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Original Article

Relationship of salivary adipocytokines, diet quality, physical activity, and nutrition status in adult *Emirati* females in United Arab Emirates

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ABSTRACT

Aims: The United Arab Emirates (UAE) ranks as the fifth most obese country with increasing cardio-metabolic risks. In this paper, relationships of salivary adipocytokines (markers of cardio-metabolic syndrome), diet quality and physical activity in 90 normal-weight, overweight and obese (30 subjects in each group) *Emirati* adult females were investigated.
Methods: A cross-sectional research design was adopted. Anthropometric measurements, diet quality and physical activity questionnaires were administered. Overnight fasting saliva was collected to determine levels of adiponectin, interleukin-10 (IL-10) and tumor necrosis factor-alpha (TNF-α).
Results: Salivary adiponectin was significantly lower, while TNF-α was higher in obese than normal-weight subjects. IL-10 displayed a lower trend in obese subjects. Though diet quality and physical activity did not exhibit significant differences among the three groups, better diet quality and higher physical activity level were reported among normal-weight subjects. Salivary TNF-α correlated positively with body mass index (BMI) ($r = 0.37$; $p < 0.001$) and waist circumference ($r = 0.31$; $p < 0.001$), while adiponectin correlated negatively with BMI ($r = -0.28$; $p < 0.05$). IL-10 showed negative trend in correlation with obesity measures. Correlations were not observed between diet quality and physical activity with salivary adipocytokines. Interestingly, a significant negative correlation emerged between diet quality and neck circumference ($r = -0.24$; $p < 0.05$).
Conclusion: Our findings demonstrate that salivary adipocytokines correlate with obesity measures and can serve as convenient adjunct method in predicting cardio-metabolic risks in the population.

1. Introduction

Obesity has become a major worldwide health problem that leads to high rates of mortality and morbidity. Recent definitions of obesity have highlighted it to be a low grade chronic inflammatory condition leading to the development of metabolic disorders including insulin resistance, type 2 diabetes, and cardiovascular disease [1].

Many lines of evidence indicate that adipose tissue is not only an energy storage tissue, but also an endocrine organ that secretes multiple bioactive mediators, collectively known as adipocytokines. These are closely involved in the regulation of many processes such as energy metabolism, inflammation, diabetes and atherosclerosis [2]. Anti-inflammatory and pro-inflammatory adipocytokines, such as adiponectin, leptin, tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), interleukin-10 (IL-10) and other chemokines are produced by adipose tissues and have been

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shown to be implicated in the pathogenesis of insulin resistance, adipogenesis and inflammation [3]. Dysregulation in the secretion of these adipocytokines, resulting from excessive adiposity and/or adipocyte dysfunction, plays a major role in the development and progression of various cardio-metabolic disorders [1,4]. For instance, decreased serum levels of adiponectin and IL-10, and increased levels of TNF-α, were found to be associated with various metabolic and inflammatory disorders including obesity and metabolic syndrome [4–6].

Over the past decade, many studies have demonstrated that saliva is a potential biological fluid for detection of biomarkers of metabolic and inflammatory conditions [7–10]. Being non-invasive, and easily collected and analyzed, saliva offers several advantages over blood and has proven to be an effective alternative to serum analysis, especially for screening purposes in pediatric and elderly subjects [11,12]. Studies conducted on healthy subjects as well as on subjects with diabetes, cardiovascular disease and metabolic syndrome, have reported close association between serum and salivary levels of many of these adipocytokines [10–14].

In the United Arab Emirates (UAE), obesity has become an important health concern among the native *Emirati* (UAE national) population. The UAE ranks as the fifth most obese country in the world with nearly 75% of the population being either overweight or obese [15]. Various lifestyle factors contribute to obesity and related cardio-metabolic risks. On the one hand, nutrition transition has witnessed the replacement of traditional *Emirati* food with energy-dense fast foods, sugar-sweetened beverages, frequent snacking and low fruits and vegetables consumption [16]. On the other hand, *Emiratis* blame their reduced physical activity on personal, social and environmental factors such as inactive occupations, rare participation in sports and sedentary leisure, hot weather, car-dependence, and restrictive nature of traditional clothing [16,17]. These lifestyle behaviors and conservative society norms are strongly associated with the development of obesity, particularly among females, in the UAE [16,17].

To the best of our knowledge, no studies on salivary adipocytokines and its association with dietary intake and physical activity in obese females from the UAE have been previously reported. Thus, the aim of this study was to investigate the association of selected salivary adipocytokines (adiponectin, TNF-α and IL-10) with diet quality and physical activity among healthy and obese young females from the UAE.

2. Materials and methods

2.1. Study design and setting

A cross-sectional study was conducted at the University of Sharjah (UOS), Sharjah, UAE between February–May 2016. All *Emirati* (UAE Nationals) females (staff and students) from the UOS were invited to participate in this study. A total of 90 subjects comprising 30 each of normal-weight, overweight and obese *Emirati* females aged 18–35 years were selected using the convenience sampling technique. The study protocol and consent forms were approved by the Research and Ethics Committee for the UOS (Ref. No. REC/16/01/13/S). Objectives of the study were explained and written informed consent obtained from the subjects before the data was collected.

2.2. Nutrition status

Physical measurements included stature (standing height) and body weight for assessment of body mass index (BMI), neck (NC) and waist circumferences (WC), and blood pressure. Stature was measured using a stadiometer (Seca Model No. 217) and weight using a weighing scale (Seca Medical Digital Column Model No.703) utilizing standardized techniques with minimum clothing and without the subjects' footwear [18]. BMI was calculated by dividing body weight in kilograms by the square of height in meters. The World Health Organization classification was used to determine the nutrition status. Accordingly, BMI values 18.5–24.9 kg/m^2 indicated a healthy weight (normal-weight), BMI≥25.0 to < 30.0 kg/m^2 was considered as overweight and BMI≥30.0 kg/m^2 as obesity [18].

Circumference measurements were taken using a measuring tape (Seca Model No. 203) and the mean of three readings was considered. Neck circumference was measured at mid-neck height, between mid-cervical spine and mid-anterior neck, to within 1 mm [19]. Waist circumference, a measure of central obesity, was assessed at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest [18]. Blood pressure was measured using a digital automated blood pressure monitor (OMRON®–BP742N, OMRON, Matsuzaka, Mie, Japan) on the right upper arm with the subjects in the sitting position [20].

2.3. Diet quality

A validated questionnaire- MEDFICTS (MF) Dietary Assessment Questionnaire was utilized to determine the diet quality of the subjects. MF is a brief instrument consisting of 8 food categories: meats, eggs, dairy, fried foods, fat in baked goods, convenience foods, fats added at the table, and snacks. The first column of the questionnaire addresses each of these food categories. Within each category, food items are assigned to either group 1 (desirable) or group 2 (undesirable) based upon total fat content. Numeric values are assigned to each food group, with weightings based upon weekly consumption and serving size. The questionnaire is scored using a totaling of the quality-adjusted intake quantity yielding a possible range of scores from 0 to 216 points. The National Cholesterol Education Program recommends MEDFICTS to assess adherence to the Adult Treatment Panel (ATP) III Therapeutic Lifestyle Changes (TLC) diet. Lower MF scores indicate diets containing less dietary fat. Thereby, a score of <40 points is consistent with a Step 2 diet (intake of <7% of energy from saturated fat, <30% of energy from total fat, and <200 mg dietary cholesterol/day), a score between 40 to 69 is consistent with a Step 1 diet, and a score of >70 is considered as high fat diet [21].

2.4. Physical activity

Physical activity was assessed in four domains using the eighth version of the International Physical Activity Questionnaire- IPAQ-long form (work, transportation, housework and leisure-time). A domain-specific activity score was calculated separately for each domain of physical activity (at work, transportation, housework and leisure). In addition, a total physical activity score was calculated as the sum of the number of minutes of total moderate activity for each subdomain (including walking), plus two times the number of minutes of vigorous activity for each subdomain. The domain-specific activity scores were calculated similarly to the total physical activity score. Accordingly, moderate activity was defined as activities performed for at least 10 min that produced an increase in respiration and heart rate, and caused sweating. Vigorous activities were defined as those activities that produced greater increases in respiration, heart rate and sweating. Insufficient physical activity was defined as less than 150 min of combined moderate and vigorous physical activity per week and subjects were categorized as insufficiently physical active. Similarly, subjects who reported ≥150 min of combined moderate and vigorous physical activity per week were considered to be active [22,23]. In this study, the subjects were categorized into “low”