GLUTAMIC-OXALOACETIC TRANSAMINASE IN HUMAN SEMEN AND REPRODUCTIVE ORGANS

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(Received 10th November 1964, revised 5th April 1965)

Summary. Determinations were made of glutamic-oxaloacetic transaminase activity in 135 ejaculates, ten testicular biopsy specimens, and post-mortem material consisting of testes, epididymides, seminal ducts, prostate glands and seminal vesicles. Transaminase levels in semen appeared to be directly related to sperm concentration. Lowest values were observed in azoospermic and aspermic semen. The various organs which compose the male reproductive tract did not differ much in transaminase activity.

INTRODUCTION

So far few reports have been published on the level of transaminase activity in human ejaculates and male reproductive organs (Povoa & Villela, 1960; Gregoire, Rakoff & Word, 1961; Searcy, Craig & Bergquist, 1962; Barron & Huggins, 1946; Awapara, 1952; Mann, 1954). We therefore made it our task to perform systematic transaminase determinations in a large number of normal and pathological ejaculates, with a view to finding out whether there exists a relation between the level of transaminase activity and sperm concentration. Furthermore, by an investigation of the testis, epididymis, seminal duct, seminal vesicle and prostate, we set out to determine which of these organs is richest in transaminase.

MATERIAL AND METHODS

Transaminase determinations were made in (i) 135 ejaculates of men aged 23 to 54 years, (ii) ten testicular biopsy specimens and (iii) post-mortem material from six men, comprising testes, epididymides, prostate glands, seminal ducts and seminal vesicles (the latter from three men only); from five men, both semen and testicular biopsy specimens were available.

The evaluation of semen quality was based on the criteria listed in Table 1.

Glutamic-oxaloacetic transaminase (GOT, glutamate-aspartate transaminase) determinations were made by the method of Reitman & Frankel (1957): 0.1 ml ejaculated semen and 0.5 ml substrate were placed in two test-tubes; to one, which served as blank, 0.5 ml dinitrophenylhydrazine solution was added immediately, and to the other after 1 hr incubation at 38° C. Twenty minutes

later 5 ml 0.5 N-NaOH solution were added to both test-tubes, and after another 10 min the colour intensity was determined in a Klett colorimeter using a green filter (540 m μ).

In biopsy specimens and post-mortem material the GOT determinations were carried out after grinding the tissue with sand in fifty parts normal saline, followed by centrifugation. The results were expressed in enzyme units/1 ml seminal plasma or 1 g fresh tissue.

TABLE 1
EVALUATION OF NORMAL AND PATHOLOGICAL SEMEN

	<i>Sperm. conc.</i> (10 ⁶ /ml)	<i>Sperm. motility</i> at $\frac{1}{2}$ –2 hr after ejaculation (%)	<i>Normal</i> <i>sperm. (%)</i>	<i>Immature</i> <i>sperm. forms (%)</i>
Normospermia	60	80	80 to 85	0.5 to 2
Hypoospermia	60 to 30	80 to 60	80 to 50	2 to 5
Oligospermia	30 to 1	60 to 30	50 to 20	10 to 40
Azoospermia	0	0	0	100
Aspermia	0	0	0	0

TABLE 2
GLUTAMIC-OXALOACETIC TRANSAMINASE ACTIVITY IN SEMEN (UNITS/ML)

<i>Semen</i>	<i>No. of</i> <i>specimens</i>	<i>Transaminase activity</i>	
		<i>Range</i>	<i>Average</i>
Normospermia	40	35 to 270	122.6 $\pm$ 59.7
Hypoospermia	12	15 to 200	90.5 $\pm$ 49.1
Oligospermia	62	5 to 200	64.5 $\pm$ 52.4
Aspermia and azoospermia	19	5 to 38	18.6 $\pm$ 9.1

RESULTS

The data provided in Table 2, which include ranges of activity, averages and standard deviations for transaminase in human semen, indicate that there exists a direct relationship between sperm concentration and enzyme activity. The highest transaminase values were observed in normal semen (normospermia) as well as in those cases of hypoospermia which were still near the limits of normality. The lowest transaminase values have been recorded in cases of azoospermia and aspermia, while in oligospermia the activity was intermediate.

From Table 3, which affords a direct comparison, it appears that there is no definite relationship between the enzyme activity in semen and in testes, either normal or atrophied to such an extent that the semeniferous tubules contained only Sertoli cells (Grade IV, as defined by Joël, 1953).

Further, Table 3 shows that, while transaminase values in oligospermic and aspermic ejaculates were always low, no marked difference existed between the various testicular biopsy specimens, irrespective of the state of spermatogenesis in the testes.

Table 4 shows the transaminase values in testis, epididymis, ductus deferens, seminal vesicle and prostate gland. There does not appear to be much difference in transaminase activity between the different organs, but the highest value of all (42,500 units/g tissue) was recorded in a prostate gland.

TABLE 3
GLUTAMIC-OXALOACETIC TRANSAMINASE ACTIVITY IN SEMEN (UNITS/ML) AND IN
TESTICULAR BIOPSY SPECIMENS (UNITS/G WET WT)

No.	Semen	Transaminase activity		State of testis
		In semen	In testis	
1	Oligozoospermia	10	28.000	Atrophy I-II
2	Aspermia	26	26.000	Atrophy II-III
3	Aspermia	5	30.250	Atrophy IV
4	Aspermia	—	34.500	Normal
5	Aspermia	42	18.750	Atrophy II-III
6	Aspermia	—	4.500	Atrophy II-III
7	Aspermia	20	15.000	Normal
8	Aspermia	—	46.000	Normal
9	Oligozoospermia	—	R 30.000	} Atrophy I-IV
			L 28.000	
10	Aspermia	—	R 42.500	} Normal
			L 43.500	

Testicular tissue was obtained in individuals Nos. 1 to 8 from the right gonad, in Nos. 9 and 10 from both gonads (right, R, and left, L). The amount of testicular tissue available was usually 16 to 55 mg, except in No. 6 where it was only 11 mg wet wt. The figures I to IV denote the four grades of testicular atrophy as defined by Joel (1953).

TABLE 4
GLUTAMIC-OXALOACETIC TRANSAMINASE ACTIVITY (UNITS/G WET WT) IN TESTES AND
MALE ACCESSORY ORGANS

No.	Testis		Epididymis		Ductus deferens		Seminal vesicle	Prostate gland
	Right	Left	Right	Left	Right	Left		
1	20,500	18,000	32,000	—	7,000	4,250	—	19,500
2	24,000	26,250	18,500	9,000	12,000	9,000	—	16,250
3	22,500	27,500	35,000	16,250	—	—	—	10,000
4	20,000	16,500	16,500	13,000	20,000	7,000	—	42,500
5	14,000	19,500	12,000	12,500	9,500	—	—	6,500
6	17,000	11,600	19,000	15,400	6,400	7,300	—	17,400
7	—	—	—	—	—	—	14,200	—
8	—	—	—	—	—	—	13,100	—
9	—	—	—	—	—	—	6,200	—

DISCUSSION

The investigations conducted so far have not elucidated the role played by transaminase in the male genital tract. There does appear to exist a direct relationship between sperm concentration and transaminase activity in human semen. Nevertheless, it is clear from our analyses that the testes cannot be regarded as the sole source of transaminase. It would seem that the prostate, owing to its relatively large size, makes a particularly important contribution towards the total activity of the human ejaculate.

ACKNOWLEDGMENT

We wish to thank Professor J. Fisher for his interest, help and advice.

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