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Original Research Article

Effect of Coitus (Copulation) on Sperm Parameters and Gonadosomatic Index in Hemi-orchidectomized Wistar Rats

Ekpe O. Aribo[1*], Atim I. Okpo-Ene[1], Justina Nwangwa[1], Rita Chisom Okwara[1], Raneobhazi E. Aribo[1]

[1]Department of Physiology, University of Calabar, Calabar, Nigeria

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***Corresponding author:** Ekpe O. Aribo
Department of Physiology, University of Calabar, Calabar, Nigeria

Abstract

Background: There are conflicting reports on the effect of coitus on seminal parameters. Similarly, studies believe hemi-orchidectomy improves the function of the contralateral testis while others observed no differences in the function of the contralateral testis. But there is paucity of information on the effect of coitus on seminal parameters in hemi-orchidectomized animals, and hence this study. ***Methods***: Twenty (20) male Wistar rats were used for this study. The 20 male rats were divided into 4 groups of 5 rats each. Group 1 (both testes, no coitus); group 2 (both testes, with coitus); group 3 (hemi-orchidectomized, no coitus) and group 4 (hemi-orchidectomized, with coitus). Each male rat in groups 2 and 4 was cohabited with 2 females for three months after two weeks of the orchidectomy. Animals were sacrificed and their cauda epididymis and right testes dissected out for assessment of relevant parameters. ***Results*:** The results shows that seminal fluid parameters were not significantly different among the groups. There were no significant differences in body and organ weights among the groups. Group 2 rats (both testes/coitus) had a significantly reduced sperm count ($p<0.05$) compared with group 1 (both testes, no coitus). Sperm count was also significantly lower in group 3 (hemi-orchidectomized, no coitus) than in group 1 (both testes, no coitus) ($p<0.05$). Sperm count was significantly increased in group 4 (hemi-orchidectomy, with coitus) compared with group 2. ***Conclusion*:** We conclude that coitus may reduce sperm count in normal rats but does not have effect on sperm parameters in hemi-orchidectomized animals. However, orchidectomy increases sperm count in the contralateral testis.

Keywords: Coitus, hemi-orchidectomized, seminal parameters.

I. INTRODUCTION

Coitus, coined from the Latin word 'coitio' ('a coming together') [1] or copulation (intercourse) classically is a sexual activity involving the insertion and thrusting of the penis into the vagina for sexual pleasure, reproduction or both [2]. This may also take other forms like anal coitus, interfemoral coitus, oral coitus, etc. [3]. This process is regulated by neuroendocrine hormones [4].

The primary functions of the testis, steroidogenesis and spermatogenesis are executed under neuroendocrine regulation involving the hypothalamo-pituitary-gonadal axis, the endocrine effects being mediated and modulated by local paracrine and autocrine factors [5]. Spermatogenesis is affected by pre-testicular, testicular and post testicular factors [6, 7].

Reports on the effects of coitus on seminal fluid parameters have been conflicting. The values of these parameters are said to be dependent on whether there was abstinence or continuous coitus [8]. Sexual abstinence depending on the duration increases semen volume and count [9]. But in another study, no significant changes were observed in semen volume following abstinence [10]. Sperm motility, morphology and viability were not found to be affected by coital abstinence [8, 11, 12].

Other studies on the effect of coitus on seminal parameters indicate that seminal volume and sperm count decrease with increasing frequency of coitus while sperm motility, morphology, viability and pH were not affected by coitus [13, 14]. In their study, Knight *et al.*, [15] found a reduced sperm count and scrotal volume associated with coitus while Kanakas *et al.*, [16] reported increased testicular weight in rams allowed to mate.

Hemi-orchidectomy is the surgical removal of one testis from an animal for experimental purpose or as a means of treating disease. During ejaculation, the semen so produced and its constituents are usually products released simultaneously from both testes [4]. Hemi-orchidectomy may therefore be thought of as having the potential to impair fecundity and reduce the chances of male fertility. However, studies have suggested that this may not always be the case. Available reports on this are conflicting. Umesiobi [17] reported a compensatory increase in sperm count, motility, tubular diameter and Leydig cell count in the contralateral testis while Oloye *et al*., [18] and Jung *et al*., [19] reported no significant changes in the sperm count, motility, viability and testicular volume in the contralateral testis following hemi-orchidectomy. Naoman and Taha [20] also observed an increase in testicular diameter semen volume, sperm viability and motility in the contralateral testis.

Fecundity is the potential of an animal to reproduce [21]. It is a measure of gametes production expressing the number of eggs or sperms produced by a female or male respectively. It is positively correlated with sperm count and it is therefore influenced by the health of the gonads, genetics and age [22]. Fecundity measurements are of particular importance in animal biology and ecology since they are used for assessing population reproductive dynamics and energetics [23].

From the above literature, coitus and hemi-orchidectomy each may have its effect on reproductive parameters and fertility, though reports are conflicting. There is however paucity of information on the possible effect of coitus and or hemi-orchidectomy on seminal parameters particularly sperm count.

2. MATERIALS AND METHODS

Ethical approval: The approval for this study was obtained from the Animal Research and Ethics Committee of the Faculty of Basic Medical Sciences, University of Calabar (approval No-183PHY1121).

Experimental animals: Sixty (60) sexually mature Wistar rats of both sexes (20 males and 40 females) were used for the study. All the animals were housed in wooden cages in the Animal House of the Department of Physiology, University of Calabar, under internationally accepted principles of animal use and care and a 12 hours day/night cycle. They were given animal feeds and water ad libitum.

Experimental design: The twenty male Wistar rats were divided into four groups of 5 rats each. Group 1 served as the normal control with both testes present and not exposed to coitus. Group 2 had both testes present and each rat co-habited with two female rats for coitus. Group 3 rats were hemi-orchidectomized but not exposed to coitus while group 4 rats were hemi-orchidectomized and each cohabited with 2 female rats for copulation. Cohabitation of the rats commenced after two weeks of surgery and the animals had become strong. The male rats were separated from their female counterparts (abstinence) two days before sacrifice and determination of sperm parameters. The duration of experimentation was three (3) months.

Procedure for hemi-orchidectomy: Animals were anaesthesized with intraperitoneal ketamine (0.1ml). In suppine position, the hairs on the inguinal areas were cleared and the skin treated with antiseptic. An inguinal incision was made and the testes delivered through the wounds approach. The spermatic cord was then ligated with Vicryl 2-0. The wound was then closed in a single interrupted sutures using Vicryl 2-0. Post operatively animals were given oral acetomynophen and Levo-floxacin for 7 days. After over two weeks post operatively and animal had stabilized, the animals were then cohabited with their female counterparts.

Collection of samples: After 3 months of experimentation, all male animals were sacrificed, and their testes and epididymis dissected out for the evaluation of testicular weights and seminal parameters.

Seminal fluid analysis: This was done as recommended by the World Health Organization [24] and used by Aribo *et al* [25].

Sperm motility: The cauda epididymis was sliced into several halves and then incubated in saline (PBS) solution at 37^0C for 10 minutes to allow the epididymis to release the sperms. A drop of the sperm solution was placed on a slide. It was then viewed under x400 with a microscope (Olympus, Tokyo, Japan) for various indices of sperm movement.

Seminal pH: The epididymis was collected and quickly placed in a clean petric dish and its pH determined using a pH meter.

Sperm count: This was done with the improved Neubauer counting chamber on a 0.5ml sperm solution diluted with 9.5ml of sperm-diluting solution [$NaHCO_3$, 1ml formalin (35%) and 25mg eosin per 100ml distilled water]. The suspension was viewed under x40 maginification under light microscope and using the formula:

Sperm count = Total number of sperms in the 4 of the Neubaur counting chamber x 100,000 ($x10^6$).

Sperm morphology: One drop of the sperm suspension was smeared on glass slide, air dried and stained with 1% eosin. The morphology of the sperms were evaluated from a total of 200 sperms per animal, and recorded as a percentage of the normal sperms.

Sperm viability: This was done using the dye exclusion assay. A drop of semen was placed on a slide and a drop of eosin-nigrosin in 3% Sodium citrate solution added. The mixture was well mixed and air-dried. The slide was then viewed microscopically for life sperms (unstained) and dead ones (stained). The percentage of viable and non-viable sperms was then computed.

Determination of fecundity: This was determined as sperm count using the improved Neubauer counting chamber as above.

Body and organ weights: The body, testicular and epididymal weights were measured using electronic weighing balance.

3. RESULTS

Body and organ weight changes among different experimental groups

There were no significant differences in the initial and final weights as well as body weight changes among the groups. Epididymal weights were not significantly different among the group. Testicular weight and the gonadosomatic indices of the different groups were not significantly different. This is as shown in Table 1.

Table 1: Organ and body weights of the different experimental groups

	Initial body weight (g)	Final body weight (g)	Body weight change (g)	Epididymis weight (g)	Testes weight (g)	GSI
Group 1	139.94	207.82	67.88	0.515	1.281	0.623
	±6.89	±12.78	±6.94	±0.034	±0.046	±0.026
Group 2	140.66	221.30	80.64	0.446	1.303	0.613
	±4.33	±21.05	±18.72	±0.061	±0.048	±0.056
Group 3	140.30	230.64	90.34	0.503	1.280	0.562
	±3.50	±14.05	±13.69	±0.046	±0.035	±0.026
Group 4	127.80	192.64	64.84	0.479	1.301	0.675
	±7.96	±16.43	±10.04	±0.066	±0.173	±0.071

Values are expressed as mean ±SEM, n = 5.
No significant differences among groups

Seminal fluid parameters:

Sperm count: Sperm count was significantly decreased ($p<0.05$) in group 2 (both testes, no coitus) compared to group 1 (both testes, with coitus). The count was also significantly decreased ($p<0.05$) in group 3 (hemi-orchidectomized, no coitus) compared with group 1 (both testes, no coitus). It was significantly higher ($p<0.05$) in group 4 (hemi-orchidectomized, with coitus) than in group 2 (both testes, with coitus). This is shown in Table 2.

The semen pH, sperm motility and viability were not significantly different among the groups. Teratozotospermia was higher in group 3 (hemi-orchidectomy, no coitus) than in group 2 (both testes, with coitus) but lower in group 4 (hemi-orchidectomy, coitus) than in group 3 as shown in Table 2.

Table 2: Semen pH, sperm count, and motility, viability and morphology in the different experimental groups

	pH	Sperm count ($x10^6$/mL)	Motility	Non-motile sperm count	Viable sperm count	Non-viable sperm count	Total defects
	6.96	79.56	79.00	21.00	87.40	12.60	9.00
Group 1	±0.08	4.92	±7.56	±7.56	±5.99	±5.99	0.82
Group 2	6.82	13.78	68.33	59.00	79.33	52.40	9.20
	±0.20	4.42***	±13.89	±18.17	±12.15	±19.71	1.06
Group 3	6.88	36.66	57.00	43.00	66.60	33.40	13.20
	±0.07	10.14***	±11.69	±11.69	±11.37	±11.37	1.17*,
Group 4	7.02	62.66	77.00	23.00	87.00	13.00	8.00
	±0.09	8.75^c	±8.24	±8.24	±6.51	±6.51	1.19^y

Values are expressed as mean ±SEM, n = 5.
*= $p<0.05$, *** = $p<0.001$ vs group 1
c = $p<0.001$ vs group 2
y = $p<0.01$ vs group 3

4. DISCUSSION

This study evaluated the effect of coitus on gonadosomatic index and seminal parameters in hemi-orchidectomized Wistar rats. Our findings are discussed.

Our findings show that there were no significant differences in testicular, body and epididymal weights among experimental groups. The observed insignificant difference in testicular weights agrees with previous

studies [11, 13]. It however disagrees with the findings by Knight *et al*., [15] who reported a decrease in scrotal volume and testicular size and that by Kanakas *et al*., [16] who noted an increase in testicular volume associated with coitus. The differences between these results might have been due to variations in ages and sizes of the rats which Knight *et al*., [15] and others did not state. A positive correlation between body size and testicular weight exists [26, 27]. Testicular, body and epididymal weights were equally not significantly different between the two hemi-orchidectomized groups (hemi-orchidectomy/coitus and hemi-orchidectomy, no coitus), agreeing with the study by Jung *et al*., [19] and Oloye *et al*., [18]. It is rather at variance with the findings by Naoman and Taha, [20] who reported an increase in testicular weight/volume following hemi-orchidectomy. The differences in results might have been due to age and weight differences of rats used in the various studies [28]. These results suggest that coitus might not have significant effect on testicular morphometric induces.

Our finding of an insignificant difference in testicular morphometric parameter (testicular and epididymal weights) between the hemi-orchidectomized groups agrees with previous studies [18] but disagrees with that by Naoma and Taha [20] and Jung *et al*., [19] who rather found a significant increase in the volume and weights of testes following hemi-orchidectomy and attributed it to hypertrophy of the contralateral testis. Testicular weight and volume are affected by several factors including body weight, nutrition, age and state of health of the individual [29]. The gonadosomatic index (gsi) was not different among the groups as there were no testicular and body weight changes. This suggests that hemi-orchidectomy might not have a significant effect on gonadosomatic indices in the remaining testis under some situations.

Sperm count was observed to have been significantly lower in group 2 (both testes, with coitus) than in group 1 (both testes, no coitus). This difference might have been due to the fact that rats in group 1 had much longer period of abstinence since they never had sex at all than group 2 (both testes, with coitus). Longer period of abstinence has been said to increase seminal volume and sperm count [9, 21] while frequency of ejaculation or coitus is associated with reduced seminal volume and sperm count [5, 30]. We observed that rats that underwent orchidectomy but not mated (group 3) had a lower sperm count than the normal control. This might have been due to the effect of the procedure on the general health of the rats [31].

Hemi-orchidectomized rats that were mated (group 4) had a significantly higher sperm count than those with both testes that were also mated (group 2). The observation might have been due to a compensatory effect of hemi-orchidectomy on the contralateral testis [20, 17] and not coitus since the two groups had coittus. This strongly suggests that hemi-orchidectomy may improve sperm count in the contralateral testis and of course, fecundity.

The non-significant differences in seminal pH, viability and motility between the normal control (both testes, no coitus) and group 2 (both testes with coitus) are similar to reports from previous studies [8, 11, 13]. This however disagrees with the study by Agarwal [9] and Welliver *et al*., [14] who reported an increase and decrease respectively in seminal volume associated with coitus. These differences in reports might have been due to age and weight-related factors in the different studies and the duration of abstinence before samples were collected [9, 30]. The higher teratozotospermia seen in group 3 compared with group 2 might have been due to the stress of the procedure which might have affected the general health of the group.

We also observed that they were no significant differences in seminal pH, sperm count, motility, viability and morphology in the hemi-orchidectomized, no coitus group (group 2) compared with the hemi-orchidectomized, coitus group (group 4). This findings are similar to those made by previous researchers Oloye *et al*., [18, 19]. The observations however disagree with reports by Naoman and Taha [20] who noticed increase in sperm viability, motility and semen volume following hemi-orchidectomy. This suggests that the effects of hemi-orchidectomy on the seminal parameters of the contralateral testis could depends on several factors.

5. CONCLUSION

Coitus in rats with single or both testes does not appear to have a significant effect on seminal parameters and gonadosomatic indices. Hemi-orchidectomy especially with coitus could improve the sperm count and fecundity in the contralateral testis.

Conflict of interest: Authors declare that there are no conflicts of interest in the study.

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