Journal of Advances in Medicine and Medical Research

Volume 35, Issue 10, Page 23-30, 2023; Article no.JAMMR.98603
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

The Experience of Infertility: A Review of Recent Literature on Male Infertility Due to Post Testicular Disorders

Rania Abdeen Hussin Abdalla [a++*]

[a] *Department of Obstetrics and Gynecology, College of Medicine, University of Hail, KSA.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JAMMR/2023/v35i105015

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/98603

Review Article

Received: 05/02/2023
Accepted: 08/04/2023
Published: 12/04/2023

ABSTRACT

Infertility is usually well-defined as the inability of a couple to conceive even after one year of unprotected, frequent sexual intercourse [1,2]. At least 180 million people worldwide and about 15% of all couples in the US are affected by it [3,4]. Male infertility is defined as the inability of a male to successfully carry a fertile female to term, also for at least one year of unprotected sexual activity. About 20% of all cases of infertility are solely the male's fault, and another 30% to 40% have the male as a contributing factor [5]. Due to the frequent coexistence of male and female causes of infertility, it is crucial that both partners undergo infertility testing and receive joint management. A total of 50% of all cases of infertility are significantly attributed to the male factor [6-8]. Even though clinical emphasis still dominates research, more studies are now situating infertility within broader social contexts and social scientific frameworks. Methodological issues persist, but there have also been significant advances. In the social scientific study of infertility, we identify two active research traditions. In order to enhance service delivery and determine the need for psychological counseling, one tradition studies clinic patients primarily using quantitative techniques. The other tradition uses primarily qualitative research to capture the experiences of

[++] *Assistant Professor;*
**Corresponding author: E-mail: raniarose1010@gmail.com;*

infertile people in a sociocultural context. We conclude that more attention is now being paid to the ways in which the experience of infertility is shaped by social context. We call for continued progress in the development of a distinctly sociological approach to infertility and for the continued integration of the two research traditions identified here.

Keywords: Infertility; literature review; psychological distress; treatment; illness experience.

1. INTRODUCTION

"We urge further development of a clearly sociological perspective on infertility as well as continued fusion of the two research traditions mentioned here. Male infertility can be brought on by a variety of factors, all of which can be broadly categorized based on their common underlying etiology. These include sperm transport disorders (such as vasectomy) at 5%, primary testicular defects (which include abnormal sperm parameters without any identifiable cause) at 65- 80%, idiopathic (where an infertile male has normal sperm and semen parameters), and endocrine disorders (usually due to hypogonadism) at 2% to 5%, according to estimates, and toxins like lead and uric acid can also cause infertility" [9-11] "The post testicular portion of the reproductive tract includes the epididymis, vas deferens, seminal vesicles, and associated ejaculatory apparatus" [12-15].

1. Cystic fibrosis: Cystic fibrosis (CF) is the most common autosomal recessive genetic disorder in the United States and is fatal. It is associated with fluid and electrolyte abnormalities (abnormal chloride-sweat test) and presents with chronic lung obstruction and infections, pancreatic insufficiency, and infertility. Interestingly, 98% of men with CF have missing parts of the epididymis. In addition, the vas deferens, seminal vesicles, and ejaculatory ducts are usually atrophic, or completely absent, causing obstruction. Spermatogenesis is usually normal [16,17] Congenital absence of the vas deferens (CABVD) accounts for 1-2% of infertility cases. On physical examination, no palpable vas deferens is observed on one or both sides. As in CF, the rest of the reproductive tract ducts may also be abnormal and unreconstructable. This disease is related to CF. Even though most of these men demonstrate no symptoms of CF, up to 65% of patients will harbor a detectable CF mutation. In addition, 15% of these men will have renal malformations, most commonly unilateral agenesis [17,18].

2. Young syndrome: Young syndrome presents with a triad of chronic sinusitis, bronchiectasis, and obstructive azoospermia. The obstruction is in the epididymis. The pathophysiology of the condition is unclear but may involve abnormal ciliary function or abnormal mucus quality. Although spermatogenesis is usually normal, reconstructive surgery is associated with lower success rates than that observed with other obstructed conditions [19].

3. Idiopathic epididymal obstruction: Idiopathic epididymal obstruction is a relatively uncommon condition found in otherwise healthy men. There is recent evidence linking this condition to CF in that one-third of men so obstructed may harbor CF gene mutations [19,20].

4. Adult polycystic kidney disease; Adult polycystic kidney disease is an autosomal dominant disorder associated with numerous cysts of the kidney, liver, spleen, pancreas, epididymis, seminal vesicle, and testis. Disease onset usually occurs in the twenties or thirties with symptoms of abdominal pain, hypertension, and renal failure. Infertility with this disease is usually secondary to obstructing cysts in the epididymis or seminal vesicle. Obesity is another Causative factor for infertility with deranged lipid profile and Renal function test [21,22].

5. Blockage of the ejaculatory ducts: "Blockage of the ejaculatory ducts, the delicate, paired, collagenous tubes that connect the vas deferens and seminal vesicles to the urethra, is termed ejaculatory duct obstruction. It is the cause of infertility in 5% of azoospermic men. Obstruction can be congenital and result from mullerian duct (utricular) cysts, wolffian duct (diverticular) cysts, or congenital atresia or is acquired from seminal vesicle calculi or postsurgical or inflammatory scar tissueprsents as hematospermia, painful ejaculation, or infertility. The diagnosis is confirmed by finding a low-volume ejaculate and TRUS showing dilated seminal vesicles or dilated ejaculatory ducts" [23]. WHO reference range for semen analysis with examples of main abnormalities related to semen analysis.

Table 1. Common congenital causes of testicular failure

Semen Parameter	Reference Range	Abnormality	Description
Semen volume	≥1.5 ml		
pH	≥7.2		
Sperm concentration	≥15 million sperm/ml	Azoospermia	Absence of sperm in seminal plasma
		Oligozoospermia	<15 million spermatozoa/ml
		Cryptozoospermia	<1 million spermatozoa/ml
Total sperm count	≥39 million sperm/ ejaculate		
Total sperm motility	≥40% motile sperm	Asthenozoospermia	<40% total motile spermatozoa or <32% progressive motile spermatozoa
Progressive sperm motility	≥32% progressively motile sperm	Asthenozoospermia	<40% total motile spermatozoa or <32% progressive motile spermatozoa
Sperm morphology	≥4% morphologically normal sperm	Teratozoospermia	<4% normal form/morphology
		Oligoasthenoteratozoospermia (OAT syndrome)	Combination of <15 million spermatozoa/ml, <32% progressive motile spermatozoa, and <4% normal form

Based on WHO reference range for semen analysis (Cooper et al. [34]).
Abbreviations: pH, potential of hydrogen; WHO, World Health Organization.
Common congenital causes of testicular failure and obstructive azoospermia with genotype–phenotype correlations

Table 2. Obstructive azoospermia with genotype–phenotype correlations

Genetic Aberration	Phenotype
Klinefelter syndrome	Azoospermia to severe oligozoospermia
Robertsonian translocation	
Y chromosome microdeletions	
AZFa deletion	Azoospermia
AZFb deletion	Azoospermia
AZFc deletion	Azoospermia to normozoospermia
46 XX male syndrome	Azoospermia
CFTR	Obstructive azoospermia
INSL3-LGR8	Cryptorchidism

Abbreviations: AZF, azoospermia factor; CFTR, cystic fibrosis transmembrane conductance regulator; INSL3-LGR8, insulin-like factor 3–leucine-rich repeat-containing G protein-coupled receptor 8

2. ACQUIRED BLOCKAGE

1. Vasectomy: Itis performed on 750,000 men per year in the United States for contraception. Subsequently, approximately 5% of these men have the Vasectomy reversed, most commonly because of remarriage [24].

2. Groin and hernia surgery: It can result in inguinal vas deferens obstruction in 1% of cases. There has been concern that Marlex mesh used for hernia repairmay add to perivasal inflammation and increase the likelihood of vasal obstruction.[25]

3. Bacterial infections: Bacterial infections (E coli in men age > 35) or Chlamydia trachomatis in young men) may involve the epididymis, with scarring and obstruction [22,25].

3. FUNCTIONAL BLOCKAGE

Besides physical obstruction, functional obstruction of the seminal vesicles may exist. Functional blockages may result from nerve injury or medications that impair the contractility of seminal vesicle or vasal musculature. A classic example of nerve injury affecting ejaculation is after retroperitoneal lymph node dissection for testis cancer. This can cause either retrograde ejaculation or true anejaculation, depending on the degree of injury to postganglionic sympathetic fibers arising from the thoracolumbar spinal cord [26-29]. These autonomic nerves overlie the inferior aorta and coalesce as the hypogastric plexus within the pelvis and control seminal emission. Multiple sclerosis and diabetes are other conditions that result in disordered ejaculation. Evidence from animal models indicates that the seminal vesicles, lined by smooth muscle, possess contractile properties similar to those of the urinary bladder, making it conceivable that seminal vesicle organ dysfunction may underlie some cases of ejaculatory duct obstruction. The main points of the study should be summarised and explained to readers in a research paper conclusion. While conclusions do not usually provide new information that is not mentioned in this article, they often change the subject or offer a fresh view on it.

4. GENETIC TESTING IN PATIENTS WITH AZOOSPERMIA

In the case of nonobstructive forms in azoospermia, genetics may play an essential role. The two most common types of genetic factors associated with nonobstructive azoospermia are: chromosomal abnormalities resulting in impaired testicular function; and chromosomal abnormalities resulting in Y chromosome microdeletion leading to isolated spermatogenic impairment [29-32].

5. KARYOTYPE

A karyotype analyzes all chromosomes for the gain or loss of the entire chromosomes as well asstructural defects, including chromosome re-arrangements (translocations), duplications, deletions, and inversions. Chromosomal abnormalities account for about 6% of all maleinfertility, and the prevalence increases with increased spermatogenic impairment (severeoligospermia and nonobstructive azoospermia). Paternal transmission of chromosome defectscan result in pregnancy loss, birth defects, infertility in male offspring, and other genomicsyndromes. Lead toxicity is one of the leading causes of male infertility due to hazardous effects on DNA due to microdeletions [33-35].

6. Y CHROMOSOME MICRODELETION

Approximately 13 % of men with nonobstructive azoospermia or severe oligospermia may havean underlying Y-chromosome microdeletion. chromosome microdeletions responsible for infertility — regions AZF a, b, or c — are detected using sequence tagged sites (STS) andpolymerase chain reaction analysis. There is no consensus on the number of STS's required foroptimal detection of AZF deletions. Y chromosome microdeletions carry both prognosticsignificance for finding sperm and consequences for offspring if these sperm are utilized.

Successful testicular sperm extraction has not been reported in infertile men with large deletionsinvolving AZFa or AZFb regions but the total number of reports is limited.However, up to80% of men with AZFc deletions may have retrievable sperm for ICSI. Furthermore, the couplemust be counseled on the inheritance of this compromised fertility potential in all maleoffspring [36,37].

6.1 Lifestyle Changes

Reasonable healthy lifestyle changes should be recommended or at least discussed with all male

infertility patients. These changes include stopping smoking, limiting or eliminating alcohol intake, adopting a more nutritious diet, weight loss measures if obese, increased exercise, avoiding potentially toxic artificial lubricants during sexual activity, reducing stress, eliminating illegal and recreational drug use (such as marijuana), minimizing prescription drugs, avoiding exposure to pesticides and heavy metals (such as lead, mercury, boron, and cadmium), and eliminating any unnecessary chemical exposures [29,30,36,37]. Low body weight is also a possible risk factor for male infertility [38-41]. Fish oil ,almond oil , Fresh fruits containing antioxidants supplements have also been suggested as helpful in male fertility, but there is insufficient evidence to make a recommendation [42].

Depression and anxiety during pandemic COVID -19 have been shown to worsen the quality of Life , might play a role in male infertility due to possible alterations in scrotal temperature, with being preferred, although the evidence is not compelling or definitive [43,44]. While avoiding hot baths, saunas, and tight-fitting underwear have not been conclusively demonstrated to significantly improve male fertility, it is not unreasonable to discuss these suggestions with patients. Use of herbal medication, anti-oxidant and various other healthy dietary planshave been advocated by some studies [45,46]. Acquired urogenital abnormalities Bilateral obstruction or ligation of the vas deferens, bilateral orchiectomy, epididymitis, varicoceles, retrograde ejaculation [47-50]. Immunological causes lymphocytic hypophysitis, hemosiderosis, hemochromatosis, sarcoidosis, histiocytosis, tuberculosis, fungal infections, etc.Urogenital tract infections - Gonococci, chlamydia, syphilis, tuberculosis, recurrent urogenital infections, prostatitis, and recurrent prostate vesiculitis [51-53] Sexual dysfunction - premature ejaculation, anejaculation, infrequent sexual intercourse, and erectile dysfunction.Malignancies - sellar masses, pituitary macroadenomas, craniopharyngiomas, and surgical or radiation treatment of these conditions, testicular tumors, or adrenal tumors leading to an excess of androgens. Medications or drugs - cannabinoids, opioids, psychotropic drugs can cause inhibition of GnRH, exogenous testosterone or androgenic steroids supplementation, GnRH analogs and antagonists used in prostatic carcinoma, chronic glucocorticoid therapy, alkylating agents, antiandrogens, ketoconazole, cimetidine. Environmental toxins - insecticides, fungicides, pesticides, smoking, excess alcohol.While it remains unclear exactly how much influence these factors have in male infertility, it is reasonable to expect that avoiding potentially spermatotoxic activities and adopting a healthier lifestyle will improve overall male fertility [54,55].

7. CONCLUSION

We reach the conclusion that more attention is now being paid to the ways in which social context shapes the experience of infertility. We advocate for continued progress in developing a distinctly sociological approach to infertility, as well as the integration of the two research traditions recognized here. Low body weight is another risk factor for male infertility. Reasonable healthy lifestyle changes should be recommended or at the very least discussed with all male infertility patients.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Practice Committee of tAmerican Society for Reproductive Medicine. Definitions of infertility and recurrent pregnancy loss. Fertil Steril. 2008 November; 90(5);Suppl ;Suppl:S60.
2. Khatoon F, Ibrahim H, Wazir ali PH, Badawy A. Association of BMI with Follicular stimulating Hormone and with sperm parameters in males. IOSR JNHS (IOSR-JNHS e-ISSN: 2320–1959.p- ISSN: 2320–1940. January 2014;3(1):13-23.
3. Khatoon F et al. Correlation and reproductive hormone and fructose with sperm count and motility in infertile males. SAJMR Spec J Multidiscip Res. 2014;3.
4. Khatoon F, Essaa Abdullah F, Mushtaq M, Balouch Z. Correlation of fructose with spermatogenesis. Pinnacle Biochem Res. 2014;1(1).
5. Khatoon F, Alam N, Mahmood A, Imtiaz F. Antisperms antibodies in infertile males attending a Tertiary Care Hospital in Karachi. Pak J Med Sci. 2012;28(1):171-4.
6. Khatoon F, Mahmood A. Association of BMI with testosterone. J Dow. 2012;6(2): 62-5.

7. Khatoon F et al. Association between BMI and prolactin levels in male patients science. J Med Clin Trials. ISSN: 2276-7487;2013:2012:Article ID sjmct-259, 6.
8. Chuang WW, Lo KC, Lipshultz LI, Lamb DJ. Male infertility. In: Strauss III JF, Barbieri RL, editors. Yen and Jaffes reproductive endocrinology Elsievier. Philadelphia: Saunders; 2004. p. 669-90.
9. The World Health Organization (WHO). The SuRF Report 2: TheSurveillance of chronic disease Risk Factors, Geneva. WHO; 2005.
10. Aboelnaga SM, Kahtoon F, Hameed R. Association between serum creatinine kinase and oral Submucousal fibrosis. Bull. Env. Pharmacol. Life Sci. April 2020;9(5):125-7.
11. Aboelnaga SM, Khatoon F. Effect of Mobile phone radiation on human health. Adv Biotechnol Microbiol. 2020;16(1):138-40.
12. Alkwai H, Aboelnaga SM, Hussain RA, Khatoon F. Surfactant protein D levels with obesity and type 2 diabetes mellitus. Gomal J Med Sci. 2020 January-March;18(1):39-42.
13. Khatoon F. Correlation of antioxidant zinc with Variousdiet pattern (fructose oxonic acid,fructose and oxonic acid) in induced hyperuricemia. Adv Biol Res. 2019;10(4).
14. Khatoon F, Aysha F et al. Effect of Lead toxicity and correlation with different variables of DNA damages. JIDMC J Islamabad Med Dent Coll. 2018;7(2).
15. Baker HWG, Barger HG, de Kretser DM, Hudson B. Relative incidence of etiologic disorders in male infertility. In: Male reproductive dysfunction: diagnosis and management of hypogonadism, infertility and impotence. New York: Marcel Dekker. (Santen RJ Swerdloff RS, editor). 1986;341-72.
16. Int J Obes Relat Metab Disord. Vermeulen A. Senile hypogonadism in man and hormone replacement therapy. Acta Med Austriaca. 2000;27(1):11-17;24(4):485-91.
17. Simoni M, Weinbauer GF, Gromoll J, Nieschlag E. Role ofFSH in male gonadal function. Ann Endocrinol (Paris). 1999;60(2):102-6.
18. Khatoon F, Essa F. Human Genetic Association Studies: Association between of Human genome with Clinical outcome. J Biotechnol Microbiol. 2018 ISSN: 2474-7637;10(1).
19. (karpas and Marrow) Morrow AF. Baker HWG, burger HG. Clin Reprod Fetil. Partial gonadotropin deficiency is infrequent in infertile men. 1986;4:319-27.
20. Khatoon, F. (2022). Association of Genetic and Reproductive Hormone with Infertility in Male. Progress in Medical Sciences,1–11.
21. Vydra N, Malusecka E, Jarzab M, Lisowska K, Glowala-Kosinska M, Benedyk K et al. Spermatocyte-specific expression of constitutively active heat shock factor 1 induces HSP70i-resistant apoptosis in male germ cells. Cell Death Differ. 2006;13(2):212-22.
22. Khatoon F et al. Polymorphism of apolipoprotein B and its correlation with adiposity. Spec J Multidiscip Res. 2014, ISSN 2278-0637;1(5, May):180-91.
23. Khatoon F et al. Polymorphism of apolipoprotein B and its correlation with adiposity. Spec J Multidiscip Res. 2014, ISSN 2278-0637;3(5, May):180-91.
24. Raman JD, Schlegal PH. Aromatase inhibitors for male fertility. J Urol. 2002;167(2 ntl):624-9..(126)excess testosterone.
25. Tüttelmann F, Gromoll J, Kliesch S. Genetics of male infertility. Urologe A. 2008;47(12):1561-2.
26. Reproductive endocrinology and infertility: integrating modern clinical and laboratory practice. Douglas T, Carrell C. Matthew Peterson. Springer-Verlag. 345-70.
27. Greil AL. Infertility and psychological distress: A critical review of the literature. Soc Sci Med. 1997;45(11):1679-704.
28. Skakkebaek NE, Giwercman A, de Kretser D. Pathogenesis and management of male infertility. Lancet. 1994;343(8911):1473-9.
29. Khatoon F, Zahid B. Role of dietary copper supplementation as an antioxidant in the induced hyper uricemic rat model. Vol. 5(12, January). p. 2320-5083http:; 2018.ISSN. Journal of International Academic Research for Multidisciplinary. Available: http://www.jiarm.com/JAN2018
30. Khatoon F, Abdullah FE. Human Genetic Association Studies: association between of Human genome with Clinical outcome. Adv Biotech Microgr. 2018;10(1):555778.
31. Hend Alkwai FK. Significance and Role of Genome Wide Association Studies in relation to Current Scenario of Human Genomic Framework. Adv Biol Res. November 2018.ISSN: 0976-4585;9(6).

32. Fahmida K. Use of deoxy ribonucleic acid in human identification. Gomal J Med Sci. 2018 ISSN: 1819-7973;16(October-December).
33. Fahmida K, Aysha F et al. Effect of Lead toxicity and correlation with different variables of DNA damages. JIDMC. 2018;7(2):102-7.
34. Ahmad F, Pervez A, Khatoon F, Ahmed Z, Mahmood S. Correlation of serum lead with various hematological parameters in male humans (car painters) of Lahore. Int J Biochem Photon. 2014;195:388-94. Impact Index: 4.52, e. ISSN: 4438-5728.
35. Ahmed F, Pervez A, Khatoon F. Association of Lead with Heamoglubin damage in males (car painters) of Lahore. IOSR journal of dental and medical sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861;13(1) Ver. IX. (Feb. 2014):83-8.
36. Meyerhardt JA, Niedzwiecki D, Hollis D, Saltz LB, Mayer RJ, Nelson H et al. Impact of body mass indexand weight change after treatment on cancer recurrence and survival inpatients with stage III colon cancer: findings from Cancer and Leukemia Group B 89803. J Clin Oncol. 2008;26:4109-15.
37. Khatoon F, Mahmood MR, Obeidat ST, Alsatti MAM, Alanazi RSSA, Kabbos RSMA et al. Assessment of Perception, Awareness about Predictors of Colorectal Cancer of Hail Region Saudi Arabia population. J Pharm Res Int. 2021;32(47):14-24.
38. Khatoon F. Challenges linked with adherence to treatment by adult TB patients in Pakistan. IOSR P-ISSN. PP-40-45;4(3):40-5.
39. Aboelnaga SM. Balouch Fk. Protective effect of yerba mate on rats fed on high cholesterol diet- an experimental study. J Clin Diagn Res. 2021;15(10) :BC09-13.
40. Shimaa MA, Fahmida K. Dietary habits and consumption of fruits and vegetables in type 2 Diabetes in Ha'il Saudi Arabia. Bull. Env. Pharmacol. Life Sci. 2020; 9(5):05-11.
41. Al-Hazimi A, Khatoon F. Strategies for Preventive measure and awareness tools for COVID-19 and for adherent stress and anxiety. Adv Biol Res. May 2020;11(13):54-62.ISSN: 0976-4585.
42. Kahtoon F, Ahmed RME, Iqbal N, Balouch Z, Alenazi FS. Genetic identification: a review on autosomal single nucleotide polymorphism's as diagnostic tool for identifying human. J Pharm Res Int. 2021;32(46):25-33.
43. Zahra A, Hassan SU, Hassan MS, Parveen N, Park JH, Iqbal N et al. Effect of physical activity and sedentary sitting time on psychological quality of life of people with and without disabilities; A survey from Saudi Arabia. Front Public Health. 2022;10:998890.
44. Hassan SU, Zahra A, Parveen N, Khatoon F, Bangi NA, Hosseinzadeh H. Quality of life and adherence to healthcare services during the COVID-19 pandemic: A cross-sectional analysis. Patient Prefer Adherence. 2022;16:2533-42.
45. Zakout YM, Khatoon F, Bealy MA, Khalil NA, Alhazimi AM. Role of the coronavirus disease 2019 (COVID-19) pandemic in the upgrading of personal hygiene. A cross-sectional study in Saudi Arabia. Saudi Med J. 2020 November;41(11):1263-9.
46. Aboelnaga SM, Khatoon F. Effect of Jerusalem artichoke and olive oil on hyperglycemic Rats. J Genet Cell Biol. 2020;4(1):207-16.
47. Aboelnaga SMH, Khatoon F. Effect of Low Fat Diet, lmonds, Green Coffee and mackerel Fish on Obese Rats. J Pharm Res Int. 2021;32(42):80-9.
48. Khatoon F, Al-Hazimi A. Pandemic COVID-19 comparative analysis with MERSA and SARS, Etiology epidemic and current Interventions with future prospective. Adv Biol Res. May 2020;11(13):31-6.ISSN: 0976-4585.
49. Khatoon F, Alkwai H et al. Preventive measure and Use of Herbal medicine for COVID-19 Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci. 2020;9(6):18-22 ISSN: 277-1808 ISI indexed journal published 9/5/2020.
50. Aboelnaga SMH, Khatoon F. Analyzing the impact of long-lasting changes in energy homeostasis and nutrient sensing on nutritional programming of hypothalamus in Rats. Asian J Med Health. 2021; 18(12):32-8.
51. Fahmida K. Recent techniques based on the utilization of DNA and autosomal single nucleotide polymorphism. Gomal J Med Sci. 2019;17(2);16(April-June):59-62 ; ISSN: 1819-7973.
52. Khatoon F, Yahya RS, et al. Natural regulatory T cells in some parasitic

diseases. J Bacteriol Parasitol. 2014;6 :210.

53. Cooper TG. WHO laboratory manual for the examination and processing of human semen. 5th ed. Geneva: WHO Press; 2010.
54. batool S, Fahmida k et al. Lowered serum metal levels in fructose-induced hyperuricaemic rat model. Natl Med J India. 2015;28(3).
55. Beg S, Almalki WH, Khatoon F, Malik Arshi, Afaq S, Choudhry H. Lipid- and polymer-based nanocomplexes in nucleic acid delivery as cancer vaccines. Drug Discov Today, ISSN 1359. 2021; 644.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/98603