COMPARATIVE STUDY OF THE REACTION OF THE SUBMANDIBULAR SALIVARY GLANDS TO AMPUTATION OF THE LOWER INCISORS IN MALE AND FEMALE RATS

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The submandibular salivary gland of noninbred albino rats responds to repeated amputation of the lower incisors by hypertrophy, mainly on account of an increase in size of the structural components of the organ, and to a lesser degree through proliferation. The degree of hypertrophy of gland is much higher in females than in males after the same number of amputations.

Repeated amputation of the lower incisors in rats is known to produce hypertrophy of the submandibular salivary glands [1, 3-10]. Although this phenomenon has been studied in detail by physiologists, it has received insufficient attention from morphologists.

An investigation was accordingly undertaken to determine the structural changes which accompany hypertrophy of the salivary glands after this procedure and to examine any sex differences in its intensity.

EXPERIMENTAL METHOD

Noninbred albino rats (99 males and 53 females) weighing 160-250 g were used in the experiments. Structural changes in the salivary gland of males and females were studied at the height of hypertrophy (after five and six amputations of both incisors). The lower incisors were amputated under ether anesthesia

TABLE 1. Changes in Weight of Submandibular Salivary Glands and in Size of Their Structural Units in Rats after Amputations of Lower Incisors (at the height of hypertrophy)

Index studied	Males			Females		
	control	experiment	increase in %	control	experiment	increase in %
Absolute wt. of one gland (in mg) after 5 amputations in both lower incisors	218,0	305,0	39,9	170,5	297,5	74,5
P		< 0,01			< 0,01	
Size of one acinus	4,5±0,1	7,6±0,5	68,9	4,6±0,3	12,9±0,2	180,4
P		< 0,01			< 0,01	
Size of 1 convoluted duct in transverse section	7,6±0,6	8,3±0,6	9,2	9,1±0,3	11,5±0,6	26,4
P		0,38			< 0,01	
Size of 1 acinar nucleus	16,8±0,3	31,0±1,6	84,5	23,3±0,4	37,8±1,8	62,2
P		< 0,01			< 0,01	
Number of nuclei per acinus	6,27±0,13	7,34±0,12	17,0	6,65±0,30	8,93±0,22	34,3
P		< 0,01			< 0,01	

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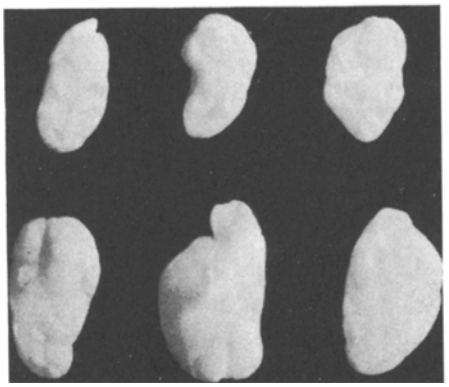

Fig. 1

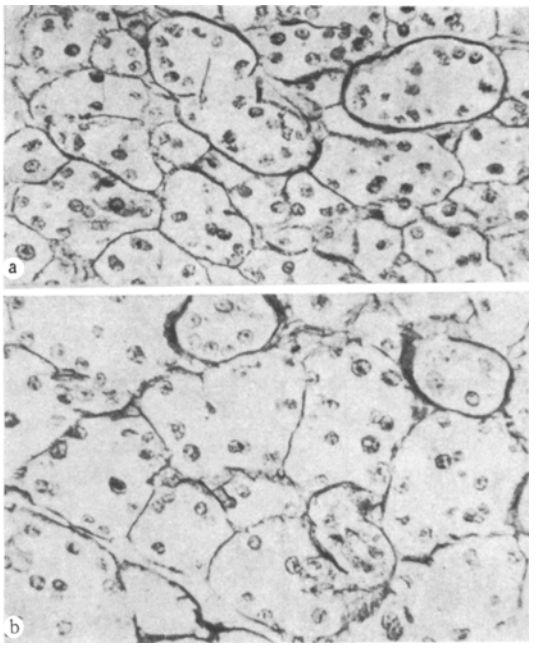

Fig. 2

Fig. 1. Submandibular salivary glands of control female rats (top row) and of female rats undergoing five consecutive amputations of both lower incisors (bottom row).

Fig. 2. Structure of submandibular salivary gland of female rats: a) control rat; b) experimental rat. Hypertrophy of acini can be seen (after sixth amputation of both lower incisors). Silver impregnation by Gomori's method, 400×.

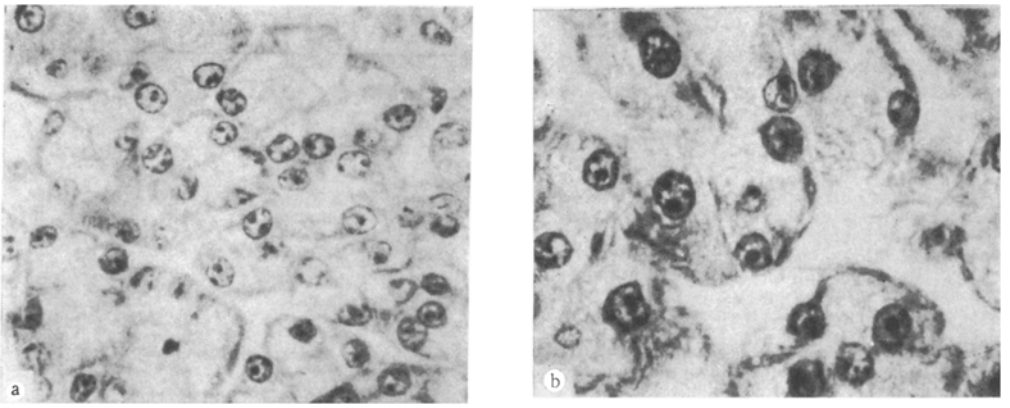

Fig. 3. Section through submandibular salivary gland of female rats: a) control rat; b) experimental rat. Hypertrophy of cells and nuclei after sixth amputation of both lower incisors can be seen. Hemotoxylin-eosin, 900 ×.

at the level of the gingival border and it included injury to the pulp of the teeth. The intervals between amputations were 2-3 days. The glands were weighed and the results expressed as percentages of the weight of one gland of a control animal. The area of the structural units of the gland was determined by a gravimetric method and expressed in conventional units, as described previously [2]. The number of nuclei per acinus was counted in 100 acini of the same gland of each animal under the MBI-3 binocular microscope (objective 60, ocular 7). The numerical data were subjected to statistical analysis by the Fisher–Student method.

EXPERIMENTAL RESULTS

As the results in Table 1 show, after the fifth amputation of both lower incisors, hypertrophy of the submandibular glands in the female rats (Fig. 1) was much more marked than in males after the same number of amputations. The increase in weight of the enlarged gland, for instance, was 74.5% in the females and 39.9% in the males ($P < 0.01$).

The sixth amputation of both lower incisors gave an even greater increase in size of the submandibular salivary gland in the females, viz. by 89.2% ($P < 0.01$).

Histological and morphometric analyses showed that hypertrophy of the submandibular salivary glands in response to amputation of the lower incisors is accompanied by an increase in size of the acini (Fig. 2), on account of hypertrophy of the cells (Fig. 3). Under these circumstances an increase in the size of the nuclei and in their number per acinus was observed. The convoluted ducts were appreciably enlarged only in females ($P < 0.01$). As Table 1 shows, the size of a single acinus in the males was increased by 68.9%, but in the females by 180.4% ($P < 0.01$). The difference was evidently due to the greater increase in weight of the submandibular salivary glands in the females.

Hypertrophy of the nuclei of the acinar tissue differed in degree in the males and females. No evidence of cell division could be detected but proliferation evidently also occurred because the mean number of nuclei per section of one acinus was significantly increased.

It thus follows from these results that the degree of hypertrophy of the submandibular salivary gland is greater in females than in males after the same number of amputations. Hypertrophy of the gland in animals of both sexes takes place mainly through an increase in size of the structural components of the organ and to a lesser degree through proliferation.

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