

Effect of stress on fertility in albino rats

K. Muthuselvi^{1*}, T. Meena²

¹Associate Professor, ²Professor, Dept. of Physiology, ¹Madurai Medical College, Madurai, Tamil Nadu, ²Sivagangai Medical College, Tamil Nadu, India

*Corresponding Author: K. Muthuselvi

Email: k.selvi_rajaram@yahoo.co.in

Received: 25th February, 2019

Accepted: 15th March, 2019

Abstract

Introduction: Stress is a physical, mental or emotional factor that causes bodily or mental tension and it is the word often uttered every now and then, even by offsprings nowadays. It has its ill effects, affecting each and every organ system. The present study is done to evaluate the effect of stress on fertility in albino rats.

Aim: To study the effect of stress on fertility in albino rats.

Materials and Methods: 12 Albino rats were chosen for study, 4 males and 8 female albino rats. Out of 4 males 2 were kept as controls and 2 subjected to study and among 8 female rats, 4 were kept as controls and 4 subjected to experiment. All the 12 rats were 5-8 months of age and 160–180gms in weight. Reproductive utility of both male and female rats were confirmed and any other reproductive pathology has been ruled out before subjecting them for study. Experimental rats were subjected to immobilization stress by keeping them in a closed transparent jar with 8 holes in it for aeration, 5 hours/ day for 45 days. The control rats were kept in 12 hours light dark cycles, 20 +/- 2 degree C temperature and 60–65% humidity with food and water ad libitum. At the end of 45 days the male and female rats were allowed to mate in the ratio of 1: 2 in separate cages. The litters produced by the controls and experimental group of rats were tabulated.

Results: There is drastic reduction in the no. of litters produced by the rats subjected to immobilization stress when compared with the unstressed controls, with significant 'P' value.

Conclusion: It is clearly evident from the present study that there is a significant negative correlation between stress & fertility in albino rats. Berga and her colleagues studied women who had stopped ovulating for more than six months and found that they had high levels of cortisol, a stress hormone. Aug 27, 2010

Keywords: Stress, Fertility, Immobilization stress, Albino rats.

Introduction

Stress, the word that is used by each and every individual including kids nowadays, creating really an arena of thoughts within which lies a number of medical disorders beyond our imagination. Stress affecting almost all the organ systems, the reproductive system too is not immune to it. The rising titre in the incidence of infertility at present is the key for the present preliminary study of stress on fertility in albino rats. As per the study done by Rai, Jyoti; *Pandey, S.N., *Srivastava, R.K. Department of Anatomy, HIMS, Dehradun: *GSVM medical college, Kanpur, stress causes decrease in the size and weight of testes, and increased intra testicular lipid accumulation which altogether suppresses spermatogenesis leading to infertility. Therefore, in infertile couples, if stressful conditions last for a long period of time, disorders of testicular and ovarian functions will ensue and also there will be chronic abdominal vasocongestion and spasm of the Fallopian tubes which will be very much responsible for reducing the fertility of the couple. (Nijs and Rouffa, 1975; Kipper et al., 1975). So the present study aims at establishing stress as the cause of the reduction of fertilising capacity in albino rats which can very well be implied in humans too.

Materials and Methods

This is a case control study, where in totally 12 albino rats were used for the experiment. Out of 12 albino rats 4 were males and 8 were females. Among 4 males 2 were used as

controls and the other 2 were in experimental group. Among 8 females 4 were used as controls, the other 4 were in the experimental group. All the albino rats were 5-8 months of age and weighing between 160-180gms. All the male rats have already mated with females and have caused pregnancy and in female rats, positive pregnancy observed previously. Thus sterility being excluded in both male and female rats and any other reproductive disorders were also ruled out before subjecting them for this study. The experimental group rats both male and females were subjected to immobilisation stress by keeping them in a transparent jar with 8 holes, 5 hours / day for 45 days. The control group were kept in 12 hours light/dark cycle at 20±2^oc temperature in 60-65% humidity with food and water ad libitum. At the end of 45 days, experimental and control group albino rats were allowed to breed in 1:2 ratio in 4 cages. 21 days later, number of litters produced by the experimental and control group albino rats were tabulated.



Fig. 1

Results

Following were the results of the number of litters produced by stressed and unstressed albino rats respectively.



Fig. 2



Fig. 3

Statistical Analysis

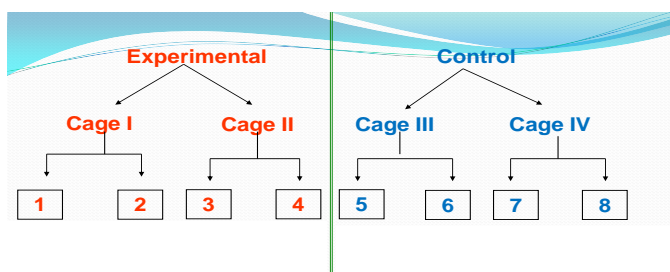


Fig. 4

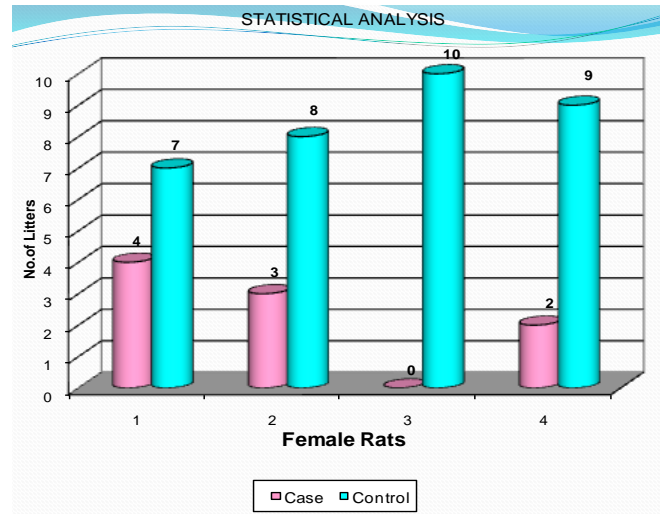


Fig. 5

Discussion

Results of the present study reveals that there is a significant reduction in the number of litters produced by the experimental group albino rats subjected to stress when compared with the control group. Immobilisation stress significantly decreased the whole body weight in experimental group compared to control group. This effect is in accordance with Nayanatara et al.¹ reports. The decreased weight could be due to decreased food intake in the rats under the influence of stress and the decreased food intake in turn affects the fertility rate naturally. Corticotrophin Releasing Hormone (CRH) is commonly released during the stress and might be a factor that suppressed food appetite, in stressed albino rats. So, apart from stress directly affecting the hypothalamo- pituitary – gonadal axis indirectly reduces the fertility rate by affecting the appetite through CRH. In males stress causes suppression of hypothalamo-pituitary-testicular axis which is due to the activation of hypothalamo-pituitary-adrenal axis, this results in decrease in levels of plasma leutinising hormone and testosterone levels which has its effect on the germinal epithelium resulting in reduction of spermatogenesis. The above results are consistent with the studies done by West 1990, Setchel et al. 1965 and Vandemark & Free 1976. It is clear from the above observation that immobilization stress causes marked suppression of spermatogenesis. The reason behind that restraint, is a potent stimulus which induces depression of hypothalamus-pituitary-testicular axis (Norman & Smith, 1992), mediated by activated hypothalamo-pituitary-adrenocortical axis. In females stress acts on hypothalamo – pituitary-adrenal axis, which in turn causes increased corticotrophin releasing hormone and increased glucocorticoids (UC Berkley, Assistant Professor of integrative biology). This results in decreased gondotrophin releasing hormone and decreased pituitary leutinising hormone, ovarian estrogen and progesterone levels. Altogether there occurs “Hypothalamic amenorrhea” of stress. Along with this, the increased glucocorticoids, also

boost up gonadotrophin inhibiting hormone (GnIH) production as per the studies done by George Bentley, Kaufer & Kirby. so in stressful states, glucocorticoids went sky high which decreases the sexual drive which ultimately results in decreased fertility rate. Stress hormone such as cortisol reduces estradiol production possibly by affecting the granulosa cell functions within the follicle, which results in deterioration of oocyte quality as per the study done by Shilpa Prasad, Meenakshi Tiwari, Ashutosh N. Pandey, Tulsidas. G. Shrivastav, and Shail. K. Chaube. The novel invention is the RF amide –related peptides (RFRPs) which are elevated in long term chronic level of stress, in the dorsomedial hypothalamus areas of the brain which causes suppression of activity in the reproductive axis cascade with lowered sexual activity. Critically it is reviewed that, the RFRP neurons express the receptors for glucocorticoids, which are released from the adrenal glands prevents the stress-induced upregulation of RFRP (Bentley) this is an entirely novel pathway for stress induced reproductive dysfunction.

Conclusion

From this study, it is clearly evident that, there is a strong negative correlation between stress and fertility. As per the study of Setchel al (1965) and Aitken et al (1996) there is exfoliation of germ cells in the lumen of seminiferous tubules in the male albino rats, which underwent stress that could be due to the suppression of hypothalamo – pituitary – gonadal axis. With increased GnIH there is drastic reduction in the sexual drive and further the fertility rate is reduced. Preservation of stem cells will be responsible for reversing the sterilising effect, is the promising evidence as per the studies done by Dumontier and Burdick (1977). So, before going for an extensive and expensive work up of infertility management, do give importance to interrogate, how much stress that the concerned couple is imparted to, since the present study reveals that even in small animals stress has its prongs severely biting the reproductive component of it.

Conflict of Interest: None.

References

1. Nayanatara AK, Vinodini NA, Ahemed B, Ramaswamy CR, Bhat Shabarianth Ramesh. Role of ascorbic acid in monosodium glutamate mediated effect on testicular weight, sperm morphology and sperm count, in rat testis. *J Chin Clin Med* 2008;3(1):1.
2. Rabin D, Gold PW, Margioris AN, Chrousos GP. Stress and reproduction: physiologic and pathophysiologic interactions between the stress and reproductive axes. *Adv Exp Med Biol* 1988;245:377-87.
3. Chatterjee A, Chatterjee R. How stress affects female reproduction. *Biomed Res* 2009;20:79-83.
4. Rivest S, Rivier C. The role of corticotropin-releasing factor and interleukin-1 in the regulation of neurons controlling reproductive functions. *Endocrinol Rev* 1995;16:177-99.
5. Saki G, Rahim F, Alizadeh K. Effect of forced swimming stress on count, motility and fertilization capacity of the sperm in adult rats. *J Hum Reprod Sci* 2009;2(2):72-5.
6. Chandralekha G. The effect of noise induced stress on the male reproductive endocrine glands of albino rats. PhD Thesis, M.G.R Medical University and Research Chennai; 2002.
7. Agarwal A., Nallella K.P., Allamaneni S.S., Said T.M. Role of antioxidants in treatment of male infertility: an overview of the literature. *Reprod Biomed Online* 2004;8:616–27.
8. West J.B: Best and Taylor's Physiological basis of Medical practice, 12th Ed. p. 853. (1991)
9. Vandemark, M.L. Free, M.J. (1970): Temperature effect in the testis. New York Academic Press 3: 233.
10. Dumontier, B.S. & Burdick, A. Effect of sonication on mature rat testis. *Fertil Steril* 1977;28(2):195-204.
11. Norman, R.L. & Smith C.J. Restraints inhibit leutinizing hormone & testosterone secretion in intact male rhesus macaques, effect of counter current nalaxone administration. *Neuroendocrinol* 1902;55(4):405-15.
12. Steinberger, E. The etiology & pathophysiology of testicular dysfunction in man. *Fertil Steril* 1978;29:481.
13. Aitken, R.J. & West, R.M. Analysis of relationship between reactive oxygen species production & leukocyte infiltration in fraction of human semen. *Int J Androl* 1996;13(6):433-51.
14. Bajkova, O.V. Cyto-Physiological indicator of the status of the reproductive organs of male rats after 7 days of immobilization stress & 7 days of hypokinesia. *Kosm Biol Aviakosm Med* 1988;22(5):55-9.
15. Steinberger, E. & Chowdhary, A.K. Early changes in germinal epithelium of rat testis following exposure to heat. *J Reprod Fertil* 1970;22: 205-12.

How to cite this article: Muthuselvi K, Meena T. Effect of stress on fertility in albino rats. *Indian J Clin Anat Physiol* 2019;6(2):190-2.