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THE EFFECT OF SALIVARY GLANDS EXTIRPATION, DUCT LIGATION, AND THYROXINE ADMINISTRATION UPON BODY WEIGHT IN RATS

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ABSTRACT: Forty-eight male albino rats, 15 days old, were used to study the effect of salivary glands surgery (extirpation and duct ligation) and thyroxine administration upon body weight gain. They were divided into six groups of eight animals each: Control, Thyroxine; Duct Ligated; Salivariadenectomized; Duct Ligated + Thyroxine; Salivariadenectomized + Thyroxine. The results obtained in this experiment demonstrated that salivary gland possibly have a biological factor that seems to participate endocrinally upon body weight gain in rats. The salivariadenectomy and duct ligation promote a decrease of body weight gain (at least till the age of 39 days or 24 days after surgery). The daily injection of thyroxine in the dosage of 0.5 mcg by intraperitoneal way does not correct alteration of body weight gain in both salivariadenectomized and duct ligated animals and does note increase body weight gain in intact animals.

KEY-WORDS: Salivary gland; thyroxine; body weight.

INTRODUCTION

The major salivary glands, structurally divided into mucous, seromucous and mixed glands, besides their primordial function of salivary secretion, seem to participate in the endocrine control of the organism. After the isolation by OGATA *et alii*[13] and the cristalization by ITO & MIZUTAMI[10] of a protein extracted from the bovine parotid gland, the "Parotin", the interest and the number of reports about the salivary gland and its biological activity concerning endocrine action, increased considerably.

From the endocrinous aspect, interactions between salivary and thyroid glands seem to exist; it was observed that the salivary glands take place in the thyroid activity control[6,20,21]. WELLS & MUNSON[22] found that the thyroxine had a hypertrophic action upon the submandibular gland. Otherwise, RUEGAMER[16] concluded that the salivary gland had no active role in thyroid metabolism.

The surgical removing and duct ligation of the salivary glands have demonstrated to provoke alterations on the experimental animal body weight. BLECHMAN & BARTELS[4] observed that the gain of body weight in sialoadenectomized animals was significantly minor than in the normal ones. It was also observed that the submandibular gland extirpation as well as the ligation of its duct modify the ponderal growth when compared with the control group and this is not dependent upon the type of diet and amount of food eaten[1,2,12,15].

Motivated by the interaction between salivary and thyroid glands and corporal weight, we intended to study the correlations between the salivary gland extirpation, either by surgery or duct ligation, and administration of thyroxine with the gain of body weight in rats.

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MATERIAL AND METHODS

Forty-eight newborn male albino rats were used. For better accuracy in the age determination we certified not only the day of birth, but the period of the day which the rat was born. For this purpose the 24 hours of the day were divided into three periods of eight hours each and the observation was made at 6:00 a.m., 2:00 p.m., and 10:00 p.m. One day after birth, the quantity of young per dam was standardized in eight rats.

They were then divided into six groups of eight animals each, as follows: Control animals; Thyroxine injected animals; Ligated duct animals; Ligated duct and Thyroxine injected animals; Sialoadenectomized animals; Sialoadenectomized and Thyroxine injected animals.

On the 15th day of life, the last two groups of rats were submitted to sialoadenectomy according to the technique of CHEYNE[5] modified by RULLI[17]. Two other groups were submitted to duct ligation according to the technique of STANDISH & SHAFER[18].

From the 15th day of life on, thyroxine* was administered intraperitoneally every other four days, beginning on the 15th day of life.

All the rats were weaned at 30 days and were then fed in granulated ration** and water "ad libitum". They were killed at 39 days. The results were submitted to the analysis of variance and the test of Tukey, at a significant level of 5%.

RESULTS

The various corporal weights are set in tables and graphics. We could see that only in the thyroxine injected group there was a slight increase of weight when compared to the control group (Graphic 1). In the salivariadenectomized and duct ligated groups, being or not thyroxine-injected, there was a decrease in corporal weight gain (Tables 1 and 2).

When the data from the two duct ligated groups were compared to the data from the two salivariadenectomized groups, there was a tendency for a lesser body weight gain in these last groups (Tables 1 and 2; Graphics 2 and 3). The statistical relation between all the groups is shown in Tables 2 and 3 and Graphic 4.

DISCUSSION

The possibility of action of the salivary glands on the endocrinal control of corporal weight gain, by the production of hormone or an active biological factor, is supported in this research. The salivariadenectomized and duct ligated animals show lesser gain of body weight (statistically significant) when compared to the controls. This picture is not improved when thyroxine is administered; conversely, there is a tendency to greater emaciation in operated plus thyroxine-injected rats.

The difficulty for food ingestion or digestion by the absence of saliva has been the reason for a decrease of body weight gain[3,7,9,19], but in some experiments in which the consumption of food is controlled, i.e., the same amount for normal as for salivariadenectomized rats, the diminution of body weight gain was greater in those whose glands were removed[4,14].

The sialoadenectomy effect upon the corporal weight in this paper is in agreement with the data of several papers[1,2,4,8,11,12,14,15]. Besides, NARASIMHAN & GANLA[12] found a greater loss of weight in salivariadenectomized animals than in duct ligated ones.

CONCLUSIONS

Based on our experiment about the salivary glands extirpation or their ducts ligation, in 15 days old male rats, with or without tyroxine daily injetion, we may conclude that:

1. The sialoadenectomy and duct-ligation cause decrease in the corporal weight gain until the rats are 39 days old, or 24 days after the operation, at least.

2. The thyroxine daily injection, in the dosage of 0.5 mcg/Kg of weight does not correct the body weight gain of the sialoadenectomized and duct ligated animals and does not increase the weight gain in normal animals.

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TABLE 1 — Mean Body weight (grams) concerning each group of rat in weighing intervals.

Groups \ weighing intervals	15 days	19 days	23 days	27 days	31 days	34 days	39 days
Control	28.20	36.15	45.85	58.62	68.96	81.96	97.93
Thyroxine	22.06	33.10	43.07	57.62	72.88	90.72	103.82
Ligated Duct	29.72	24.97	30.76	37.12	47.93	62.33	71.83
Ligated Duct + Thyroxine	24.63	21.91	27.18	37.27	46.86	61.26	75.32
Sialoadenectomized	25.25	20.82	26.00	34.67	45.12	59.07	67.17
Sialoadenectomized + Thyroxine	24.10	20.27	21.81	29.22	38.68	48.01	58.91

TABLE 2 — Body weight.

	Control	Thyroxine	Ligated Duct	Ligated Duct + Thyroxine	Sialoadenecto-mized	Sialoadenecto-mized + Thyroxine
	53.82	67.18	48.94	41.10	40.20	33.17
	59.81	64.52	48.54	40.51	27.61	33.60
	57.64	64.10	48.65	38.87	36.78	40.54
	59.85	55.22	34.18	42.61	32.40	31.67
	69.33	56.92	44.51	62.51	38.75	37.94
	62.70	54.71	52.15	41.78	41.07	41.10
	59.32	68.01	36.82	37.62	46.21	27.00
	54.80	56.21	34.34	31.50	50.42	30.42
S x	477.27	486.87	348.13	336.50	313.44	275.44
$S x^2$	28638.062	29862.036	15522.061	14717.342	12646.728	9658.7194
$(S x)^2$	227786.65	237042.39	121194.49	113232.25	98244.633	75867.193
Average X	59.65875	60.85875	43.51625	42.0625	39.18	34.43

TABLE 3 — Body weight.

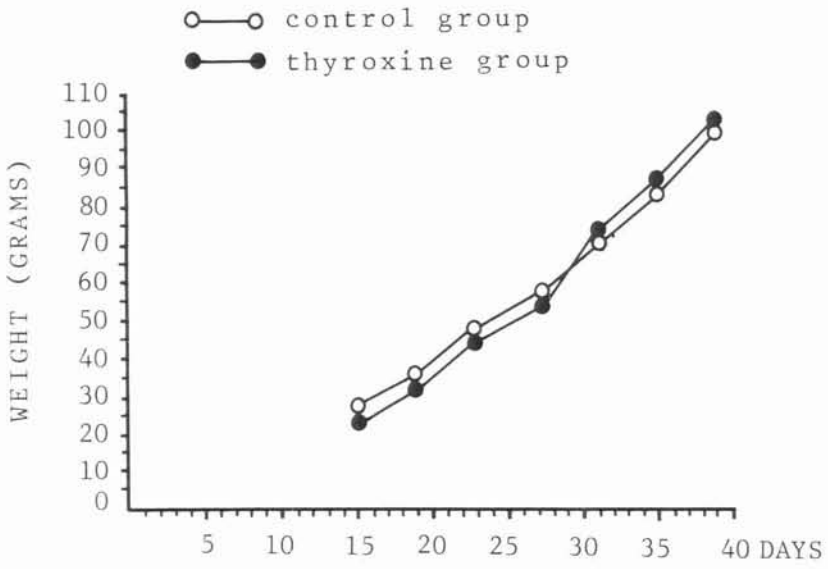
Variation Source	Square sum	L.D.	Mean square	F
Treatment (between groups)	4795.2623	5	959.0525	22.0927
Resting Error	1823.2365	42	43.4104	2.45
Total	6618.4988	47		

$S\bar{x} = \frac{r}{\sqrt{n}}$ $r = \sqrt{43.4104} = 6.5887$

$S\bar{x} = \frac{6.5887}{2.8284} = 2.3295$

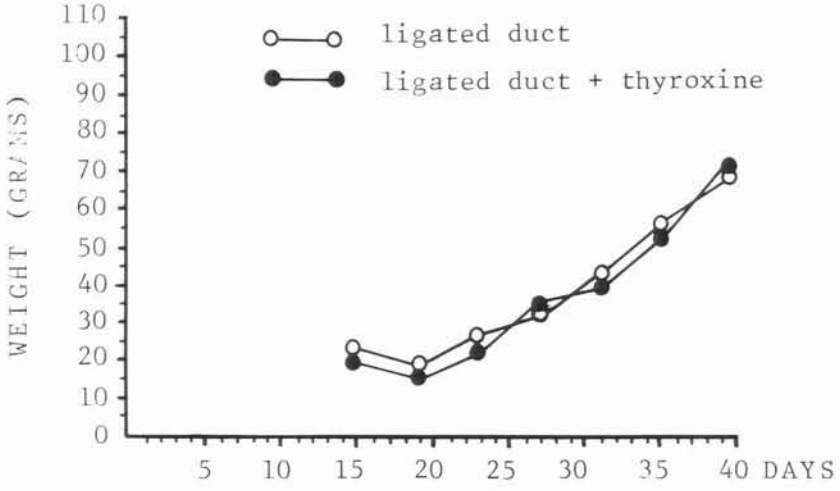
Q- table = 4.23
D = 4.23 x 2.3295 = 9.853

Graphic 1 — Mean body weight of rats from the control and thyroxine groups in every 4th day.



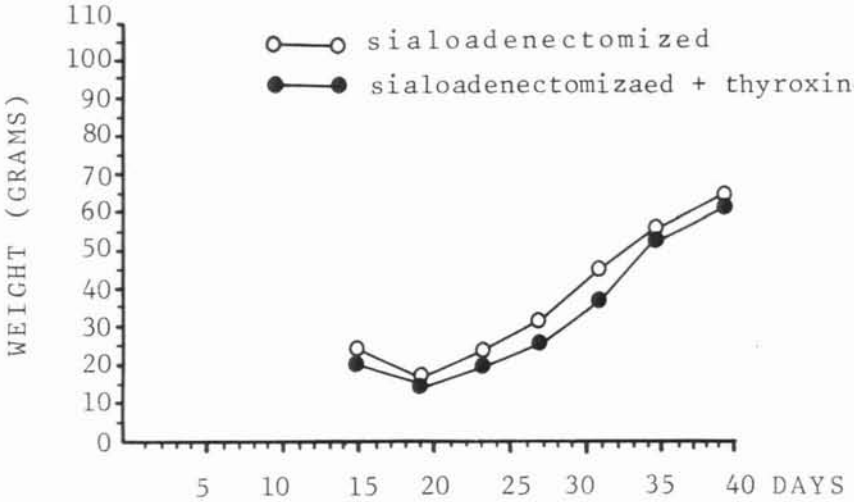
GRAPHIC 1

Graphic 2 — Mean body weight of rats from the ligated duct and ligated duct + thyroxine groups in every 4th day.



GRAPHIC 2

Graphic 3 — Mean body weight of rats from the sialoadenectomized and sialoadenecetomized + thyroxine groups in every 4th day.



GRAPHIC 3

Graphic 4 — Statistical relation of significance between the groups: A. Control; B. Thyroxine; C. Ligated duct; D. Ligated duct + Thyroxine; E. Sialoadenectomized; F. Sialoadenectomized + Thyroxine.

	A					
B	—	B				
C	+	+	C			
D	+	+	—	D		
E	+	+	—	—	E	
F	+	+	—	—	—	F

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RESUMO: Quarenta e oito ratos albinos, machos, com 15 dias de idade, utilizados para se observar o efeito da cirurgia das glândulas salivares (ablação e ligadura de ductos) e da injeção de tiroxina sobre o ganho de peso corporal, foram divididos em seis grupos de oito animais cada: Controle; Tiroxina; Ducto-atado; Salivariadenoprivo; Ducto-atado + Tiroxina; Salivariadenoprivo + Tiroxina. Os resultados obtidos neste trabalho demonstram que as glândulas salivares possivelmente possuem um fator biológico que parece participar endocrinamente sobre o ganho de peso corporal dos ratos. A sialoadenectomia e a ducto atadura provocam diminuição no ganho de peso (pelo menos até a idade de 39 dias ou 24 dias após a operação). A injeção de tiroxina, na dose de 0,5 mcg por via intraperitoneal, não corrige a alteração de ganho de peso corporal os animais sialoadenoprivos e ducto-atados e não aumenta o ganho de peso em animais normais.

UNITERMOS: Glândula salivar; tiroxina; peso corporal.

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