Age Related Changes of Submandibular Salivary Glands (Ultrasonographic and Structural Study)

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Abstract

Back ground :- The present study introduced the age changes in the parameters of the submandibular salivary glands (SMSGs) of twenty-four volunteers subjects.

Aims: ultrasonographical and structural age changes study of sub mandibular salivary glands in living human and cadavers.

Materials and methods: the study considered ; twenty four volunteers and sixteen male cadavers. The cadaver's weighed and grouped according to ages; G (A) 20-25 years, (B) 30-35 years, (C); 45-50 years, and group (D) 60-70 years. The same grouping manner applied to the ultrasonographic study. Cadavers with diseased history of the (SMSGs), or maxillofacial trauma were excluded.

Results; The histological findings revealed that there was; a decrease in the number of serous demilunes, but an increase in the diameter of both serous and mucous acini with, proportional increases of the serous acini, and an increase in the diameter of striated ducts during the increase of age. The thickness of the interlobular connective tissue were increased with advancing age, as well as the number of adipose cells.

Conclusion; The sonographic, and gross anatomical parameters showed little but no significant changes during the ages considered in this experimentation, so for the weight and dimensions of the glands.

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Introduction

The submandibular gland participates as a major salivary secreting gland and have important anatomical position in relation to vital structures such as facial artery, submandibular lymph nodes, its duct related to the hypoglossal and lingual nerves.

The salivary glands have high incidence to be affected by certain types of pathological conditions in which a ratio of 10:1 or 8:1 of cases with salivary calculi are affected in the submandibular gland [1].

Many studies and mostly that introduced; histochemical analysis of the submandibular gland were advanced to be applied on experimental animals, and they found that the glands like many other organs may shows changes with age [2]. The present study aims to study and to investigate the age related changes of the submandibular salivary glands anatomically as a cadaveric study,

ultrasonographic, and the structural age changes of the glands in human being.

Material & methods

Twenty-four male healthy volunteers, at age 20-70 years introduced in this study for examining their right and left submandibular glands ultrasonographically (Siemens / Sonoline versa pro/with small part probe 7.5 Mhz.). Subjects with history of renal failure and thyroid disturbances were not included in this study [3]. The submandibular glands have been well-defined for their three dimensions (Figure 1; A &B).

Design of the study:

the study introduced sixteen male cadavers, at age 20-70 years; in the period from august 2003 until September 2004 at the Department of Forensic Medicine / Tikrit Teaching Hospital / Salahaldin Province. In this study, the cadavers that showed maxillofacial injuries or history of, kidney failure, and hypothyroidism were excluded from the study [3]. The ages of the cadavers obtained from the individual's identity card and the accompanied official papers. The cadavers were divided into four age groups; each of four cadavers; at following ages Group (A): 20-25 years, (B); 30-35 years, (C):45-50 years, and Group (D): 60-70 years.

The cadavers were dissected, bilaterally, at the submandibular region, an incision was made from (1 cm) behind symphysis menti of the mandible to (1 cm) behind the angle of the mandible, then (1 cm) upward beneath the auricle [4], the length of the incision was (8 cm), (Figures 2). The skin was reflected and subcutaneous tissues were removed, the submandibular glands and their main duct was explored in site, and examined to recognize; length and width, then the glands were removed, weighed using (Mettler A E 200) electronic balance, there after each specimen was cut with a blade into small pieces (5mm in dimentions), fixed in 10% neutral buffered formaldehyde for 24 hours.

Tissues Sectioning:

Tissue washed, dehydrated, and then embedded in paraffin blocks. Serial sectioned were made longitudinally at 4-6μm thickness using Cambridge rotary microtome. The processing continued then stained by haematoxylin and eosin stains [5], the morphological and histometric measurement were done including; twenty microscopic fields; in order to estimate the number and types of acini, striated ducts, intercalated ducts, and adipose cells. The standard counting or measuring unit for counting were expressed per microscopic field; twenty observations were made, and were examined by (40X) objective.

A calibrated stage micrometer type (Leitz), which consists of (100) minute lines, each line is equal to (10 μ), a calibrated ocular micrometer type (Reichert) and a light microscope type (Meiji) were used.

A superimposition between the calibrated ocular micrometer and calibrated stage micrometer were performed [6].

Statistical analysis:

For age related trends, results were analyzed statistically using regression analysis procedure. Differences between the means of different age groups were also examined using analysis of variance. In order to find the relationship between age and the different variables, correlation analysis were used for this purpose. These statistical tests were prepared using Statistical program under Microsoft Excel XP.

Results:

The ultrasonographic three dimensional measurements; & standard deviation, the means of; body weight, and height of the (SMSGs) [7], were estimated (Table 1), and collectively had an alternative changes, so the result appeared to have no statically significant changes in the size of the gland with the four age groups (Figure 3).

The structural finding showed that mixed population of both serous and mucous acini, the mucus acini of the gland in group (A) [F igure 4-5], distributed in groups each of (12-15), rather than occasional completely lobules of serous acini. The adipose cells are few and scattered (1-2 cells) in the parenchyma; not as groups and the connective tissue septa was thin and devoid of adipose cells. The mean of the diameters of the intercalated ducts was (18 μ).

The connective tissue septa in group (B) are slightly thicker than group (A), which is composed of connective tissue cells rather than adipose cells. The main ducts were lined by stratified columnar epithelium [Figure 6].

The more constituent of the glands in group (C) were serous acini, the mucous acini are little in comparison with group (A), and (B), and they were founded in groups of (4-6) acini. Groups of many adipose cells diffused in the parenchyma, and the mean diameter of the intercalated ducts were (25.5μ). The connective tissue septa formed mainly of adipose cells rather than connective tissue cells(Fig.7).

The majority of the acini of the glands in group (D) were serous type (Fig.8). The diameter of the intercalated ducts was (24μ). The interlobular connective tissue were mostly formed of adipose cells.
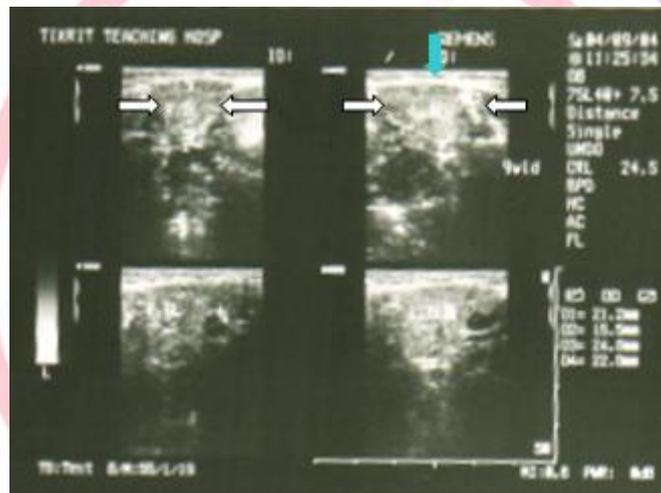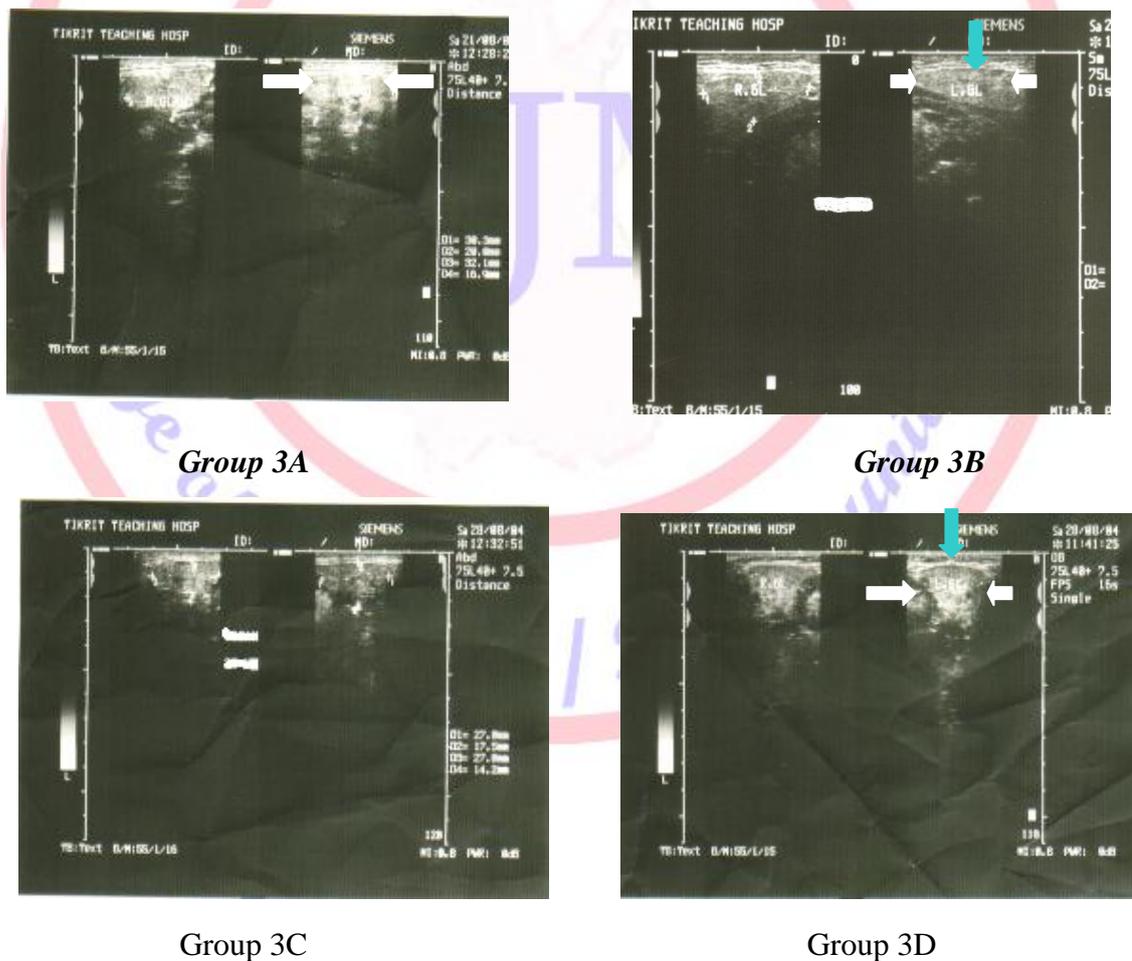

A

B

Fig.1- The ultrasonographic picture of the SMGs (The white dots and white arrows show the gland borders and blue arrows point on the lower border of the mandible).
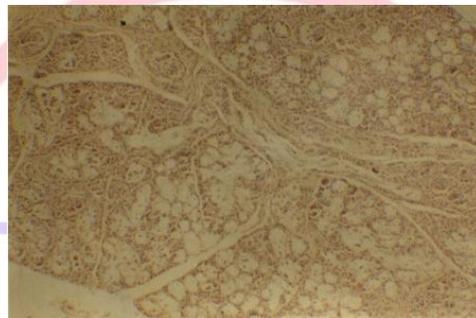

Fig.2- skin Incision to obtaining the SMG


Group 3A

Group 3B

Group 3C

Group 3D

Figure 3 - Ultrasonic images of the gland in different age groups (Note the white dots and white arrows for borders of the gland, blue arrows point on lower border of the mandible)
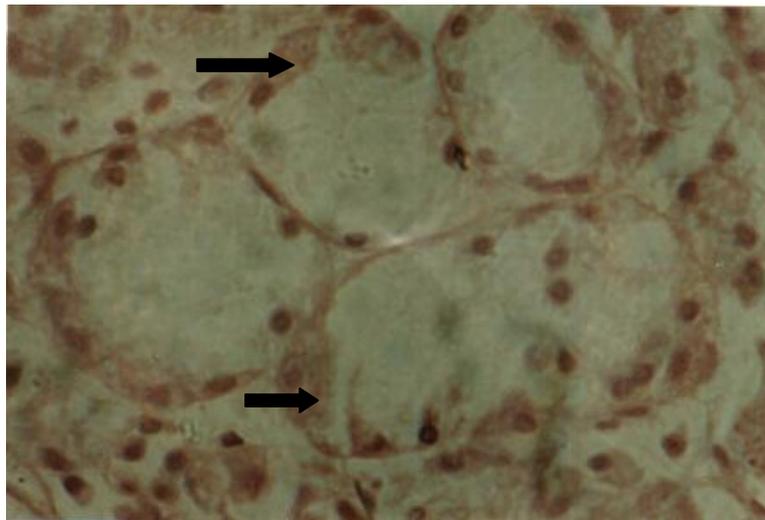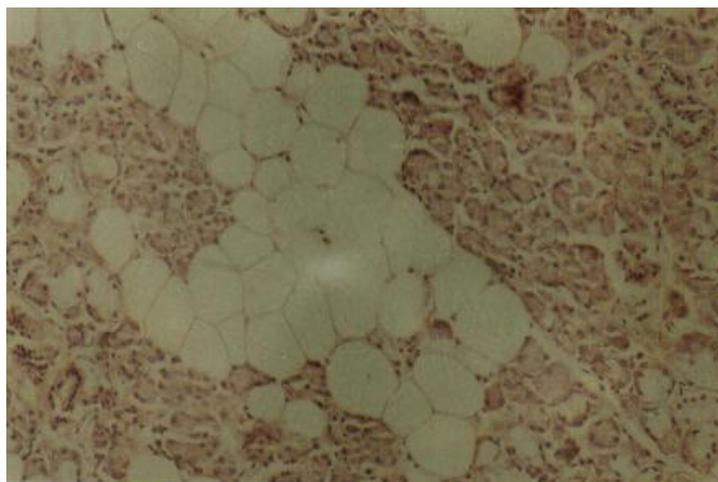
**Figure .4 Group A:** serous demilunes, pointed by black arrow (400x)

Figure.5 Group A: A lobule completely formed of mucous acini, and the inter lobular connective tissue devoid of adipose cells. (40x)
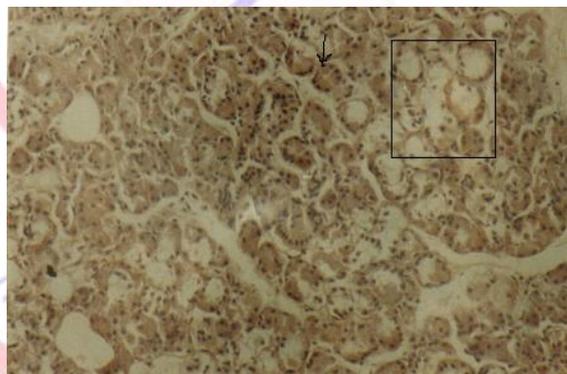
Figure .6 Group B: Group B: Parenchyma (Note the group of mucous acini inside the square and the black arrow pointing on striated duct). (100x)

Figure .7- Group C: diffusion of adipose cells in the parenchyma .100x
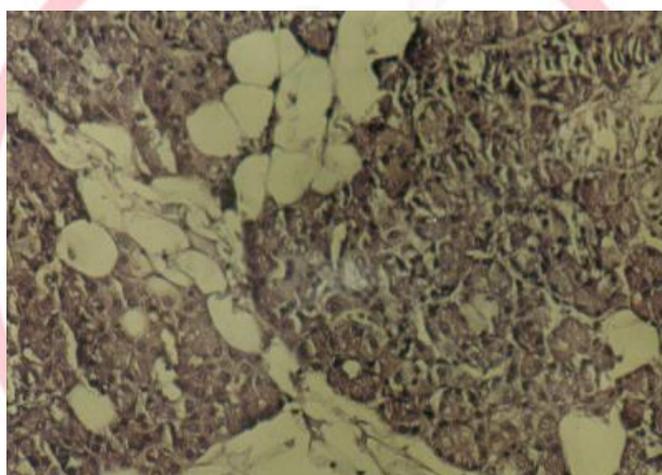
Figure.8 - Group D: Diffusion of the adipose cells in the parenchyma and interlobular

tissue. (100x)

Table 1: Means of; age, body weight, height, & standard deviation of ultrasonic
measurements of the (SMGs) (Dost study) [8]

Group	Age (years)	Body weight (kg)	Body height (cm)	Antero-posterior (mm)	Superio-inferior (mm)	Latero-medial (mm)
A	21.8	74.5	170.3	29.48±6.09	17.47±2.26	22.49±4.22
B	32.3	74	170.5	30.02±5.82	16.94±1.85	22.35±2.61
C	47	76.1	172.8	29.07±3.78	15.45±3.16	26.92±3.33
D	65.5	76	171	28.97±3.31	15.89±2.99	27.1±5.36

chart 1; Means number of serous and mucous acini
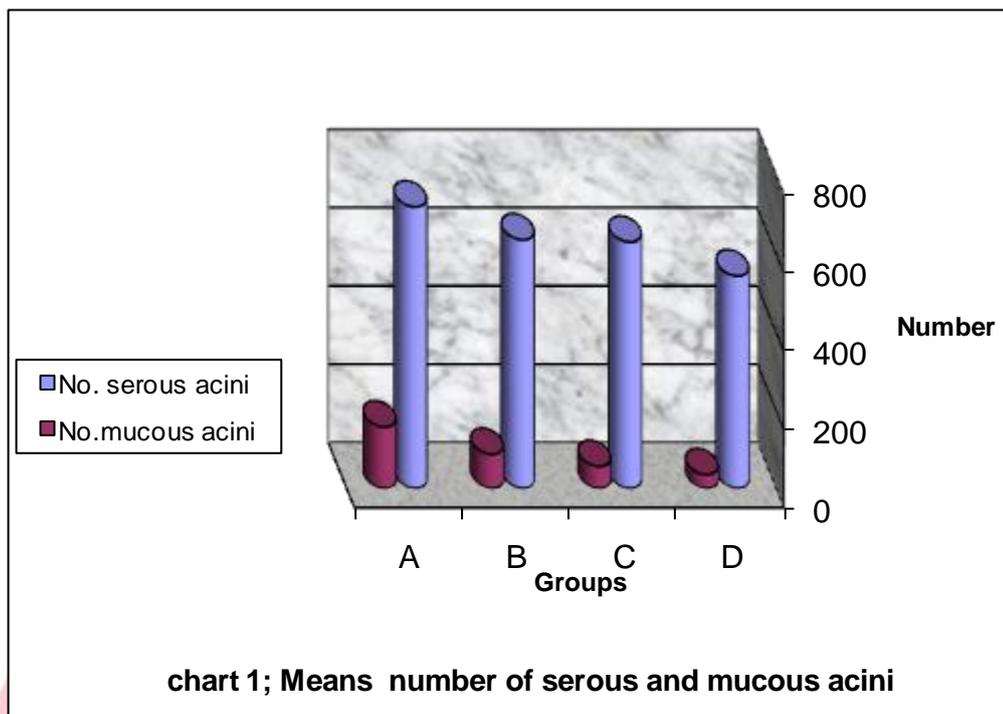
Table (2): Correlation between histological parameters and age.

	Age	No. serous acini	No. Mucous acini	Diameter of Serous acini	Diameter of Mucous acini	Diameter of Striated duct	No. Adipose cells	No. Serous demilunes
Age	1	-0.69	-0.84	0.76	0.48	0.44	0.9	-0.77

Discussion

It can be decides from the above mentioned results that there was an increases in the proportion of serous acini at the expanses of the mucous type in the (SMSGs) with increasing of the age; and accompanied by marked increases in the distribution of adipose cells in the lobules and accompanying the increases of the connective tissue in the interlobular space's. Such findings are in agreements with previous study, that obtained by Baum [8] who stated that both the parotid and the submandibular salivary glands lose between 20-30% of their essential tissue, from above an explanation for the decrease in the number of serous and mucous acini (atrophy in the parenchyma) due to aging. Such results is also in agreement with Scott [2], Dong [9], Komesu et al [10], and Sashima et al [11].

Despite the atrophy in the parenchyma, and from the previous observations of the loss of physiological reserve of most of organs which are well accepted phenomenon of aging, an obvious increase in the diameter of both the serous and mucous acini has been shown in this study, however this difference was statistically not significant, but the

human submandibular gland retains what may be termed a reverse secretory capacity [12].

Metabolic states may also affect the salivary glands, they can have their size increased through a variety of metabolic states: such as starvation, protein deficiency, and hepatic disease [13] [14].

The same is true concerning the increase in the means of the diameter of the striated ducts and the observed intercalated ducts, both are explained according to the reserve secretory capacity since both ducts are incorporated in the process of salivary secretion and absorption, participation of ions, and the cells of the intercalated ducts are capable of proliferation and division into other components to compensate the reduction in the activity of the other components in the elderly subjects [15]. This observation agrees also with Slavin [16], who stated that there is an increase in the ductal diameter with aging.

The increase in adipose tissue by aging may be attributed to the reduction in the hormone Testosterone which associated with aging[5, 17].

Conclusion:

From the results of the present study, it can be concluded that:

1. Aging has no effect on gland dimensions (anteropostrior, superioinferior, and lateromedial), in which there is decrease in both (A-P, S-I) dimensions and are replaced or alternated by increase in (L-M) dimension.
2. With aging there will be atrophy of the parenchyma, increase in; proportional number of serous acini; diameter of both serous and mucous acini; diameter of striated ducts, and in the thickness of both interlobular and interstitial connective tissue.
3. Aging increases the diffusion of adipose cells in the gland parenchyma.

Recommendations

Further studies are recommended as follows:
1- Increasing the interval of sample to include other age groups such as: adolescence and childhood and to compare with other adult and old age groups.
2- Using MRI examination as a new diagnostic imaging for more details of the gland and effect of age on it.

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