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Correlation of Salivary lipase with Diet and Obesity Indices in Apparently Healthy Young Adults

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ABSTRACT

Obesity, the condition where abnormal or excessive fat accumulates in different parts of the body may impair health. It is commonly assessed using body mass index (BMI). Other indices assessing the distribution of body fat include waist circumference (WC), waist-to-hip ratio (WHR) or waist-to-height ratio (WHTR) also are independently associated with cardiovascular morbidity and mortality. Measurement of body fat and body composition is considered more precise than anthropometric methods and continue to serve as alternate methods of risk assessment. 77 students from medical and allied health science courses were selected. Based on a medical history interview, eligible subjects were those without pre-existing medical conditions, nonsmokers, non-drug users, non-regular consumers of alcohol or energy drinks, not enrolled in weight-reducing programs and without significant body weight fluctuations in the three months preceding the study. Salivary activity exhibited significant inter-individual heterogeneity., the entire subject saliva sample's lipase activity ranged from 28.2 u/l to 902.4 u/l. The scatter plot graph and regression lines for the relationship between enzyme activities and bmi demonstrate that there was a statistically significant ($r = -0.409$., $p<0.001$) moderately negative connection between lipase activity and bmi. A statistically significant correlation between salivary lipase and subcutaneous fat, which had a weak negative correlation ($r = -0.239$., $p=0.040$) and between salivary lipase and visceral fat, which had a moderate negative correlation ($r = -0.382$., $p=0.001$) was also noted. There was a significant negative weak connection ($r = -0.289$., $p=0.012$) between salivary lipase and weight.

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Key Words
Salivary lipase, diet, obesity

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INTRODUCTION

Obesity is on a significant rise worldwide caused by multifaceted factors, ultimately stemming from an imbalance between calorie intake and expenditure[1]. Eating can be driven by metabolic needs, pleasure-seeking impulses, or a combination of both[2]. Nutrient content meets metabolic requirements, while the sensory aspects of food play a crucial role in pleasurable eating, activating reward systems in the brain[3]. Recent research shows that long-chain fatty acid receptors are present on taste bud cells, suggesting that fats may also influence satiety through taste perception[4,5]. There is increasing evidence of the gustatory system in perception of fat as well as in intestinal lipid metabolism and their breakdown in mouth associated with increase craving for fatty food. Excessive consumption of dietary fat contributes to weight gain and obesity, suggesting that fat intake is poorly regulated in the obese state[6,7,8]. Younger individuals who are apparently healthy but, overweight and obese have propensity to develop metabolic syndrome which is a risk factor for development of lifestyle diseases like diabetes mellitus and cardiovascular disease. Saliva significantly affects oral taste and texture perception, along with aroma, by dissolving and dispersing substances to taste receptors[9,10]. Saliva can enhance salty and bitter tastes due to its hypotonicity and proteolytic activity, respectively[11,12]. Human salivary lipase may also play a role in the gustatory system. Having minimal digestive function in adults, recent studies suggest its involvement in fat taste and texture perception. Rats showed a preference for triolein emulsion over the same emulsion with orlistat, a lipase inhibitor and humans exhibited increased fat detection thresholds when orlistat was added to triolein emulsions[8]. Additionally, research indicates that free fatty acids are produced in the mouth during the consumption of high-fat foods, stimulating oral sensors[7,13]. Obesity, commonly assessed using body mass index (BMI) is also assessed using other Indices assessing the distribution of body fat include waist circumference (WC), waist-to-hip ratio (WHR) or waist-to-height ratio (WHtR) which also are independently associated with cardiovascular morbidity and mortality. Measurement of body fat and body composition is considered more precise than anthropometric methods and continue to serve as alternate methods of risk assessment[14]. With this context, this study aimed to examine the relationship between salivary lipase and food preferences among individuals with different nutritional statuses. It was hypothesized that these parameters could influence gustatory responses to dietary fats and sugars, as well as overall taste sensitivity. Saliva samples were collected from subjects and enzyme activity data were analyzed in relation to individual preferences for fatty foods. Measuring salivary lipase which will tell us how much fat is digested in oral cavity and in turn stimulate fat intake can help in determining the possibility of young individuals progressing to lifestyle disorders and detecting them in early stage can help in preventing the development of these disorders.

MATERIALS AND METHODS

Cross sectional, analytical study with 77 students from medical and allied health science courses were selected based on a medical history interview after obtaining institutional ethics committee approval. Eligible subjects included those without any medical conditions (such as hyperlipidemia, gastrointestinal disease, chronic infections, dental issues, or allergies), nonsmokers, non-drug users, non-regular consumers of alcohol or energy drinks, not enrolled in weight-reducing programs and without significant body weight fluctuations in the three months preceding the study.

Data Collection: Voluntary, informed consent was obtained from the participants. Particulars of history of medications, current use of any medications and supplements, physical activity details, exercise, smoking, substance abuse, alcohol intake if any, history of any illness, was collected using a proforma. Data on preference of diet was collected through a pre validated questionnaire available. Anthropometric Measurements like Body Mass Index (BMI), Waist Circumference (WC), Waist-to-hip Ratio (WHR) and Waist-to-height ratio (WHtR) were measured using calibrated scale. Body fat percentage and subcutaneous fat percentage was analyzed using a body composition monitor.

Sample Collection and Spectrophotometric Assays: Whole, unstimulated saliva samples was collected based on the method of Navazesh. The subjects were asked to rinse the mouth thoroughly, and then allow the saliva to drool into a container passively (for about ten minutes) without forcible spitting. The sample were collected between 9 am to 11am with a gap of 30 minutes from the last food intake. Lipase activity in the saliva samples was analyzed by the enzymatic photometric method. After collecting saliva samples, sample tubes were centrifuged at 6500 rpm for 10 min and stored at-80 °C.

Diet Preference Questionnaire: A simplified and slightly adapted version of "The Fat Preference Questionnaire" outlined by Ledikwe *et al.* (2007) was used. This questionnaire consisted of 19 food sets, with each set containing two similar items from diverse food groups, distinguished only by their fat content. Participants were instructed to specify which food (with varying fat content) they preferred in each set on

the basis of which they were given a score out of 19 for the number of high fat alternatives they preferred.

Statistical Analysis: All the quantitative data results were calculated as mean, median (Q1, Q3) and standard deviation. Correlation of lipase activity in saliva with diet preference and obesity indices were analyzed by Spearman's rank correlation coefficient. The data are expressed in terms of percentage and frequency. Scatter plot graphs are given for statistically significant correlations.

Ethics Statement: While conducting this study, guidelines given in the Declaration of Helsinki were adhered to and approval from the institutional ethics committee was obtained for all the procedures involving human subjects. All the subjects participated in this study only after reading and signing an informed consent document.

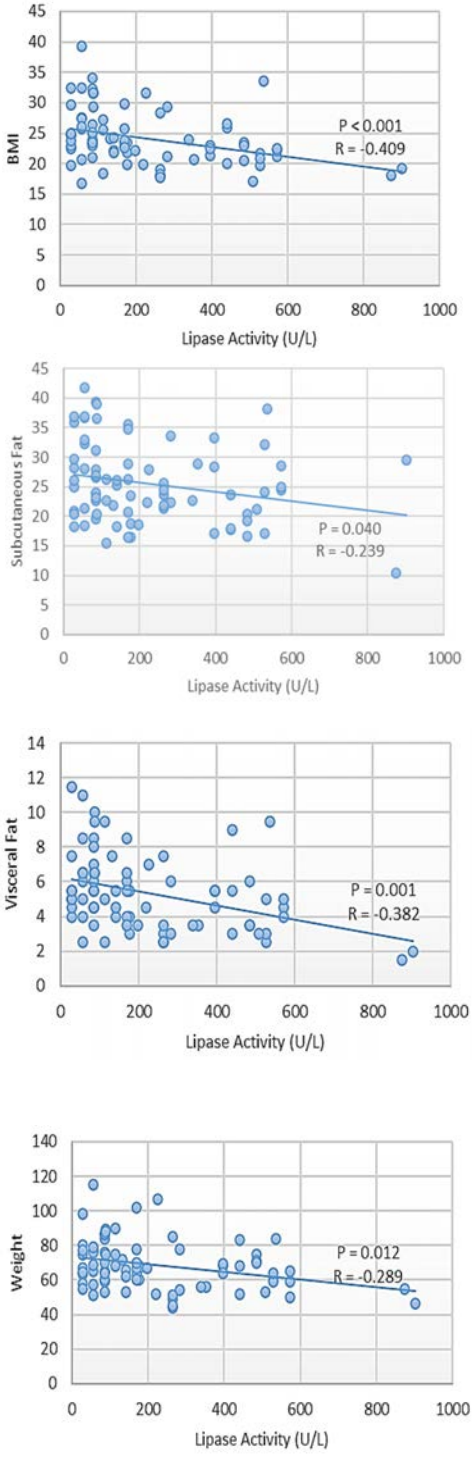
RESULTS AND DISCUSSIONS

Table 1: Data Sheet Showing Mean and Standard Deviation of lipase Activity, Anthropometric Measurements, Subcutaneous and Visceral Fat Percentages and Fat Food Preference of the Entire Sample Size

	Mean	Standard deviation (±)
Lipase activity (U/L)	227.91	201.55
BMI	24.161	4.52
Subcutaneous fat	25.521	6.71
Visceral fat	5.321	2.19
Fat food preference score (out of 19)	13.67	2.40
Weight	68.36	14.30

Anthropometric Measurements, Body fat Percentages and Salivary lipase Activity: Salivary activity exhibited significant inter-individual heterogeneity., the entire subject saliva sample's lipase activity ranged from 28.2 U/L to 902.4 U/L. The scatter plot graph and regression lines for the relationship between enzyme activities and BMI (Fig. 1, panel A) demonstrate that there was a statistically significant (r=-0.409., p<0.001) moderately negative connection between lipase activity and BMI. The scatter plot graphs (Fig. 1, panel B and panel C, respectively) also revealed a statistically significant correlation between salivary lipase and subcutaneous fat, which had a weak negative correlation (r=-0.239., p=0.040) and between salivary lipase and visceral fat, which had a moderate negative correlation (r=-0.382., p=0.001). The scatter plot graph (Fig. 1, panel D) indicates a significant negative weak connection (r=-0.289., p=0.012) between salivary lipase and weight. For men, the median (Q1, Q3) lipase activity values were 141 (84,396) and for women, 169 (56,396). Age and lipase activity were shown to have a weakly negative connection that was not statistically significant (r=-0.012., p=0.921). Lipase activity and height were shown to have a weakly positive connection that was not statistically significant (r=0.053., p=0.655). Additionally, a weak negative association (r=-0.170., p=0.148) was seen between lipase activity and resting metabolic rate., this correlation was not statistically significant. Waist circumference and lipase activity were shown to have a weakly negative connection that was not statistically significant (r=-0.076., p=0.525). [Since p>0.05, not statistically significant].

Fat Food Preference and Salivary lipase Activity: A weak non-significant positive correlation was there between salivary lipase activity and fat food preference score (r=0.085., p=0.471) as shown in the scatter plot graph (Fig. 1, panel E)



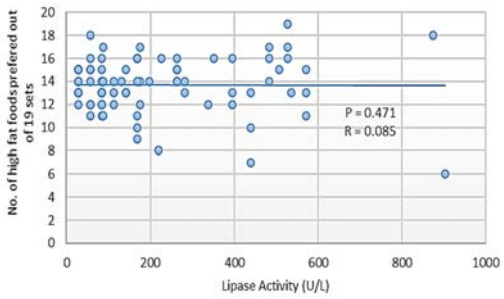


Fig 1: Scatter Plot Graphs between A-Lipase activity and BMI., B-Lipase activity and subcutaneous fat percentages., C-Lipase activity and visceral fat percentages., D-Lipase activity and weight of individuals., E-Lipase activity and Fat food preference score (out of 19)

Studies in the literature have shown that salivary lipase activity varies widely in the general population. There is still a lack of understanding regarding salivary lipase's function and individual variations[15]. The purpose of this study was to confirm any potential associations between dietary practices, food preferences and individual salivary enzyme activity and it there were any correlation of these with obesity indices and an individual's predisposition to become obese in the future and if salivary lipase can be used as a diagnostic parameter to detect obesity non-invasively[16]. The study examined the diversity of salivary enzyme activity in 77 individuals who were in good health and did not smoke. Their BMI ranged from 16.7 kg/m2 to 39.3 kg/m2. Salivary lipase activity varied inversely with weight showing lower levels in overweight subjects than in normal weight subjects, according to data from a more thorough investigation on dietary difference between overweight and normal weight persons. The amount of fat in a person's regular diet, their liking for and frequency of consuming high-fat foods and their BMI were all substantially connected with lipase activity. The data were highly relevant since they demonstrated that salivary lipase in overweight people might release twice as much free fatty acids as in normal weight subjects. These results were consistent with behavioral research on humans showing a relationship between a liking for high-fat foods and increased fat intake and with studies on animals showing a high-fat diet can raise salivary enzyme activity[17,18]. Unfortunately, because overweight participants consumed more of all macro nutrients, it was not possible to determine if dietary fats had a unique function in adjusting lipase activity level. In this study it was seen that salivary lipase activity had a moderate correlation with BMI showing that salivary lipase activity decreased with increasing BMI of the subjects which is in contrast to the previous literature reviews. Even though a significant correlation was found between salivary lipase and BMI, only a weak correlation with height signifying that the weight of the individual was ultimately correlated with lipase levels in saliva. To confirm this a significant correlation was found between salivary lipase and weight[18]. Data of this study only weakly supported the hypothesis that the preference for high fat foods in subjects with high BMI is due to their low fat taste perception. In other words, overweight preferred and consumed high-fat foods more frequently than normal weight because they could not perceive the fat taste in low fat foods thus attributing them a low hedonic value. The reasons for such contrasting findings in this study and previous studies could be that the subjects were choosing their food preference on their conscience of what should be right for them rather how they choose instinctively when in the moment of decision., a consequence of conscious bias. Contrastingly it was also seen that sometimes subjects with higher BMI were choosing low fat options and those with lower BMI choosing high fat options. Another reason could also be that people are usually disregarding of a food being high fat or low fat and thereby they make this decision relatively occasionally only[18]. The idea that people with high BMI prefer high-fat foods because they perceive low-fat food to taste better was validated by data from a recent study. Put another way, overweight gave low-fat foods a poor hedonic value because they were unable to detect the fat taste in them, hence they preferred and ate high-fat items more frequently than normal weight. It should be noted, nevertheless, that the majority of the 77 volunteers in this study were normal weight, with a small minority being overweight. As a result, the association between fat food preference and physiological significance was likely minimal within this narrow range[16,18]. Salivary lipase activity also had a moderate correlation with visceral fat and weak correlation with subcutaneous fat percentages which goes to show there might be a link between adipose tissue deposits and lipase enzyme activity in saliva. Moreover the spectrometric method used for this study is known to be very sensitive and other methods of saliva samples assay like ELISA might give more accurate results. Salivary lipase levels may be influenced by variables other than genetics, such as psychological stress, inflammatory conditions, or certain metabolic pathways. This could account for the few values that are non-characteristically high and as there was not much variability among the subjects, it could also lead to biased results. This theory should be confirmed by future research combining neuro-endocrinology, biochemistry and behavioral techniques.

CONCLUSION

In conclusion, this study showed that salivary lipase activity is higher in individuals with lower BMI than in those with higher BMI. This may have an impact on the

frequency and taste preference for high-fat foods in overweight people, who require a greater quantity of fatty foods to make up for their poor oral fat sensitivity. Future research is required to evaluate salivary lipase activity in the obese population and to offer more proof of the interaction between eating habits, salivary lipase activity and overweight/obesity. Salivary lipase activity could serve as non-invasive and reliable marker for screening, diagnosis of young adults progressing to obesity as people with higher BMI have significantly low salivary lipase activity levels. Correlation of salivary lipase activity with obesity indices could go a long way in establishing it as potential diagnostic marker of metabolic syndrome.

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