flow rate was expressed as milliter per minute (ml/min). Then salivary samples were taken to the laboratory for biochemical analysis at the Poisoning Consultation Center/Gazi Al-Hariry hospital. Salivary antioxidants (total protein and uric acid) were determined calorimetrically using the spectrophotometer (Cecil CE 1011, UK). Salivary total protein was measured using a ready kit (Spinreact, Spain) while salivary uric acid level was measured using a ready kit (Biosystems, Spain) according to the manufactured instructions. Data analysis was conducted by application of SPSS program (SPSS version 18).

Results

Result of the current study revealed that the mean value of salivary total protein was statistically highly significantly lower among the obese than that of the normal weight females (P<0.01), while the mean value of uric acid was statistically highly significantly higher among the obese than that of the normal weight females (P<0.01) as shown in Table 1.

Table 2 showed that the mean value of salivary flow rate was higher among the obese than that of the normal weight females with statistically highly significant difference (P<0.01). Data of present study showed that the mean value of dental plaque and gingival index for the study group was lower than that for the control group with statistically highly significant difference for dental plaque (p<0.01) as shown in Table 3.

The distribution of the sample (study and control groups) according to severity of gingival inflammation is illustrated in Figure 1.The mild type of gingival inflammation was higher in the study group (100%) in comparison with that in the control group (87.50%). On the other hand, the moderate type of gingival inflammations was only found in the control group (12.5%).

Discussion

In the current study, data analysis showed that the concentration of salivary total protein was lower among the obese group than that among the normal weight group. The same result was also reported by other study [24] among overweight females but contradict with other studies among obese children and adults [25, 26]. This could be attributed to the fact that the elevated free radical generation with obesity resulting in higher lipid peroxidation so salivary antioxidants would be exhausted in reaction with the elevated free radicals [27]. Or, it could be explained according to the finding in the control group as the level of salivary protein was higher among the control group compared to the study group and this could be explained by the response of salivary glands to an inflammatory disease (gingivitis) and its severity leading to an increased synthesis and secretion of certain acinar protein to enhance salivary defense mechanisms [28]. This explanation is supported by the result of this study in which moderate type of gingival inflammation was found in the control group only, while the study

group demonstrated the mild type of gingivitis only and further supported by the result of present study in which gingival inflammation was higher among the control group compared to the study group.

The present study found that the level of uric acid was higher among the obese than that among the normal weight females. The same result was also reported by other studies [29, 30]. On the other hand, this result was inconsistent with the result of other study [25]. An elevated level of salivary uric acid among the obese female might be related to the fact that the body raises the level of its antioxidant systems to combat the oxidative damage [31], since uric acid is a powerful and dominant antioxidant in the body [32]. Another explanation for the elevated uric acid concentration in saliva among obese females is that the elevated uric acid is closely associated with fat accumulation [33]. Obese adipose tissue is characterized by active fatty acids synthesis. It is presumed that fatty acids synthesis is closely associated with purine synthesis and uric acid is the final product of purine metabolism, thus, accelerating uric acid production [34]. Salivary flow rate was higher among the obese group compared with the normal weight group with statistically highly significant difference between them. The same result was also reported by other studies [25, 35]. But contradict with findings of other studies [14, 29]. The obese subjects may have a larger salivary gland and this could be the reason for the increase in the salivary flow rate [36].

The result of the present study showed decreased gingival inflammation represented by lower gingival index among the study group. The same result was also reported by previous studies among children and adolescents [14, 15], while an opposite result was reported by other studies [12, 35]. Furthermore, only mild type of gingival inflammation was found among the study group these results could be partially explained by many findings that illustrated by the data of the present study these includes:

1. Higher antioxidant protection as indicated by statistically highly significantly higher salivary uric acid (antioxidant) among obese females in comparison with those in the control group. It was found that antioxidants enhance periodontal health by providing protection against reactive oxygen species that induce damage of periodontal tissue especially gingival hyaluronic acid and proteoglycan [37].
2. Lower level of salivary total protein among obese females in comparison with those in the control group that may lead to decreased amount of dental plaque. This is probably due to the fact that total proteins include several types of protein with different functions that might enhance plaque formation, since certain salivary proteins as mucins promote bacterial adhesion to tooth surface that enhance dental plaque accumulation [38], so, lower salivary protein may result in lower salivary mucins, consequently, when dental plaque decreases, bacteria also decrease in number with a decrease in bacterial toxins leading to decrease in gingival disease [39].
3. Higher salivary flow rate among obese females in comparison with those in the control group which was statistically highly significant and the result can be explained by that the salivary flow rate may play an important role in relation to plaque accumulation since increase of salivary flow rate lead to increase of washing action of saliva as well as protective constituents increased

with increased salivary flow rate so, plaque accumulation decreased [40].

4. Better oral hygiene represented by statistically highly significantly lower plaque accumulation among the obese in comparison with those in the normal weight females reflected better gingival health condition among them. Dental plaque was found to be the primary etiological factor in gingival inflammation [39, 41], this result was also reported by other studies among children and adolescents [14, 15]. On the other hand, it was inconsistent with the result reported by other studies among adults [12, 25]. Furthermore, in this study, it was obvious that obese females had better oral hygiene as well as better external appearance and general cleanliness than those in the control group and this could be explained by the fact that obese individuals are often stigmatized by their peers, which can increase the likelihood of poor self–esteem, depression and the risk of social discrimination [42], consequently, they may be more interested about their general looking and as a part of which, the oral cavity, putting oral hygiene practices at a corner stone on their oral health [43].

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Table 1: The concentration of salivary antioxidants among the obese and normal weight females

Variables	Obese		Normal weight		Statistical test		
	Mean	±SD	Mean	±SD	t-test	P-value	df
Total protein(mg/dl)	503.14	37.54	556.19	32.14	6.79	0.001**	78
Uric acid (mg/dl)	4.26	0.90	3.66	0.67	3.34	0.000**	78

**= Highly significant at P<0.01

Table 2: The salivary flow rate among the obese and normal weight females

Variables	Obese		Normal weight		Statistical test		
	Mean	±SD	Mean	±SD	t-test	P-value	df
SFR (ml/min)	0.38	0.04	0.34	0.05	4.35	0.000**	78

**= Highly significant at P<0.01

Table 3: Plaque and gingival indices among the obese and normal weight females

Variables	Group				Statistical differences		
	Study		Control				
	Mean	± SD	Mean	± SD	t-test	p-value	df
PII	1.04	0.22	1.17	0.17	2.89	0.005**	74.53
GI	0.73	0.16	0.79	0.23	1.49	0.142#	70.22

** = Highly significant at P<0.01 # = Not significant at P>0.05

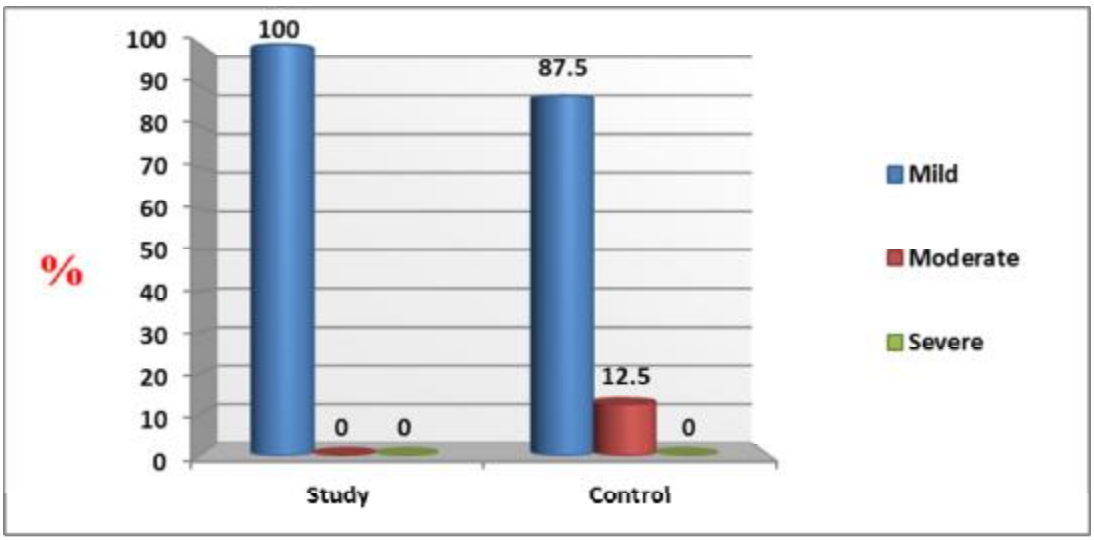

Figure 1: Severity of gingival inflammation among obese and normal weight females