Original Research Paper

ernational	A COMPARATIVE MORPHOLOGICAL STUDY ON MAMMALIAN TESTES
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ABSTRACT INTRODUCTION: The testes are ovoid or walnut shaped bodies suspended in the scrotal region by the support of scrotal tissue including non striated dartos muscle and spermatic cord. MATERIALS AND METHODS: The study was conducted in the Department of Anatomy, Gauhati Medical College, Guwahati on the testis of human, pig, goat and albino rat. They were divided into four mammals group consisting of 6 to 9 animals in each group. RESULTS: Biometrical values were statistically analyzed and significant differences of length, breadth, thickness and weight were noted. It was found that in all groups, the measurements were more in right side than the left but was found to be statistically insignificant. The highest values in case of length, breadth, thickness and weight were found in pig and lowest in the albino rat. CONCLUSIONS: The high value in the right side is supposed to be due to organogenesis in the right side where it occurs first during the development. Therefore it needs further evaluation in this matter.

KEYWORDS : Testis, mammalian testes, morphometry, testes length, testes breadth, testes weight

INTRODUCTION

Testes are ovoid or walnut shaped bodies that have the organization of compound tubular glands¹ with a thick fibrous capsule i.e tunica albuginea². The testes are suspended in the scrotal region by the support of scrotal tissue including non striated dartos muscle and spermatic cord³.

The paired testes develop in abdominal cavity and later descend into scrotum where they are suspended at the ends of the spermatic $cords^{3.4}$. Testes are the organs for spermatogenesis and site for production of male sex hormone testosterone⁴.

The testes is one of the organ which has capability to adapt in environmental change, but its extreme sensitivity alter its function in some manner⁵. The location of the testes in the scrotum along with skin involves in the counter-current mechanism of heat exchange of the testicular pampiniform plexus that maintain the testes at a temperature 3-4° C below body temperature³. The cell components of the testes are interdependent with each other, multiply at an astonishing rate during puberty though it varies from species to species.⁵

MATERIALS AND METHODS

The study was conducted in the Department of Anatomy, Gauhati Medical College during the period of May,2012 to May,2014. The study was conducted on the testis of human, pig, goat and albino rat. They were divided into four groups consisting of 6 to 9 animals in each group as follows:-

Table – 1 Shows The Different Mammals Divided Into Different Groups With Number Of Animals

Sl. No	Name of the mammal	Group	No. of animal
1	Human	Ι	7
2	Pig	II	8
3	Goat	III	6
4	Albino rabbit	IV	9

Group- I : The testes were collected from cadavers, after excluding all possible history of abnormality of the testes within 1-2 hours of death. The testes of the 7 cadavers that

were placed for dissection in the department of Anatomy. Gauhati Medical College were also examined. There was no difference in the size and shape of the testes compared to the testes obtained within 1-2 hours of death. No significant shrinkage was found in the testes.

Group-II: The testes were collected from the local slaughter's House immediately after death of the animal at Beltola market, Guwahati and preserved.

Group-III: The testes of the goat were obtained from the slaughter's House immediately after death of the animal at Narengi Market, Guwahati and preserved.

Group-IV: The animals were anaesthetized and the testes were obtained after careful dissection.

In all the above groups, immediately after removal of both testes, their length, and thickness were measured by means of Vernier calipers. The measurement were done according to Baishya et al⁶. The length, breadth and thickness were recorded as follows:-

Length:-Cranio-Caudal distance of the testes.

Breadth:- Anterio Posterior diameter at the middle of the testes.

Thickness:-Medio-Lateral distance at the middle of the testes.

Biometrical values were statistically analyzed, according to Snedecor et al⁷ and significant difference of length, breadth, thickness and weight was noted. Paired t-test was done and 't' was taken as significant if the value of 't' was greater than 2.645.

RESULTS AND OBERVATIONS

The average length(in cm) of right and left testes of Group I, II, III and IV was found to be 4.52 and 4.49, 6.28 and 6.25, 4.67 and 4.65 and 1.91 and 1.89 respectively.

The average breadth(in cm) of right and left testes of Group I, II, III and IV was found to be 2.56 and 2.53, 5.08 and 5.06, 3.47 and 3.45 and 1.06 and 1.04 respectively.

The average thickness(in cm) of right and left testes of Group I, II, III and IV was found to be 2.89 and 2.86, 4.12 and 4.09, 3.08 and 3.02 and 0.95 and 0.93 respectively.

The average weight(in gm) of right and left testes of Group I, II, III and IV was found to be 12.29 and 12.26, 75.14 and 75.11, 54.86 and 54.82 and 1.25 and 1.22 respectively.

No significant statistical difference between right and left testis was found in all groups, though in group I length, breadth, thickness and weight were found more in right one than left one.

In group II, also length, breadth, thickness and weight found slight more in right testes than left one but statistically found insignificant.

Again in group III and IV, length, breadth, thickness and weight were found more in right testes than left one but statistical analysis shown non-significant to them.

The shape of the testes in group I, II, III and IV was found to be oval in case of group I(Fig-2), but elongated oval to group II, III(Fig-1, 3) and IV respectively.



Figure 1: Photograph showing adult goat testis both right and left side with a measuring scale



Figure 2: Photograph showing adult human testis both right and left side with a measuring scale



Figure 3: Photograph showing adult pig testis both right and left side

Table - 2 Average Values For The Length, Breadth, Thickness And Weight Of The Testes In Different Mammals

Paramotor	Sido	Group	Group	Group	Crown
rurumeter	DIGE	Gioup -	Gioup -	Gioup -	Gioup -
		1	11	111	IV
Length of the	Right	4.52±	$6.28 \pm 0.$	$4.67\pm$	1.91±
testes in cm		0.01113	06329	0.09284	0.01968
\pm SE.	Left	4.49±	$6.25\pm$	$4.65\pm$	1.89±
		0.00925	0.0669	0.09446	0.0100
Value of 't'		2.125	1.442	0.658	0.530
Breadth of	Right	$2.56 \pm 0.$	$5.08 \pm 0.$	$3.47\pm$	1.06±
Testes in cm		01819	13036	0.01483	0.002986
± SE.	Left	2.53±0.	5.06±0.	3.45±	1.04±
		01363	1360	0.01663	0.00645
Value of 't'		0.923	0.0140	1.420	1.505
Thickness of	Right	2.89±0.	4.12±0.	3.08±	0.95±
Testis in cm		01447	06873	0.0778	0.011365
± SE.	Left	2.86±0.	4.09±0.	3.02±	0.93±
		01813	6544	0.0365	0.011242
Value of 't'		1.653	2.192	0.825	1.4432
Weight in	Right	12.29 ± 0	75.14 ± 0	$54.86{\pm}0$	1.25 ± 0.0
gms \pm SE.		.1225	.1204	.08537	167
	Left	12.26 ± 0	75.11±0	54.82±0	1.22 ± 0.0
		.1346	.14818	.07749	1224
Value of 't'		2.174	0.532	0.614	0.7737

Table - 3 Length, Breadth, Thickness And Weight Of The Right And Left Testes In Human

					i			
Name of	Length		Breadth		Thickness		Weight	
mammal	in C	M	in	СМ	in (СМ	in (GΜ
Human	Right	Left	Right	Left	Right	Left	Right	Left
1.	4.57	4.50	2.63	2.52	2.92	2.84	12.52	12.49
2.	4.55	4.49	2.54	2.53	2.90	2.82	12.46	12.45
3.	4.52	4.48	2.57	2.54	2.88	2.84	12.10	12.08
4.	4.54	4.52	2.48	2.46	2.97	2.94	12.48	12.46
5.	4.50	4.46	2.55	2.54	2.86	2.89	11.63	11.52
6.	4.51	4.49	2.60	2.58	2.87	2.81	12.47	12.46
7.	4.52	4.53	2.54	2.52	2.89	2.90	12.38	12.37

Table -4 Length, Breadth, Thickness And Weight Of The Right And Left Testes In Pig

Name of	Length in		Breadth		Thickness		Weight		
mammal	C	М	in (in CM		in CM		in GM	
Pig	Right	Left	Right	Left	Right	Left	Right	Left	
1.	6.56	6.55	4.61	4.56	4.26	4.15	75.12	75.04	
2.	6.24	6.14	5.11	5.06	3.88	3.87	75.01	74.95	
3.	5.98	5.94	4.47	4.43	4.47	4.45	74.86	74.82	
4.	6.46	6.44	5.59	5.57	4.10	4.09	75.56	75.54	
5.	6.20	6.22	5.29	5.31	3.91	3.89	74.46	74.50	
6.	6.21	6.17	5.18	5.19	4.15	4.14	75.26	75.24	
7.	6.37	6.34	5.25	5.24	4.17	4.15	76.03	75.02	
8.	6.23	6.22	5.20	5.19	3.99	3.98	75.86	75.84	

Table -5 Length, Breadth, Thickness And Weight Of The Right And Left Testes In Goat.

Name of	Length in		Breadth		Thickness		Weight	
mammal	C	М	in (CM	in (CM	in (GM
Goat	Right	Left	Right	Left	Right	Left	Right	Left
1.	4.56	4.44	3.49	3.46	3.01	3.11	54.66	54.65
2.	5.01	4.98	3.41	3.40	3.43	3.02	54.56	54.68
3.	4.60	4.48	3.47	3.50	2.90	2.89	55.09	55.06
4.	4.90	4.88	3.51	3.49	2.96	2.94	54.96	54.92
5.	4.50	4.63	3.50	3.41	3.02	3.04	54.87	54.81
6.	4.46	4.47	3.48	3.45	3.14	3.10	55.02	54.94

Table -6 Length, Breadth, Thickness And Weight Of The Right And Left Testes In Albino Rat

3								
Name of	Leng	th in	Bred	ıdth	Thick	ness	Wei	ight
mammal	C	М	in (CM	in (CM	in (GΜ
Albino rat	Right	Left	Right	Left	Right	Left	Right	Left
1.	1.94	1.83	1.05	1.02	0.98	0.87	1.28	1.18

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2.	1.92	1.88	1.10	1.04	0.99	0.95	1.29	1.22
3.	1.90	1.89	1.02	1.07	0.98	0.93	1.18	1.28
4.	1.81	1.92	1.11	1.05	0.96	0.93	1.29	1.21
5.	1.95	1.89	1.05	1.03	0.94	0.91	1.16	1.27
6.	1.87	1.89	1.07	1.05	0.97	0.96	1.25	1.19
7.	1.97	1.93	1.03	1.05	0.95	0.90	1.26	1.23
8.	1.83	1.90	1.06	1.01	0.88	0.98	1.30	1.20
9.	1.97	1.92	1.07	1.06	0.93	0.91	1.27	1.18

Table -7 Average Size And Weight Of Right Testes In Mammals

Group	Length	Breadth	Thickness	Weight
Group I	4.52	2.56	2.89	12.29
Group II	6.28	5.08	4.12	75.14
Group III	4.67	3.47	3.08	54.86
Group IV	1.91	1.06	0.95	1.25

DISCUSSION

The discussion of morphological study of testes have been done under the following headings.

Human: -

Investigation on the weight, length, breadth and thickness of testes in human have been reported by Hamilton⁸, Sahana⁹, Mitra¹⁰, Dutta¹¹, Lawrence et al¹².

The range of weight, length, breadth and thickness varied from 10 to 15 gm, 4 to 5 cm, 2.5 cm to 3 cm and 2.5 cm to 3.2 cm respectively Hollineshed¹³, Singh¹⁴.

In the present study, the biometrical values of right and left testes were as follows.

Table -8 Average , Length, Breadth, Thickness And Weight Of Right & Left Testes In Human.

Average	Right	Left
Group I	4.52	4.49
Group II	2.56	2.53
Group III	2.89	2.86
Group IV	12.29	12.26

In the human, the length of right testis was found a little bit more than left one but statistically it was found non significant. The shape of the testes was found to be oval which was in conformation with the findings of Hamilton[®].

Again Kimber et al.¹⁵, Hollinshed¹³, Ham et al.¹⁶, Mitra¹⁰, Lawrence et al.¹² and Singh¹⁴ reported the length of the testes as 4 to 5 cm , 3.7 cm, 4 to 5 cm , 4 to 5 cm, 4 to 5 cm and 4 cm respectively which are quite comparable with the present findings.

In human being width, thickness and weight of right testes were found much more than left testes but again statistically it was found non significant. This is probably due to organogenesis which first occurs in right side.

The width, thickness and weight were found in right and left testes as 2.56 and 2.53 cm, 2.89 and 2.86 cm and 12.29 and 12.26 gm respectively which is again in conformation with Hamilton⁸, Lawrence et al¹². In human being the length of testes was more than breadth and thickness and again thickness were found more than the breadth. It is probably due to oval organ. The weight of the right testis was found more than left one which having similarity to the finding as reported by Sahana⁸.

Pig : Biometrical analysis of weight, length, breadth and thickness of testes in pigs have been reported by Goswami¹⁷. The length, breadth, thickness and weight were to be found 6.5 \pm 0.06 cm, 5.05 \pm 0.04 cm, 4.47 \pm 0.05 cm and 75.18 \pm 1.02 gm respectively.

In present investigation the biometrical values of right and left testis was as follows.

Table -9 Average, Length,	Breadth, thickness	And Weight Of
Right & Left Testis Of Pig.		

Average	Right	Left
Length in cm	6.28	6.25
Breadth in cm	5.08	5.06
Thickness in cm	4.12	4.09
Weightingm	75.14	75.11

Schwark¹⁸ mentioned that the length, breadth, thickness and weight of right testis was little bit more than left one, but statistically they were found to be non significant. Though Goswami¹⁷ reported that the left testis was heavier significantly than right one but in present study the right testis found heavier than the left though it was found again statistically non-significant.

This present finding carries similarity to the finding reported by Colyer¹⁹. Again Daudu et al²⁰ who reported that the right testes was heavier than left one in Bujani and Sokoto gudali bulls at the age of 4 to 5 years and it was significant in both groups.

In present study, the right and left testes having differences in their weight which was non significant probably may be due to sample variation.

Goat: Investigation of weight, length, breadth and thickness of testes in Assam goat has been reported Baishya et al⁶. The average length, breadth, thickness and weight were found as 1.65 ± 0.586 cm, 1.333 ± 0.4099 cm, 0.8500 ± 0.2958 cm and 0.9348 ± 0.3262 at the age of 61 to 90 days.

The weights of the testes were found by Gier et al^{21} and Yao at al^{22} as 135 gm and 91.3 gm at the age of 6 months and 7th months (210 days) respectively.

In the present investigation the biomertrical values of the right and left testis of Assam goat were as follows.

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Average	Right	Left		
Length in cm	4.67	4.65		
Breadth in cm	3.47	3.45		
Thickness in cm	3.08	3.02		
Weight in gm	54.86	54.82		

Table -10 Average,	Length, Breadth,	, Thickness	And	Weight
Of Right & Left Test	is Of Goat			

No literature about the length, breadth and thickness of adult goat testes were available till the completion of our study and so it is compared to the findings of Baishya et al⁶ who reported the biometrical values of testes in Assam goat at the age of 61 to 90 days. As the present investigation done on the adult group above 6 month, so the length, breadth, thickness and also weight were found higher than findings of Baishya et al⁶.

The weight of the testes were well comparable to Gier et al^{21} and Yao at al^{22} concerning the age with the present findings. In the present investigation, the length, breadth, thickness and weight again found little more in right testis than left testis one which were found statistically non significant. It is probably due to organogenesis affected right side first.

Albino Rat: No literature regarding the biometry of testes excluding weight was available till the completion of study.

In albino rat, right testis was found little higher value in length, breadth, thickness and weight but found statistically, non significant.

Amman²³ found that the weight of both testes were found 2.6 gm and 5.8 gm at the age of one year in albino rat and New Zealand white rabbit.

Paufler et al^{24} and Amman²⁵ found the weight of the testes were at average 2.58 gm, and 6.16 ± 0.38 gm, at the age of 15 to 17 months and 20 to 54 weeks respectively.

In the present investigation the biometrical values of the right and left testes were as follows :

Table -11 Average, Length, Breadth, Thickness And Weight Of Right And Left Testis Of Albino Rat.

Average	Right	Left
Length in cm	1.91	1.89
Breadth in cm	1.06	1.04
Thickness in cm	0.95	0.93
Weight in gm	1.25	1.22

The length, breadth and thickness was not comparable as no literature was available within our reach, but weights of the both testes in albino rat are quite comparable with the finding of Paufler et al²⁴ and Amman²³. From the present investigation, it is seen that pig having largest value in length, breadth, thickness and weight and in albino rat have the lowest value in case of length, breadth, thickness and weight of the testes.

It is seen that larger body weight shows higher value in case of length, breadth, thickness and weight of testes. So body weight is directly proportional to testicular length, breadth, thickness and weight.

Carmon et al²⁶ showed that testes weight of ram was closely co-related with the body weight, in the same species the right and left testes having variance in length, breadth, thickness and weight but not significant statistically. It is probably due to organogenesis. It should be further evaluated. It is commonly believed that limbs having slight enlargement due to functional reason in right handed person, so here right side found much more larger as the investigation done irrespective to right handed and left handed mammals including man. Again it is the matter of further study for perfect evaluation.

CONCLUSION

From this investigation it is seen that in all groups the testes in right side have high value than the left side but found statistically insignificant.

The high value on right side is supposed to be due to organogenesis in the right side where it occurs first during the development. It is seen that right handed person having high size value in right side due to more function. But in animal it might be do so. Therefore it needs further evaluation in this matter.

Again highest value in case of length, breadth, thickness and weight are found in pig and lowest in the albino rat. This descending pattern of the biometrical value from pig to human and pig to albino rat to their body weight which was highest in pig and lowest in albino rat. So the testes weight is directly proportional to body weight.

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