

# ACID PHOSPHATASE ACTIVITY AND FRESH TISSUE WEIGHTS OF ACCESSORY SEX ORGANS IN ADULT MALE RATS FOLLOWING PITUITARY TRANSPLANTATION

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**Summary :** The effect of female pituitary transplantation under renal capsule of castrated adult male rats on accessory sex organs was studied either in presence or in absence of testosterone. Acid phosphatase activity in prostate and seminal vesicle was estimated apart from recording the fresh tissue weights of prostate, seminal vesicle, coagulating and preputial glands. Prolactin secreted from grafted pituitary significantly increased the fresh tissue weights of all sex accessories except seminal vesicle. Testosterone treatment in presence of pituitary graft stimulated the acid phosphatase activity of prostate and seminal vesicle. Prolactin in absence of testosterone could not change the enzymatic activity of prostate and seminal vesicle. The results indicate that prolactin can act directly on prostate, coagulating glands and preputial glands. Accessory sex organs also require the presence of androgens as well as prolactin to maintain the functions of sex accessories in adult male rats.

**Key words :** prolactin      transplantation      prostate      seminal vesicle      preputial gland  
coagulating glands      acid phosphatase      pituitary graft      testosterone

## INTRODUCTION

Prolactin is necessary for the growth and maintenance of accessory sex gland functions. Receptors for prolactin have been demonstrated in testis, prostate and seminal vesicle (1, 3, 10). With regard to accessory sex organs, the effect of prolactin on seminal vesicle and on different lobes of prostate in castrated and testosterone treated animals appears to be conflicting (8, 11, 13, 16). A number of published reports indicate positive effects on weight (4, 8, 13) nucleic acid levels (18) protein synthesis (18) and acid phosphatase activity (17).

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Inhibitory actions of prolactin on male reproductive functions has also been demonstrated (6, 20). Prolactin can act on its own or requires the mediation of androgens is still unsettled (8, 9, 11, 15, 16). In our previous study we have shown synergism between prolactin and testosterone in increasing total protein content and acid phosphatase activity in young male rats (19).

Therefore, the aim of the present investigation was to study the effect of prolactin secreting graft independently and in combination with testosterone on the growth of accessory sex organs in adult male rats.

### MATERIAL AND METHODS

In the present study, inbred male rats of Charles Foster strain (200-250 g body wt.) were used. Rats had free access to water and standard diet. Animals were housed (4 rats/cage) in well ventilated animal house under similar husbandary conditions.

Rats were divided into group I (sham control); Group II (castrated); Group III (grafted and castrated); Group IV (castrated and testosterone propionate (TP) treated); Group V (grafted, castrated and TP treated). Animals first received pituitary grafts (Group III and V) and were castrated within 24 hours. Posterior pituitary was removed before transplantation. Rats of group IV and V received 40  $\mu$ g of TP (dissolved in olive oil) subcutaneously on alternate days from 7th day following castration till 21st day. The sham control (group I) received only surgical exposure of kidney. All the rats of various groups were sacrificed on 21st day following castration.

Prostate, seminal vesicle, coagulating gland and preputial gland were dissected out. Fresh tissue weights were recorded and expressed in mg/100 g of body weight.

Acid phosphatase activity of prostate and seminal vesicle was estimated by method described earlier (19). Protein for enzyme assay was determined by Folin Phenol method (12).

Specific activity for acid phosphatase was defined as unit of enzyme per mg protein used. Total unit was calculated by multiplying *unit/ml* with total volume of homogenate.

Unit/100 gm of body weight was calculated by using the following formula

$$\text{Unit/100 g body weight} = \frac{\text{Total unit}}{\text{Body weight (gms)}} \times 100$$

After three weeks the kidney bearing pituitary grafts were fixed in 10% formaldehyde solution and histology was carried out to check viability of graft.

All results were analysed by using students 't' test.

### RESULTS

In Fig. 1 fresh tissue weights of prostate, seminal vesicle, coagulating gland and preputial gland in various experimental groups are shown. The weights of all accessory sex organs except seminal vesicle in castrated rats (Gr. II) increased significantly following pituitary transplantation (Gr. III). Seminal vesicle did not respond to graft placement in castrated rats. Prolactin secreted from transplanted pituitary in combination with TP (Gr. V) caused a significant increase in the fresh tissue weights of all sex accessories including seminal vesicle in comparison to castrated and TP treated rats (Gr. IV). Combination of graft and TP could restore the weights of coagulating and preputial glands nearer to untreated control value (Gr. I).

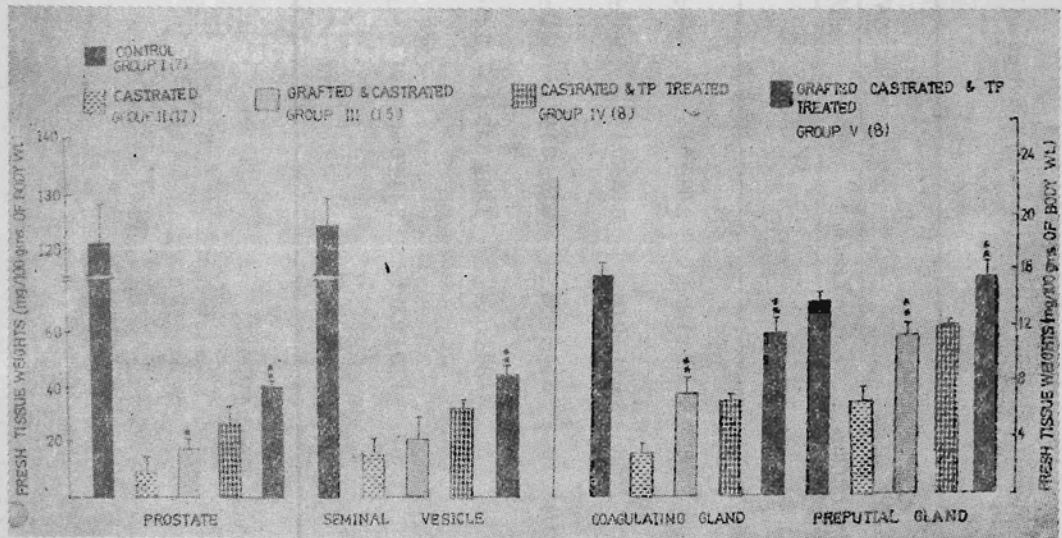


Fig. 1 : Organ weight of accessory sex organs (following various experimental treatment in adult rats. (Values are Mean  $\pm$  SD). Figures in paranthesis indicate the numbers of rats used. Comparisons were made between Gr. II & III, Gr. IV & V.

- \* Shows  $P < 0.01$
- \*\* Shows  $P < 0.001$

Table I shows the acid phosphatase activity in the prostate and seminal vesicle. Following pituitary transplantation in castrated rats, no significant change in enzymatic

TABLE I : Acid phosphatase activity in the Prostate (P) and Seminal Vesicle (SV) after various experimental treatments. (Values are mean $\pm$ SD).

Experimental treatments and groups	No. of rats used	ENZYMATIC ACTIVITY					
		Total unit		Unit 100 gm of body wt.		Specific activity	
		P	SV	P	SV	P	SV
Control (I)	8	2.2 $\pm$ 1.25	2.89 $\pm$ 0.3	0.88 $\pm$ 0.01	1.15 $\pm$ 0.46	0.94 $\pm$ 0.12	0.75 $\pm$ 0.12
Castrated (II)	8	0.61 $\pm$ 0.08	0.88 $\pm$ 0.1	0.14 $\pm$ 0.03	0.35 $\pm$ 0.04	2.86 $\pm$ 0.89	1.42 $\pm$ 0.28
Grafted and Castrated (III)	10	0.57 $\pm$ 0.58	0.69 $\pm$ 0.14	0.13 $\pm$ 0.46	0.25 $\pm$ 0.02	0.91 $\pm$ 0.23	0.76 $\pm$ 0.10
Castrated (IV) and TP Treated	5	1.13 $\pm$ 0.04	1.40 $\pm$ 0.15	0.45 $\pm$ 0.02	0.56 $\pm$ 0.05	0.77 $\pm$ 0.05	0.81 $\pm$ 9.10
Grafted, (V) Castrated and TP Treated	6	1.85 $\pm$ 0.19*	3.14 $\pm$ 0.56*	0.74 $\pm$ 0.06*	1.26 $\pm$ 0.24*	0.8 $\pm$ 0.17	0.82 $\pm$ 0.04

\*P<0.001 Versus Group IV.

activity was observed (Gr. III). However, TP treatment in grafted castrated (Gr. V) produced maximum enzyme activity which was significantly higher than castrated and TP treated rats (Gr. IV). The specific activity of acid phosphatase was highest in castrated rats (Gr. II) and decreased in other group.

## DISCUSSION

In experimental animals lowering of circulating levels of prolactin by injection of antiserum to prolactin is known to produce atrophy of accessory sex organs (2). Administration of prolactin or pituitary homograft placement in castrated rats stimulates the growth of accessory sex organs (4, 8, 15, 16). In the present study, pituitary transplantation under renal capsule was favoured due to non-availability of highly pure homologous rat prolactin and in difficulties in maintaining sustained level of prolactin in the blood. Transplantation of anterior pituitary under renal capsule is known to produce prolactin in large quantities (5, 11, 15, 16). Other pituitary hormones are not produced in significant amounts. Prolactin secretion from grafted pituitary increases because the negative influence of prolactin inhibiting hormone, dopamine is removed (7, 11).

Prolactin secreted from grafted pituitary augmented the fresh tissue weights of prostate, preputial and coagulating glands in adult castrated rats. Seminal vesicle did not respond to prolactin. This was in contradiction to the reported observation of Takahashi (16) who recorded a significant increase in weight of seminal vesicle and no change in prostatic weight. But in respect to preputial gland the present observation confirms findings of Takahashi (16). On the other hand Bartke and Lloyd (4) did not find any trophic action on male accessory sex organs by pituitary homograft in adult rats. The inconsistencies between result presented in this study and that of others (4, 16) may be due to the fact that animals used in the study of these authors did not receive pituitary graft until two weeks after castration. The accessory sex organs might undergo atrophy prior to placement of graft. Therefore, to preclude such possibility rats were grafted first and then animals were castrated within 24 hours.

In order to evaluate the interaction between androgen and prolactin, one group of castrated rats was treated with TP alone while other group received TP in combination with graft. It is evident from results (Fig. 1) that there is no indication of any synergistic action between TP and prolactin. The present observation is in agreement with that of others (13, 15, 16). However, seminal vesicle which did not respond to prolactin alone showed a significant increase in fresh tissue weight following combined treatment with TP and pituitary graft. It may be due to an androgen mediated increase in the prolactin binding sites on seminal vesicle with the assumption that prolactin receptors on other three glands remain in sufficient number to elicit a response to prolactin even in absence of androgen.

It is clear from results (Table I) that pituitary transplantation in castrated rats could not change the acid phosphatase activity in prostate and seminal vesicle. The enzymatic activity in prostate and seminal vesicle significantly increased in grafted, castrated and TP treated rats. The obtained response was additive rather than synergistic. Specific activity was highest in castrated rats (Gr. II) and decreased in other groups. It was anticipated because the protein content of glands increased to higher extent in comparison to the increase in the total enzymatic activity.

Synergism between prolactin and TP in increasing acid phosphatase activity and total protein content has been earlier reported by us in young male rats (19). The same could not be confirmed in adult rats. It is well documented in literature (1, 3, 14) that serum prolactin in male rats increases sharply around 23 days of age and accessory sex organs register rapid growth between 30 to 60 days. Therefore it is quite possible that the age of the animal used is determining factor for the response of accessory sex organs to prolactin.

The results obtained in the present study demonstrate that prolactin secreted from transplanted pituitary acts directly on the prostate, preputial and coagulating glands. Prolactin also requires mediation of androgens in promoting growth of accessory sex organs. Whether a direct action of prolactin or an androgen mediated action is observed depends upon the age of animal and the particular function of a gland under investigation.

#### REFERENCES

1. Aragona, C. and H. G. Friesen. Specific prolactin binding sites in the prostate and testis of rats. *Endocrinology*, **97** : 677-684, 1975.
2. Asno, M., S. Kanzanki, E. Sekiguchi and T. J. Taska. Inhibition of prostatic growth in rabbit with anti-vine prolactin serum. *J. Urol.*, **106** : 248-255, 1971.
3. Barkey, R. J., J. Shani, T. Amit and D. Barzilai. Specific binding of prolactin to seminal vesicle, prostate and testicular homogenate of immature, mature and aged rats. *J. Endocrinol.*, **7** : 163-168, 1977.
4. Bartke, A. and C. W. Lloyd. The influence of pituitary homograft on the weights of sex accessories in castrated male mice and rats on mating behaviour in male mice. *J. Endocrinol.*, **46** : 313-320, 1977.
5. Chen, C. L., Y. Amenomori, K. H. Lu, J. L. Voogt and J. Meites. Serum prolactin levels in rats with pituitary transplants or hypothalamic lesions. *Neuroendocrinol.*, **6** : 220-227, 1970.
6. Fang, V. S., S. Refetoff and R. L. Rosenfield. Hypogonadism induced by a transplantable, prolactin producing tumor in male rats; Hormonal and morphological studies. *Endocrinology*, **95** : 991-998, 1974.
7. Gordon, N. G. The hypothalamic-pituitary control system. In "Best and Taylor's Physiological Basis of Medical Practice" by West, J. B. Baltimore, The Williams and Wilkins Co., P 856, 1985.
8. Grayback, J. T., P. L. Bunce, J. W. Kearns and W. W. Scott. Influence of the pituitary on prostatic response to androgen in rat. *Bull. John. Hopkins Hosp.*, **96** : 154-163, 1955.