ORIGINAL ARTICLE

Phnx Med J. March 2024, Volume 6 No 1
DOI:10.38175/phnx.1393369

The Effect of War Conditions and Social Stress on Semen Parameters in Syrian Refugees

Suriyeli Mültecilerde Savaş Koşulları ve Sosyal Stresin Semen Parametreleri Üzerindeki Etkisi

Deniz Aka Satar **Rıdvan Bağcı** **Umut Demirdelen**

Health Sciences University, Adana City Training and Research Hospital, Assisted Reproduction Unit, Andrology Laboratory Yüregir/Adana/Türkiye

ABSTRACT

Objective: *This study aims to evaluate the effects of stress due to war in Syrians exposed to after migration to Turkey on sperm parameters.*

Material and Method: *Syrian migrant patients who underwent spermiogram due to infertility were included in the study. The patients were divided into two groups according to the period when the migration started and the stress was felt intensely, and the period when the immigrants had settled down and had less stress. Sexual abstinence duration, age, ejaculate volume, sperm concentration, total motility, progressive motility, morphology according to Kruger Strict criteria, were evaluated.*

Results: *There were 300 patients in group 1 and 902 patients in group 2. There was a statistically significant relationship between the marital status of the refugee patients and the years. There was no statistically significant difference between the groups in terms of ejaculate volume, concentration, morphology and sexual abstinence parameters. The total motility values of the patients in group 2 were statistically significantly higher than the patients in group 1. The progressive motility values of the patients in group 2 were statistically significantly higher than the patients in group 1.*

Conclusion: *The heavy psychosocial stress created by the war and post-war migration affects both sperm motility and progressive motility.*

ÖZET

Amaç: *Bu çalışma, Türkiye'ye göç sonrası maruz kalan Suriyelilerde savaş kaynaklı stresin sperm parametreleri üzerine etkilerini değerlendirmeyi amaçlamaktadır.*

Gereç ve Yöntem: *İnfertilite nedeniyle spermiogram yapılan Suriyeli göçmen hastalar çalışmaya dahil edildi. Hastalar göçün başladığı ve stresin yoğun olarak hissedildiği dönem ile göçmenlerin yerleşip daha az stres yaşadıkları dönemlere göre iki gruba ayrıldı. Kruger Strict kriterlerine göre cinsel perhiz süresi, yaş, ejakülat hacmi, sperm konsantrasyonu, toplam hareketlilik, ilerleyici hareketlilik ve morfoloji değerlendirildi.*

Sonuçlar: *Grup 1'de 300, Grup 2'de ise 902 hasta vardı. Mülteci hastaların medeni durumu ile yıllar arasında istatistiksel olarak anlamlı bir ilişki vardı. Ejakülat hacmi, konsantrasyonu, morfolojisi ve cinsel perhiz parametreleri açısından gruplar arasında istatistiksel olarak anlamlı fark yoktu. Grup 2'deki hastaların total motilite değerleri grup 1'deki hastalara göre istatistiksel olarak anlamlı derecede yüksekti. Grup 2'deki hastaların ilerleyici motilite değerleri grup 1'deki hastalara göre istatistiksel olarak anlamlı derecede yüksekti.*

Sonuç: *Savaşın ve savaş sonrası göçün yarattığı ağır psikososyal stres, hem sperm hareketliliğini hem de ilerleyen hareketliliğini etkiliyor.*

Keywords:
Stress
Infertility
Sperm concentration
Sperm motility
Sperm morphology

Anahtar Kelimeler:
Stres
İnfertilite
Sperm konsantrasyonu
Sperm hareketliliği
Sperm morfolojisi

INTRODUCTION

Infertility is defined as the absence of pregnancy despite regular (two days a week) and unprotected sexual intercourse for one year (1,2). Infertility is a problem that affects 10-15 percent of couples of reproductive age, and the male factor alone accounts for about 50 percent of this problem (3,4).

Testicular and hypothalamo-pituitary diseases (such as cryptorchidism, orchitis, genital tract infections, varicocele, male genital tract obstructions and hypogonadism), genetic conditions (Kallmann or Klinefelter syndromes, globozoospermia and Y chromosome microdeletions), cancer, systemic diseases, medical treatments or endocrine disorders are the main causes of male infertility. In addition, lifestyle-related factors such as smoking, alcohol, drug use, high-energy nutrition, obesity and psychological stress negatively affect male reproductive potential (1,5,6).

The negative effects of stress (work stress, life stress, etc.) on sperm quality, sperm concentration, motility and morphology have been discussed in previous studies. However, studies investigating the effect of war on sperm parameters are limited (7, 8). How the war affects sperm parameters is not fully understood. However, exposures and traumas experienced during and after the war seem to cause this (7,8).

Correspondence: Deniz Aka Satar, Health Sciences University, Adana City Training and Research Hospital Assisted Reproduction Unit, Andrology Labaratory, 01330, Yüregir-Adana/Türkiye. **E mail:** denizakasatar@yahoo.com

Cite as: Satar Aka D, Bağcı R, Demirdelen U. The Effect of War Conditions and Social Stress on Semen Parameters in Syrian Refugees. Phnx Med J. 2024;6(1):6-10.

Received: 20.11.2023 **Accepted:** 07.12.2023 **Online Published:** 21.12.2023

Migration from Syria to Turkey began in March 2011 with the escalation of the civil war and violence in Syria. The civil war in Syria has displaced 6.5 million Syrians, hundreds of thousands have been injured or killed, and created a vacuum in basic infrastructures that will resonate across the region for years to come (9-11). With these events, there was an intense refugee influx to Turkey (12-15). Turkey hosts nearly four million Syrian refugees. It has been observed that refugees frequently experience various physical and mental health problems such as depression, anxiety and post-traumatic stress disorder (14,15).

This study aims to evaluate the effects of stress due to war in Syrians exposed to after migration to Turkey on sperm parameters.

MATERIAL AND METHOD

The study was started after the approval of the local ethics committee (Ethics committee decision no: 1994, date: 23.06.2022). In this retrospective study, the semen analyzes of 1202 Syrian refugees who applied to the IVF Center Andrology Laboratory of a tertiary hospital due to infertility between 2014 and 2021 were evaluated retrospectively. Ejaculate volume, sperm concentration, total and progressive motility, and morphology parameters were studied based on the 2010 semen analysis criteria of the World Health Organization (16). The patients were divided into two groups according to the years of admission to our clinic. The patients who applied in the first four years (2014-2017) when the effects of the stress caused by war and refugee were intense, were evaluated as the first group, and the patients who applied in the second four years (2018-2021) when the refugees settled in our country and the stress decreased (2018-2021) were considered as the second group.

Collection and Analysis of Samples

After 2-7 days of sexual abstinence, the patients delivered their semen samples in a sperm container by masturbation by ejaculating into a sterile, cylindrical container with a transparent, red cap in a dimly lit room. Received samples were kept in an incubator (Thermo Scientific®, USA) at 37°C for 30 minutes for liquefaction. Liquefied samples were taken into a sterile laminar cabinet (K-System®, USA) and the analysis process was started. After examining the macroscopic properties, the volumes of the samples were measured with the help of graduated conical tube. Then, 0.5 µl volume of semen from each sample was placed in the Counting Chamber Makler with a pipette. Counting was started under a phase contrast microscope (Olympus CX®, Japan) and at least 200 sperm were evaluated at 200X (20X objective, 10X ocular) magnification and sperm concentration, total and progressive motility were recorded. Semen samples with a concentration above 5 Million/ml were stained with a staining kit (Spermac Stain, FertiPro®, USA) and evaluated according to the Kruger morphology criteria. The semen samples of the first and second groups of Syrian refugee patients were compared according to the data obtained based on the 2010 Semen Analysis criteria of the World Health Organization.

Statistical Evaluation

Statistical analyzes were performed using a package program called SPSS (IBM SPSS Statistics 24). Frequency tables and descriptive statistics were used to interpret the findings. The "Mann-Whitney U" test (Z-table value) statistics were used to compare the measurement values of two independent groups in the data that did not have a normal distribution. "Pearson-$\chi 2$" crosstabs were used to examine the relationships between two qualitative variables.

RESULTS

A total of 1202 patients were included in the study. There were 300 patients in group 1 (applicants between 2014-2017) and 902 patients in group 2 (applicants between 2018-2021). The first patient application to the Andrology laboratory was in 2014. After the first application, patients' applications increased over the years. There was a statistically significant relationship between the marital status of the refugee patients and the years ($\chi 2=82.889$; $p=0.000$). While the rate of being married was significantly higher among refugee patients in all years, the rate of being married was the highest in 2015 (96.2%), and the rate of being single was the highest in 2021 (30.5%) (Table 1).

Table-2 shows the mean and median values of age, ejaculate volume, concentration, total and progressive motility percentage, percentage of normal morphology, and duration of sexual abstinence. A statistically significant difference was found between the groups in terms of age

Table 1: Examination of the relationship between the years of admission and marital status of refugee patients.

Variable	Married		Single		Total		Statistical analysis* Possibility
	n	%	n	%	n	%	
Years							
2014	65	92,8	5	7,1	70	5,8	
2015	51	96,2	2	3,8	53	4,4	
2016	77	92,7	6	7,3	83	6,9	
2017	88	93,6	6	6,4	94	7,8	$\chi 2=82,889$ $p=0,000$
2018	179	91,3	17	8,7	196	16,3	
2019	287	92,8	22	7,2	309	25,7	
2020	169	85,7	28	14,3	197	16,5	
2021	139	69,5	61	30,5	200	16,6	

**Pearson-$\chi 2$ crosstabs were used to analyze the relationships between two qualitative variables.*

Table 2: Comparison of sperm parameters according to year groups.

Variable	2014-2017 (n=302)		2018-2021 (n=900)		Statistical analysis* Possibility
	$\bar{X}$±S.D.	Median [Min-Max]	$\bar{X}$±S.D.	Median [Min-Max]	
Age (years)	29,46±6,24	29,0 [17,0-51,0]	28,39±6,40	28,0 [16,0-56,0]	Z=-3,013 p=0,003
Ejaculate Volume (ml)	3,49±1,68	3,3 [0,4-12,5]	3,69±1,72	3,5 [0,0-15,0]	Z=-1,773 p=0,076
Concentration (Million/ml)	23,81±32,78	10,8 [0,0-202,0]	27,23±34,99	13,0 [0,0-232,0]	Z=-1,940 p=0,052
Total motile sperm percentage (%)	35,34±26,21	38,5 [0,0-100,0]	41,04±23,35	43,0 [0,0-100,0]	Z=-3,267 p=0,001
Progressive motile sperm percentage (%)	29,36±24,74	28,0 [0,0-100,0]	33,75±29,20	33,0 [0,0-576,0]	Z=-2,639 p=0,008
Morphology (%)	1,34±1,93	1,0 [0,0-11,0]	1,43±1,87	1,0 [0,0-12,0]	Z=-1,278 p=0,201
Duration of sexual abstinence (Day)	4,09±1,15	4,0 [2,0-14,0]	4,12±1,44	4,0 [2,0-25,0]	Z=-0,146 p=0,884

**The "Mann-Whitney U" test (Z-table value) statistics were used to compare the measurement values of two independent groups in the data not having normal distribution.*

(Z=-3.013; p=0.003). The age of the patients in group 1 was statistically significantly higher than the age of the patients in group 2.

There was no statistically significant difference between the groups in terms of ejaculate volume (ml), concentration (Million/ml), morphology (percentage of normal sperm) and fasting time (days) parameters (p>0.05). A statistically significant difference was found between the groups in terms of percent total motility values (Z=-3.267; p=0.001). The total motility values of the patients in group 2 were statistically significantly higher than the patients in group 1.

A statistically significant difference was found between the groups in terms of progressive motility values (Z=-2.639; p=0.008). The progressive motility values of the patients in group 2 were statistically significantly higher than the patients in group 1.

DISCUSSION

It is not clear how war (psychological trauma and stress) affects sperm parameters. Psychological stress has been shown to be negatively related to various parameters associated with semen quality, including sperm concentration, motility, and morphology. Increased stress levels may be related to the direct effect of the war experience from acute stress, but also to marginalization, cultural problems, deterioration in physical infrastructure and socioeconomic conditions (14,17). The effects of stress may be through the hormonal component of spermatogenesis. There is evidence that such a phenomenon may be associated with hormonal changes observed in men during stressful events. Testicular biopsies from highly stressed prisoners showed complete spermatogenetic arrest in all cases (18).

The first patient included in our study admitted in 2014. The number of patients increased over the years. There was a statistically significant difference between the first years of war and the hardships of being a refugee (Group 1) and group 2, in which the refugees were partially settled, in terms of both the number of patients and their marital status. While the number of married patients was high in the first group, the number of single patient admissions was higher in the second group. The fact that families migrated by taking all kinds of risks together with the concern of protecting their spouse and children explains the excess of the married patient population in the first years, while the long duration of the war and the fact that the children who came with the families grew up and reached the age of marriage support the increase in the number of single patients in the second four years.

In our study, total motility and progressive motility values were statistically significantly lower in the first group compared to the second group. In a study examining the relationship between work stress and life stress and semen quality, it was reported that work stress was not associated with semen parameters, but life stress was negatively correlated with sperm concentration, motility and morphology (19). War is both life stress and psychosocial stress. This study is similar to our study in terms of motility, but differs in terms of concentration and morphology. In another study, it was shown that psychosocial stress reduces sperm concentration and motility, but does not affect morphology (20). However, in this study, it was limited to 3 months whether the patients experienced a major event related to stress or not. The fact that they found the change in sperm concentration with the acute effect significant may be due to the shortness of this period. In our study, we found that sperm motility was lower in group 1 patients, who migrated due to war, had more intense life and psychosocial stress from their place of residence and homeland, compared to group 2 patients, but their concentration and morphology were not significantly affected. The mechanism affecting semen

quality may be mediated by neuroendocrine factors affecting spermatogenesis (21). Stress causes an increase in seminal plasma reactive oxygen species, resulting in oxidative stress that affects semen quality and fertility (5,22). Most of the hypothetical pathways by which stress can affect semen quality operate under endocrine factors (23,24). Men living under stress have been shown to have lower testosterone and luteinizing hormone levels. However, while stress causes a secondary elevation in serum LH and FSH levels, it primarily lowers the serum total testosterone level, which alters the seminal quality (25). It has been reported that this situation impairs spermatogenesis, especially reduces sperm motility, and also negatively affects morphology and sperm count (23,24). Another study showed that an increase in post-stress levels of cortisol and adrenocorticotropic hormones may cause impaired conversion of androstenedione to testosterone in Leydig cells. This disruption results in lower mean semen volume, sperm concentration, and sperm cell motility, along with increased androstenedione and decreased testosterone levels (24). Stress can affect the level of many other factors in the plasma. For example, it has been shown that stress causes a significant increase in nitric oxide in plasma and a decrease in arginase activity, thus worsening semen quality (26). War is a psychosocial stress in which both the struggle for survival and severe traumas are experienced, perhaps it is an event where stress is experienced most intensely. While migrants struggle to survive in the country they migrate to, they are under stress with the anxiety that what they leave behind creates in them. In addition, the stress caused by the psychosocial effects of a new country and a new lifestyle will naturally affect all balances. Our study covers a long period. The significantly lower sperm motility in group 1 patients with intense stress may be due to stress-induced neuroendocrine mechanisms. The insignificance of concentration change in the long-term study may be due to the activation of adaptive mechanisms.

In a retrospective study that included 10000 semen samples to show the effects of the war on sperm parameters during and after the Lebanese civil war, it was determined that sperm concentration decreased during the war period compared to the 5-year period after the war. Again in this study, it was shown that the percentage of abnormal sperm morphology increased in the post-war period and that the war did not have a significant effect on semen volume and sperm motility (7). In this study, the authors stated that these changes in sperm parameters are due to the neuroendocrine mechanism created by war-related psychological stress. In our study, a significant difference was found between the groups in the percentages of total and progressive motile sperm. However, there was no significant difference between the two groups in terms of semen volume, concentration and sperm morphology. In a study conducted after the 10-day war in Slovenia in 1991, it was shown that there was a significant decrease in progressive motility and rapid progressive motility, and that sperm morphology and concentration did not change (27). Of course, the neuroendocrine changes caused by stress in the acute period and the changes that occur after long-term stress are different, and this situation also affects spermatogenesis differently. The effects of psychological stress on sperm parameters are still controversial and the mechanism by which it can affect semen quality is unclear. In addition to studies showing that stress negatively affects parameters related to semen quality, there are also studies showing that there is no relationship between the psychosocial status of men and semen parameters (28). This discrepancy may be explained by differences in population characteristics, study design, and assessment of psychosocial factors.

Fukuda et al. (29) evaluated only the short-term effects of the earthquake and found that sperm motility decreased in men who lost their homes as a result of the 1995 Kobe earthquake, but there was no significant difference between sperm concentrations before and after the earthquake. In our study, while there was a significant decrease in both total and progressive motility in the first group, who had to leave their homeland during the (acute) period of intense war and conflict, there was no significant difference in sperm concentrations between the two groups. The effects of disasters on semen parameters are a complex issue because many variables come into play that can affect semen parameters. Both the study of Fukuda et al (29) and our study showed that catastrophic events (civil war, loss of a family member during the war, and having to leave their homes) cause a disorder in sperm motility.

In a study conducted in the USA before and after a devastating natural disaster such as Hurricane Katrina, there was a significant difference between the two groups in terms of sperm motility and morphology, but no statistically significant difference was found in terms of concentration (30). In our study, we found that motility was significantly lower in the near period, which had devastating effects, compared to the distant period, and sperm morphology did not show a significant change. The study investigating the sperm effects of Hurricane Katrina was a study that included only normospermic patients and may explain this difference. The change in concentration between the two groups was not significant in our study either. War and post-war migration, living in a different place, pain and social stress cause significant differences between sperm parameters in both total and progressive motility. It also reveals that war conditions and social stress negatively affect sperm motility in Syrian patients. The high variability in semen parameters makes it difficult to obtain sufficient data in semen quality studies. More detailed studies are needed to clarify the information on this subject.

Conflict of Interest: No conflict of interest was declared by the authors.
Ethics: This research is approved by the local ethics committee (decision no: 1994, date: 23.06.2022).
Funding: There is no financial support of any person or institution in this research.
Approval of final manuscript: All authors.

REFERENCES

1. Baskaran S, Finelli R, Agarwal A, Henkel R. Diagnostic value of routine semen analysis in clinical andrology. Andrologia. 2021; 53(2): 1-12.
2. Satar Aka D, Gencdal S. Sperm Analysis. Arsiv Kaynak Tarama Dergisi. 2013;22 (4): 532-542.
3. Zou P, Sun L, Chen Q, Zhang G, Yang W, Zeng Y, et al. Social support modifies an association between work stress and semen quality: Results from 384 Chinese male workers. Journal of psychosomatic research. 2019; 117: 65–70.
4. Satar Aka D, Narin R, Globozoospermia. Cukurova Medikal Journal. 2014; 392(1): 1-6.
5. Agarwal A, Parekh N, Panner Selvam MK, Henkel R, Shah R, Homa ST, et al. Male Oxidative Stress Infertility (MOSI): Proposed Terminology and Clinical Practice Guidelines for Management of Idiopathic Male Infertility. World JMen Health. 2019;37(3): 296–312.
6. Fainberg J, Kashanian JA. Recent advances in understanding and managing male infertility. F1000Research. 2019; 8(670): 1- 8.
7. Abu-Musa AA, Nassar AH, Hannoun AB, Usta IM. Effect of the Lebanese civil war on sperm parameters. Fertil Steril. 2007;88(6): 1579–1582.
8. Abu-Musa AA, Kobeissi L, Hannoun AB, Inhorn MC. Effect of war on fertility: a review of the literature. Reprod Biomed Online. 2008;17(1): 43–53.
9. Bolouki A, Zal F. Impact of War on Fertility and Infertility. Arch. Iran Med. 2020;23(4): 16-22.
10. Sharara SL, Kanj SS. War and infectious diseases: challenges of the Syrian civil war. PLoS Pathog. 2014;10 (11): 1-4.
11. Pierini M. In Search Of An Eu Role In the Syrian War Carnegie Endowment for International Peace. 2016;1-33.
12. Ozden S. Syrian refugees in Turkey. Migration Policy Centre (MPC), Research Report. 2013;5: 1-12.
13. Toksoz S, Kızılkan Y. Azospermia rates and affecting factors in local population and refugee patient groups. Androloji Bulteni. 2019;(21): 45-49.
14. Smeekes A, Verkuyten M, Celebi E, Acarturk C, Onkun S. Social identity continuity and mental health among Syrian refugees in Turkey. Soc Psychiatry Psychiatr Epidemiol. 2017;52: 1317-1324.
15. Sijbrandij M, Acarturk C, Bird M, Bryant RA, Burchert S, Carswell K, et al. Strengthening mental health care systems for Syrian refugees in Europe and the Middle East: integrating scalable psychological interventions in eight countries. Eur J Psychotraumatol. 2017;8: 1-11.
16. World Health Organization: WHO Laboratory Manual for the Examination and Processing of Human Semen. 5th Edition. Geneva 2010.
17. Porter M, Haslam N. Predisplacement and postdisplacement factors assosiated with mental health of refugees and internally displaced persons: a meta-analysis. JAMA.2005;294 (5): 602-612.
18. Kobeissi L, Inhorn MC, Hannoun AB, Hammoud N, Awwad J, Abu-Musa AA. Civil war and male infertility in Lebanon. Fertil Steril. 2008;90(2): 340–345.
19. Javenic T, Kahn LG, Landsbergis P, Crillo PM, Chon BA, Liu X, Factor- Litvak P. Effects of work and life stress on semen quality. Fertil Steril. 2014; 102(2):530-538.
20. Gollenberg AL, Liu F, Brazil C, Drobnis EZ, Guzick D, Overstreet JW, et al. Semen quality in fertile men in relation to psychosocial stress. Fertil Steril. 2010;93(4), 1104–1111.
21. Pallav S, Arafa M, Haitham Elbardisi H. Hormonal regulation of spermatogenesis. Molecular signaling in spermatogenesis and male infertility. CRC Press, 2019. 41-49.
22. Kao S, Chao H, Chen H, Hwang T, Liao T, Wei Y. Increase of oxidative stress in human sperm with lower motility. Fertil Steril. 2008;89: 1183-90.
23. King JA, Rosal M.C, Ma Y, Reed GW. Association of stress hostility and plasma testosterone levels. Neuro Endocrinol Lett. 2005;26: 355-360.
24. Kreuz LE, Rose RM, Jennnigs JR. Supression of plasma testosterone levels and psychological stress. A longutidinal study of young men in Officer Candidate School. Arch Gen Psychiatry. 1972;26: 479-482.
25. Bhongade MB, Prasad S, Jiloha RC, Ray PC, Mohapatra S, Koner BC. Effect of psychological stress on fertility hormones and seminal quality in male partners of infertile couples. Andrologia. 2015;47(3):336-342.
26. Eskiocak S, Gozen AS, Taskiran A, Kilic AS, Eskiocak M, Gulen S. Effects of psychological stress on the L-arginine- nitric-oxide pathway and semen quality. Braz J Med Biol Res. 2006;39: 581-588.
27. Zorn B, Sucur V, Stare J, Maden-Vrtovec H. Decline in sex ratio at birth after 10 day war in Slovenia. Hum Reprod. 2002; 17: 3173- 3177.
28. Zorn B, Auger J, Velikonja V, Kolbezen M, Meden-Vrtovec H. Psychological factors in male partners of infertile couples: relationship with semen quality and early miscarriage. International Journal of Andrology. 2008; 0105-6263.
29. Fukuda M, Fukuda K, Shimizu T, Moler H. Decline in sex ratio at birth after Kobe eartquake. Hum Reprod. 1998; 13: 2321-2322.
30. Baran C, Hellstrom WJ, Sikka SC. A comparative evaluation of semen parameters in pre- and post- Hurricane Katrina human population. Asian Journal of Andrology. 2015;17: 676-680.