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COMPARISON OF ADRENERGIC AND ANTIADRENERGIC EFFECTS ON SPERM MOTILITY

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ABSTRACT : Male infertility is the inability of male system, which comes mainly from sperm disorder to complete normal fertilization of the egg. Some types of sperm disorders may result from the medications used by human. The main aim of this study was to investigate the *in vitro* effects of adrenalin (adrenergic) and propranolol (antiadrergic) on the motility of human sperm. Twenty semen samples were collected from the infertility outpatient clinic at Baghdad teaching hospital in the period between February 2018 and May 2018. Seminal fluid samples were taken in a clean container after 3 days of abstinence, incubated for half an hour until liquefaction, then semen sample was spread on slide and the motility was estimated. The remaining of the semen sample was divided in to 2 parts. An amount of adrenalin was added to one part and propranolol was added to the other, incubated for 10 minutes then sperm motility was assessed again. The mean motility for grade A was 8.8±9.73, for grade B was 32.8±11.41, for grade C 39.4 ± 7.33 and for grade D was 25±6.62. It was observed that the difference was significant between the basic sperm motility measurements and the mean motility measured after adrenalin addition, there was an increase in motility of grade A and B (fast progressive and slow progressive ones) and there was decrease in the non-progressively motile and immotile sperms. On the other hand, there was a decrease in the motility in the seminal fluid sample to which propranolol was added. Grade A was decreased, but with no significant difference. Grade B decreased significantly, while grade C and D became significantly higher than the basic measurements. Adrenergic substances like adrenalin cause a significant increase in sperm motility (especially the progressive motile sperms), while propranolol causes a significant decrease in sperm motility and number of immotile sperms.

Key words : Sperm motility, adrenergic, antiadrenergic, male infertility.

INTRODUCTION

Seminal fluid is a mixture of spermatozoa which are found in secretions from the testis and epididymis. Those are incorporated with secretions from the prostate, seminal vesicles and bulbourethral glands. The final structure is a viscous fluid. The sperm motility shows the ability of it to move well across the female genital tract to reach the egg. Sperm motility is an important factor in the success of fertilization (Ahmadi *et al*, 2010).

The stimulation of sperm movement is activated by intracellular ion levels changes. The ion concentration changes that promote motility are variable among species. The change in volume of the cell which alters the intracellular ion level can also participate to the activation of sperm movement (Elia *et al*, 2010).

Both alpha and beta adrenergic receptors have been manifested on human sperms. It has been demonstrated that some drugs that can block or stimulate â adrenergic receptors affect sperm motility (Sudha and Evans, 2010).

Propranolol is known to be a beta blocker, which is non-selective; it prevents the effect of epinephrine and norepinephrine on both â1- and â2- receptors. It is prepared in the form of propranolol hydrochloride (Ahmadi *et al*, 2010). It has low intrinsic sympathomimetic action, but has high membrane stabilizing action (only at increased concentrations, e.g. over the dose).

Propranolol has sexual side effects for male and female. It has been demonstrated that systemic intake of beta adrenergic antagonists drugs there is alteration in sexual activity in male rats (Mohamad, 2007).

During the early period of 1970's, there was great attention in the possible occurrence of adrenergic receptors on spermatozoa of mammals because different catecholamines, particularly adrenaline (epinephrine) and noradrenaline (norepinephrine), seemed to have biological influences on sperm action.

Adrenal gland extracts, that contain catecholamines, were found to change the motility of hamster sperm,

capacitation, acrosome reactions and fertilizing capacity *in vitro* (Susan, 2006).

The localization by immunological studies made it clear that adrenergic receptors are found on the head, specifically in the acrosomal and neck parts, and the flagellum spermatozoa of mouse and human. In fact the stimulatory effect of â-receptors are shown to act only in uncapacitated spermatozoa, but the inhibitory effect of α2A receptors act only in spermatozoa which are capacitated (Buck *et al*, 1999).

The aim of this study was to investigate the in vitro effects of adrenalin and propranolol on human sperm motility.

MATERIALS AND METHODS

Twenty semen samples were collected from the infertility outpatient clinic at Baghdad teaching hospital in the period between February 2018 and May 2018. The study was approved by the ethical committee of medical college of University of Baghdad. The Informed consents of the women, who participated in this study were taken.

Seminal fluid samples were collected from them for detailed analysis after 3 days of abstinence in a clean container, incubated for half an hour in 37ºC until liquefaction. For each sample a 10-pL of seminal fluid was placed on pre-warmed slides and the motility was determined by using light microscope and was done by a single observer. One field was examined, containing at least 100 sperms (McKinney and Thompson, 1994). Considering that :

Grade (a): Sperm that move progressively , and are considered the strongest and swim quickly in a straight path. Occasionally, it is also denoted motility **(IV)**.

Grade (b): (non-linear motility): These sperms move forward but also travel in a curved or coiled motion. They are given a symbol of motility (**III**).

Grade (c): These have non-progressive motion since they can not move forward in spite that they can move their tails. Sometimes also denoted motility (**II**).

Grade (d): These are immotile and fail to move at all. Sometimes also denoted motility (**I**) (Cooper TG etal, 2010).

The remaining of the semen sample was divided in to 2 parts. An amount of adrenalin (0.002ml)was added to one part and propranolol (0.1 mg/dl)was added to the other, incubated for 10 minutes then sperm motility was assessed again (Susan *et al*, 2006).

Data analysis

All data were analyzed using SPSS 17.0. Values were written in (mean ± SD), using unpaired t tests, where it is appropriate. A P value of less than 0.05 was considered significant (Hayden and Brown, 1999).

RESULTS

Sperm motility in seminal fluid according to the mode of movement was measured, and it was found that the mean motility for grade A was 8.8±9.73, for grade B was 32.8±11.41, for grade C 39.4±7.33 and for grade D was 25±6.62.

It was observed that there was a significant difference between the basic sperm motility measurements and the mean motility measured after adrenalin addition, especially the motility of grade A (fast progressive) and a non significant increase in grade B (slow progressive) and there was decrease in the non-progressively motile and immotile sperms (Table 1).

On the other hand, there was a decrease in the motility in the seminal fluid sample to which propranolol was added. Grade A was decreased, but with no significant difference. Grade B decreased significantly, while grade C and D became significantly higher than the basic measurements (Table 2).

Table 1 : Comparison of sperm motility between basic measurements and after the addition of adrenalin.

Motility	Basic measurement number = 20	Adrenalin number = 20	p- value
Grade A	8.8± 9.73	18.5±9.92	≤0.05*
Grade B	32.8±11.41	37.6±10.00	≥0.05
Grade C	39.4±7.33	33.8±6.50	≥0.05
Grade D	25± 6.62	18.4±4.62	≥0.05

*p is significant at <0.05

Table 2 : Comparison of sperm motility between basic measurements and after the addition of Propranolol.

Motility	Basic measurement number = 20	Inderal (Propranolol) number = 20	p- value
Grade A	8.8±9.73	3±4.10	≥0.05
Grade B	32.8±11.41	18.2±6.88	≤0.05*
Grade C	39.4±7.33	53.4±7.75	≤0.05*
Grade D	25±6.62	36.8±5.25	≤0.05*

*p is significant at <0.05

DISCUSSION

Since sperms have adrenergic receptors on them, we have tested the introduction of adrenergic and antiadrenergic substances to the seminal fluid and assessed the motility of sperms in it.

It was found that adrenalin addition caused increase

in the motility of sperms in the terms of increasing the rapid and medium progressive movement (grade A and B), and decreasing the non progressive motile (grade c), and the non motile sperms (grade D). These findings were in agreement with other studies, who reported that the epinephrine (adrenalin) can be mixed with the fertilization medium to increase sperm motility, since epinephrine minimizes the amount of superoxide production, which appears to be the major promoter of lipid peroxidation in spermatozoa (Bavister *et al*, 1979).

Mammalian spermatozoa have beta adrenergic receptors, needed to activate cyclic AMP (cAMP) formation by membrane-associated adenylyl cyclases. Because the responses to adrenaline and noradrenaline, involve the control of the production of cAMP, sperms that were put in the incubator for only 15 minutes in adrenaline were significantly having more fertility than those without its addition (Susan *et al*, 2006).

Catecholamines are important cofactors of sperm motility factor (SMF). The preservation and activation of the motility of hamster sperm *in vitro* need catecholamine. In addition to that, the fertilizing ability of hamster spermatozoa in vitro is relying on catecholamines presence. On the other hand, some studies had found that, the concentrations of catecholamines in semen have no relation to semen quality (Fait, 2001).

The addition of propranolol was found to cause a decrease in sperm motility, although it was not significant for grade A, the decrement was significant for grade B. These findings were in agreement with other studies, who documented that the addition of propranolol caused a decrease of the sperm motility for a short period of time .Other studies showed that the decrement in sperm motility was only after 60 minutes (Semczuk, 1987) and were decreased further at higher concentrations and with passing of time (Lena Rogberg and Fredricsson, 1990). Actually the very low doses of it inhibit the ability of sperm for sperm oocyte fusion. In fact propranolol can cause complete stopping of sperm movement in higher doses. The mechanism for the action of propranolol was assumed to be that the entrance of calcium is accompanied by loss of motility, but this assumption was not proven (White *et al*, 1995).

CONCLUSION

Adrenergic substances like adrenalin cause a significant raise in the motility of sperms (especially the progressive motile sperms), while propranolol causes a significant decrease in motility of sperm and number of immotile sperms.

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