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Original Research

Associations of the February 2023 Earthquakes with Semen and Serum Parameters in Men Undergoing Infertility Evaluation, Stratified by Psychiatric Diagnosis: a Retrospective Cross-Sectional Study

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ABSTRACT

Objective: To compare semen and serum parameters between the pre- and post-earthquake periods among men undergoing infertility evaluation and to examine whether the observed patterns differed according to recorded psychiatric diagnosis.

Methods: This retrospective comparative cross-sectional study used hospital records from before (January 1, 2021-February 5, 2023) and after (February 6, 2023-December 31, 2024) the February 6, 2023 earthquakes, which affected 11 provinces in Türkiye. Participants were selected by simple random sampling. The study included 274 men: 82 in the pre-earthquake period and 192 in the post-earthquake period. Overall, 137 had a recorded psychiatric diagnosis and 137 did not.

Results: In the overall sample, motile sperm, free T4, progesterone, direct bilirubin, total bilirubin, cholesterol, magnesium, and triglyceride values differed significantly between the pre- and post-earthquake periods (all $p < 0.050$). Among men with a recorded psychiatric diagnosis, sperm concentration and total testosterone were higher in the post-earthquake period (both $p < 0.050$). Among men without a recorded psychiatric diagnosis, free T4 was higher, whereas TSH, magnesium, and triglyceride values were lower in the post-earthquake period (all $p < 0.050$).

Conclusion: The post-earthquake period was associated with lower sperm motility and differences in several serum parameters among men undergoing infertility evaluation. In the subgroup with recorded psychiatric diagnoses, sperm concentration and total testosterone were higher after the earthquake. Because the study compared unmatched groups and included no objective measure of stress, these findings do not establish a causal effect of earthquake-related psychological trauma.

Keywords: earthquake, male infertility, psychiatric diagnosis, retrospective study, semen analysis

INTRODUCTION

On February 6, 2023, two earthquakes with magnitudes of Mw 7.7 and Mw 7.6 occurred at 04:17 and 13:24 local time, with epicenters in the Pazarcık and Elbistan districts of Kahramanmaraş Province, respectively. The earthquakes caused severe damage across 11 provinces, including Kahramanmaraş, Hatay, Adıyaman, Gaziantep, Malatya, Kilis, Diyarbakır, Adana, Osmaniye, Şanlıurfa, and Elazığ [1]. Beyond their social and economic consequences, major disasters may be followed by psychological distress and psychiatric disorders, including post-traumatic stress disorder (PTSD), anxiety disorders, and depressive disorders [2–5].

Male factors contribute to approximately half of infertility cases and are frequently associated with abnormal semen parameters [6,7]. Infertility is commonly defined as failure to achieve pregnancy after at least 12 months of regular unprotected sexual intercourse [8]. Its prevalence varies with demographic and socioeconomic characteristics, and infertility is estimated to affect more than 80 million people worldwide [9]. Psychological stress has been associated with changes in semen parameters, although the evidence is heterogeneous and does not uniformly support a causal relationship [10].

Main Points

- This study demonstrates that catastrophic earthquake trauma substantially modifies spermiogram parameters and metabolic markers in infertile male patients.
- Post-disaster evaluations revealed a notable reduction in motile sperm counts, magnesium levels, and triglyceride concentrations within the research cohort.
- The earthquake's impact resulted in a significant elevation of Free T4, cholesterol, and progesterone levels, signifying a systemic endocrine reaction to shock.
- Patients with concomitant psychological disorders demonstrated an unforeseen increase in sperm concentration and testosterone levels subsequent to the accident.
- The results indicate a clear difference in hormonal and reproductive outcomes between patients with pre-existing psychiatric problems and those without.

Studies conducted after major earthquakes have reported associations between disaster exposure and semen quality, particularly reductions in sperm motility [11,12]. Lower sperm motility and differences in semen quality have also been reported among men with PTSD compared with those without PTSD [13]. Psychological stress may influence spermatogenesis through the hypothalamic-pituitary-gonadal axis and stress-related hormonal regulation; however, the direction and magnitude of these effects may vary with stress severity and duration, individual adaptation, and the timing of assessment [13]. Consistent with this complexity, a longitudinal study conducted after the Wenchuan earthquake reported progressive reductions in sperm concentration and motility among male survivors [11].

The Kobe earthquake study reported a temporary reduction in sperm motility, particularly among men whose homes were destroyed; however, this observational association does not by itself establish a direct causal effect. Sperm motility recovered over the subsequent months in many participants [12].

PTSD has been associated with dysregulation of the hypothalamic-pituitary-adrenal axis and altered stress-hormone profiles [14]. Associations between psychological stress and reproductive outcomes have also been reported in female infertility and in vitro fertilization populations [15,16]; however, those findings should not be directly extrapolated to male reproductive function.

Although prior studies suggest that major disasters may be associated with impaired semen quality, individual responses are heterogeneous and causal inference remains difficult. This study therefore compared semen and serum parameters between the pre- and post-earthquake periods among men undergoing infertility evaluation and examined the findings according to recorded psychiatric diagnosis.

MATERIALS AND METHODS

This retrospective comparative cross-sectional study included men who presented for infertility evaluation and treatment at the urology department of Malatya Turgut Özal University in Türkiye (Desicion no: 2025/5 Date: January 6, 2025).

The study period was divided according to the earthquake date. The pre-earthquake period extended from January 1, 2021, through February 5, 2023, and the post-earthquake period

extended from February 6, 2023, through December 31, 2024. Data were obtained retrospectively from hospital records. A power analysis performed in G*Power 3.1 indicated a minimum of 81 observations per period based on a stated effect size of 0.52, a significance level of 0.05, and a statistical power of 0.95. Participants were selected by simple random sampling.

A standardized data collection form was developed for this retrospective study. Patients with male infertility were identified in the electronic medical record system using International Classification of Diseases, Tenth Revision (ICD-10) diagnostic codes. Demographic, biochemical, hormonal, and semen-analysis data were then extracted from the records.

Psychiatric diagnoses were identified retrospectively from the same electronic medical record system using ICD-10 codes assigned by board-certified psychiatrists during routine clinical practice. The diagnosis used in the analysis was the diagnosis recorded at the time of semen analysis. No additional psychiatric assessment was performed for this study. Information on psychiatric treatment, medication use, symptom severity, and treatment duration was not consistently available and therefore could not be included in the analyses.

The collected variables included age; serum triiodothyronine (T3), thyroxine (T4), thyroid-stimulating hormone (TSH), follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin, testosterone, prostate-specific antigen (PSA), and free PSA; and semen-analysis parameters, including Kruger morphology, progressive motility (PR), non-progressive motility (NP), immotility (IM), sperm concentration, motile sperm concentration, total motility, total motile sperm count, total progressive motile sperm count, total sperm count, semen volume, pH, viscosity, liquefaction time, leukocyte count, and normal sperm morphology.

The inclusion criteria were male sex, age 18–45 years, a clinical diagnosis of male infertility, presentation during one of the prespecified study periods, and availability of the required clinical and laboratory records. Records with incomplete data required for the analysis were excluded.

Patients were instructed to maintain 3–4 days of sexual abstinence before semen collection. Samples were obtained by masturbation into sterile containers and analyzed by experienced personnel in the same andrology laboratory. Semen analyses were performed according to the sixth edition of the World Health Organization Laboratory Manual [17].

Statistical Analysis

Analyses were performed using R software, version 4.5.2 (R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at $p < 0.050$. Data were summarized using the mean, standard deviation, median, count, and percentage, as appropriate. Independent-samples t tests were used to compare normally distributed continuous variables, and Mann-Whitney *U* tests were used for non-normally distributed continuous variables. Categorical variables were compared using Pearson's Chi-square test.

RESULTS

A total of 274 patients were included: 82 in the pre-earthquake period and 192 in the post-earthquake period. Of the 82 patients evaluated before the earthquake, 60 had a recorded psychiatric diagnosis and 22 did not. Of the 192 patients evaluated after the earthquake, 77 had a recorded psychiatric diagnosis and 115 did not. Thus, the overall sample comprised 137 patients with and 137 without a recorded psychiatric diagnosis (Table 1).

The distribution of recorded psychiatric diagnosis status differed significantly between the pre- and post-earthquake periods ($p < 0.001$). In the overall sample, motile sperm, magnesium, and triglyceride values were lower in the post-earthquake group, whereas free T4, progesterone, direct bilirubin, total bilirubin, and cholesterol values were higher (Table 2).

Table 1. Distribution of recorded psychiatric diagnosis status by study period

Variable	Before the Earthquakes (n/%)	After the Earthquakes (n/%)	Total	χ^2	p
Psychiatric diagnoses (-)	22 (26.83%)	115 (59.90%)	137 (50.00%)	25.131	0.001*
Psychiatric diagnoses (+)	60 (73.17%)	77 (40.10%)	137 (50.00%)		

n; frequency, %; percent, χ^2; chi-square test, *$p < 0.050$

Table 2. Comparison of study variables between the pre- and post-earthquake periods

Variables Mean ± sd		Patient Group Before the Earthquakes	Patient Group After the Earthquakes	t	p
		Mean ± SD	Mean ± SD		
Spermiogram	Total Motile Sperm Concentration	30.8 ± 27.25	33.28 ± 30.37	0.612	0.541
	Immotile Sperm	57.42 ± 18.62	60.17 ± 18.23	1.136	0.257
	Kruger test	8.26 ± 4.64	7.50 ± 4.17	-1.346	0.179
	Normal Morphological Sperm	18.90 ± 19.61	16.50 ± 17.35	-1.011	0.313
	Total Motile Sperm	86.40 ± 72.95	79.72 ± 72.28	-0.699	0.485
	Total Motility	43.08 ± 18.00	39.83 ± 18.23	-1.356	0.176
	Total Sperm Concentration	194.61 ± 144.73	191.73 ± 155.25	-0.143	0.886
	Total Progressive Motile Sperm	67.23 ± 63.37	63.57 ± 63.99	-0.435	0.664
	Non-progressive Motile Sperm	13.29 ± 9.64	11.22 ± 6.49	**-2.073**	**0.039***
	Progressive Motile Sperm	24.52 ± 22.38	26.53 ± 26.77	0.594	0.553
Serum Parameters	Free T3	3.53 ± 0.37	3.62 ± 0.41	1.710	0.088
	Free T4	1.23 ± 0.22	1.31 ± 0.16	3.158	0.002*
	FSH	4.77 ± 2.44	5.01 ± 4.22	0.471	0.638
	LH	5.54 ± 1.68	5.72 ± 2.24	0.653	0.514
	Prolactin	12.11 ± 4.50	11.42 ± 4.25	-1.214	0.226
	Testosterone	4.16 ± 1.29	4.42 ± 1.73	1.263	0.208
	Procalcitonin	0.07 ± 0.01	0.07 ± 0.01	0.214	0.831
	TSH	3.07 ± 10.90	1.76 ± 1.23	-1.642	0.102
	Ferritin	112.63 ± 66.86	111.49 ± 82.90	-0.111	0.912
	Folic Acid	6.77 ± 2.06	6.56 ± 2.18	-0.737	0.462
	Free PSA	0.33 ± 0.07	0.33 ± 0.08	-0.487	0.627
	PSA	0.76 ± 0.19	0.75 ± 0.19	-0.102	0.918
	Vitamin B12	361.57 ± 103.15	340.79 ± 128.69	-1.295	0.196
	Estradiol	26.90 ± 3.08	27.47 ± 11.13	0.451	0.652
	Parathormone	33.48 ± 6.25	33.83 ± 4.92	0.493	0.622
	Progesterone	0.21 ± 0.04	0.22 ± 0.04	**2.038**	**0.042***
	D. Bilirubin	0.19 ± 0.07	0.22 ± 0.10	**2.322**	**0.021***
	Glucose	98.27 ± 19.95	96.99 ± 16.34	-0.554	0.580
	Total Bilirubin	0.56 ± 0.24	0.67 ± 0.39	**2.442**	**0.015***
	Urea	29.18 ± 8.65	30.69 ± 7.50	1.454	0.147
	Cholesterol	191.05 ± 33.04	182.13 ± 30.67	**-2.155**	**0.032***
	Magnesium	1.98 ± 0.13	1.94 ± 0.10	**-2.719**	**0.007***
	Triglyceride	182.62 ± 122.74	153.71 ± 78.05	**-2.341**	**0.020***

sd; standard deviation, t; independent sample t test, *$p < 0.050$

Among patients with a recorded psychiatric diagnosis, sperm concentration and total testosterone differed significantly between the pre- and post-earthquake periods (both $p < 0.050$) and were higher in the post-earthquake group (Table 3).

Among patients without a recorded psychiatric diagnosis, free T4, TSH, magnesium, and triglyceride values differed significantly between the pre- and post-earthquake periods (all $p < 0.050$). Free T4 was higher, whereas TSH, magnesium, and triglyceride values were lower in the post-earthquake group (Table 4).

DISCUSSION

Natural disasters can have substantial physical and psychological consequences. Evidence concerning reproductive outcomes after environmental disasters has focused largely on pregnancy and perinatal health [18,19], whereas evidence specific to male reproductive health remains limited. Long-term psychological consequences, including post-traumatic stress symptoms, depression, and anxiety, have been documented after disasters [20].

The post-earthquake period included more infertility-related clinic presentations than the pre-earthquake period. Although post-disaster psychological stress may affect the hypothalamic-pituitary-gonadal axis and spermatogenesis [21], the observed difference in presentation counts should not be interpreted as evidence of an increased population incidence of infertility. Changes in healthcare access, referral patterns, service centralization, public awareness, and patient selection may also have contributed to the difference.

Studies conducted after the Wenchuan and Kobe earthquakes and during an acute conflict-related stress event reported reductions in sperm motility or total motile sperm count [11,12,22]. More broadly, psychological stress has been associated with sperm concentration, motility, morphology, and DNA integrity, although findings are not uniform across studies [10,23,24,25]. In the Kobe study, motility generally recovered within several months, but recovery took longer among men with greater exposure [12].

Consistent with some previous reports, motile sperm values were lower in the post-earthquake group in our study. This cross-sectional group difference is compatible with, but does not prove, an adverse effect of disaster-related stress. Other research has found no association between self-reported stress or stressful life events and testicular function, underscoring the potential influence of sampling, exposure measurement, and other confounders [26].

Spermatogenesis is sensitive to environmental exposures [27]. Psychological stress may alter reproductive function through interactions between the hypothalamic-pituitary-adrenal and hypothalamic-pituitary-gonadal axes [21]. In this study, however, patients with recorded psychiatric diagnoses had higher sperm concentration and total testosterone in the post-earthquake period, a pattern that does not fit a simple, uniform stress-suppression model. The finding may reflect differences between the unmatched pre- and post-earthquake samples, the timing and intensity of exposure, heterogeneity of psychiatric diagnoses, or unmeasured clinical and treatment-related factors. Because cortisol, symptom severity, and medication use were unavailable, the underlying mechanism cannot be determined from these data.

The concurrent post-earthquake differences in sperm concentration and total testosterone among patients with recorded psychiatric diagnoses warrant cautious interpretation. The study did not obtain repeated measurements from the same individuals; therefore, these findings represent differences between two independent samples rather than within-person changes.

Age distribution, lifestyle, medication use, sample composition, and measurement timing may have differed between the two periods. The higher sperm concentration observed in one subgroup should therefore be interpreted as a sample-level association rather than evidence of physiological adaptation. This caution is particularly important in the context of debated secular trends in sperm concentration [28,29].

Prolactin values were lower in the post-earthquake group, but the difference was not statistically significant. Hyperprolactinemia, including medication-induced hyperprolactinemia, can affect gonadal function [30–32]; however, medication data were unavailable, and the present study cannot attribute the observed pattern to treatment changes. Although samples were analyzed in the same laboratory, variation in abstinence duration and other pre-analytical factors may still affect semen parameters [33].

Table 3. Comparison of pre- and post-earthquake values among patients with a recorded psychiatric diagnosis

Variables	Patient Group Before the Earthquakes		Patient Group After the Earthquakes		Mann Whitney *U*	p
	Mean ± SD	M (Min - Max)	Mean ± SD	M (Min - Max)		
Total Motile Sperm Concentration	27.26 ± 25.36	20.05 (0.2-129.3)	37.72 ± 34.13	26.6 (0.2-152.1)	2190.500	0.143
Immotile Sperm	58.43 ± 19.34	54 (3-100)	60.31 ± 18.49	54 (26-100)	2387.500	0.737
Kruger test	8.14 ± 4.97	7.73 (2-30)	7.79 ± 3.75	7.73 (2-19)	2375.000	0.777
Normal Morphological Sperm	18.5 ± 21.14	17.22 (0.4-147.5)	17.66 ± 15.09	13.9 (0.4-65.8)	2258.000	0.821
Total Motile Sperm	81.07 ± 70.84	79.65 (0.6-387.9)	85 ± 74.91	63.2 (1-304.2)	2321.000	0.962
Total Motility	42.26 ± 18.56	46 (3-97)	39.69 ± 18.49	46 (0-74)	2201.000	0.636
Total Sperm Concentration	59.54 ± 49.74	57.05 (2-196.1)	85.99 ± 72.68	63.7 (2.4-365.4)	***2768.000***	***0.048****
Total Progressive Motile Sperm	62.49 ± 62.05	52.35 (0-350.1)	68.62 ± 66.52	52.5 (0-279.2)	2356.500	0.840
Non-progressive Motile Sperm	13.84 ± 10.21	11 (3-50)	10.78 ± 6.39	9 (0-37)	1915.500	0.086
Progressive Motile Sperm	22.04 ± 20.65	17.85 (0-116.7)	30.69 ± 29.79	23 (0-139.6)	2607.000	0.197
Free T3	3.55 ± 0.39	3.59 (1.85-4.88)	3.61 ± 0.37	3.59 (2.37-4.55)	2452.000	0.530
Free T4	1.24 ± 0.24	1.24 (0.04-1.67)	1.31 ± 0.17	1.29 (0.94-1.72)	2714.500	0.079
FSH	4.84 ± 2.59	4.94 (0.3-17.27)	4.81 ± 3.02	4.94 (0.97-24.1)	2225.500	0.703
LH	5.71 ± 1.74	5.66 (0.3-11.52)	5.82 ± 1.96	5.66 (1.99-16.4)	2253.000	0.796
Prolactin	11.33 ± 3.27	11.62 (3.01-21.51)	11.72 ± 3.58	11.62 (4.2-29.2)	2249.500	0.781
Testosterone	4.26 ± 1.29	4.34 (1.96-9.29)	4.59 ± 1.41	4.34 (1.68-8.38)	***2769.500***	***0.039****
Procalcitonin	0.07 ± 0.01	0.07 (0.07-0.07)	0.07 ± 0.01	0.07 (0.06-0.16)	2310.000	1.000
TSH	3.37 ± 12.74	1.54 (0.33-100)	1.75 ± 1.05	1.51 (0.2-5.94)	2351.500	0.857
Ferritin	113.42 ± 64.75	111.83 (9.44-437)	101.91 ± 55.71	111.83 (9.92-349)	2036.000	0.226
Folic Acid	6.8 ± 2.28	6.62 (2.2-16.9)	6.44 ± 2.28	6.62 (2.06-20)	1996.000	0.145
Free PSA	0.33 ± 0.04	0.33 (0.17-0.62)	0.33 ± 0.06	0.33 (0.07-0.66)	2315.000	0.962
PSA	0.76 ± 0.17	0.75 (0.33-1.53)	0.76 ± 0.17	0.75 (0.28-1.48)	2462.500	0.341
Vitamin B12	365.91 ± 100.47	347.01 (186.8-673)	348.2 ± 140.04	347.01 (112-1197)	2001.000	0.174
Estradiol	26.76 ± 3.6	27.3 (5-37.5)	26.68 ± 2.46	27.3 (16.1-35.1)	2218.000	0.474
Parathormone	34.1 ± 6.01	33.72 (12.9-71.3)	34.37 ± 6.38	33.72 (22.7-76.89)	2253.000	0.699
Progesterone	0.21 ± 0.03	0.22 (0.05-0.23)	0.22 ± 0.05	0.22 (0.05-0.43)	2453.000	0.238
D. Bilirubin	0.19 ± 0.07	0.19 (0.1-0.53)	0.22 ± 0.11	0.21 (0.1-0.64)	2616.000	0.183
Glucose	98.05 ± 21.91	94 (40-187)	94 ± 12.41	93 (66-132)	2139.000	0.458
Total Bilirubin	0.56 ± 0.24	0.51 (0.14-1.79)	0.7 ± 0.44	0.64 (0.19-2.81)	2712.000	0.081
Urea	29.04 ± 8.59	28.6 (4.1-49.8)	28.95 ± 6.84	28.4 (16.2-50)	2332.500	0.922
Cholesterol	190.95 ± 32.93	184.8 (104-281)	185.03 ± 31.24	184.8 (129-307)	2089.000	0.332
Magnesium	1.98 ± 0.14	1.95 (1.57-2.46)	1.96 ± 0.1	1.95 (1.68-2.37)	2070.000	0.219
Triglyceride	164.35 ± 70.51	162.36 (50-463)	148 ± 68.4	162.36 (39-340)	2001.000	0.175

SD; standard deviation, M; median, *$p < 0.050$

Table 4. Comparison of pre- and post-earthquake values among patients without a recorded psychiatric diagnosis

Variables	Patient Group Before the Earthquakes		Patient Group After the Earthquakes		Mann Whitney *U*	p
	Mean ± SD	M (Min - Max)	Mean ± SD	M (Min - Max)		
Total Motile Sperm Concentration	39.15 ± 30.26	34.7 (1.5-104.2)	30.46 ± 27.5	22 (0.4-137.8)	1061.500	0.233
Immotile Sperm	54.68 ± 16.59	50.5 (25-94)	60.08 ± 18.13	55 (3-97)	1491.000	0.185
Kruger test	8.6 ± 3.68	8.5 (2-19)	7.3 ± 4.44	7 (2-29)	992.500	0.109
Normal Morphological Sperm	20 ± 14.99	17.22 (0.5-56.1)	15.72 ± 18.74	9.9 (0-147.5)	954.000	0.068
Total Motile Sperm	100.96 ± 78.24	80.4 (1.5-241.5)	76.19 ± 70.57	52.4 (0.5-387.9)	1021.500	0.153
Total Motility	45.32 ± 16.59	49.5 (6-75)	39.92 ± 18.13	45 (3-97)	1039.000	0.185
Total Sperm Concentration	214.79 ± 155.33	155.9 (19.2-492.5)	183.29 ± 141.51	159.4 (5.7-601.1)	1142.000	0.471
Total Progressive Motile Sperm	80.15 ± 66.59	67.15 (0-200)	60.18 ± 62.3	35.8 (0-350.1)	1031.000	0.170
Non-progressive Motile Sperm	11.77 ± 7.9	10.5 (5-44)	11.51 ± 6.58	10 (2-40)	1228.000	0.828
Progressive Motile Sperm	31.29 ± 25.84	26.7 (0-81.6)	23.74 ± 24.27	17.2 (0-123.1)	1048.000	0.203
Free T3	3.47 ± 0.29	3.5 (3.07-4.11)	3.62 ± 0.45	3.6 (2.5-4.59)	1594.000	0.054
Free T4	1.21 ± 0.15	1.21 (0.95-1.59)	1.31 ± 0.15	1.29 (0.91-1.75)	**1804.000**	**0.002***
FSH	4.57 ± 2.04	4 (1.53-9.22)	5.14 ± 4.87	4.14 (0.3-31.7)	1206.500	0.732
LH	5.08 ± 1.46	4.7 (2.56-8.31)	5.65 ± 2.41	5.06 (0.85-15.5)	1413.500	0.384
Prolactin	14.22 ± 6.44	13.3 (6-29.1)	11.21 ± 4.66	10.36 (0.27-31.3)	950.500	0.065
Testosterone	3.87 ± 1.27	3.78 (1.75-5.94)	4.31 ± 1.92	3.97 (0.66-10.9)	1384.500	0.484
Procalcitonin	0.07 ± 0	0.07 (0.06-0.07)	0.07 ± 0.01	0.07 (0.03-0.12)	1244.000	0.762
TSH	2.26 ± 1.42	1.79 (0.74-7.16)	1.76 ± 1.33	1.52 (0.38-11.2)	**909.500**	**0.037***
Ferritin	110.49 ± 73.85	111.83 (21.8-313)	117.9 ± 96.65	111.83 (9.88-574.5)	1321.500	0.736
Folic Acid	6.68 ± 1.35	6.62 (4-9.43)	6.65 ± 2.12	6.62 (2.15-20)	1213.500	0.747
Free PSA	0.33 ± 0.11	0.33 (0.04-0.62)	0.32 ± 0.08	0.33 (0.03-0.66)	1266.000	0.993
PSA	0.75 ± 0.25	0.75 (0.2-1.28)	0.75 ± 0.2	0.75 (0.17-1.49)	1252.000	0.923
Vitamin B12	349.74 ± 111.69	347.01(145-671)	335.84 ± 120.89	343 (125-859)	1092.000	0.304
Estradiol	27.3 ± 0	27.3 (27.3-27.3)	28 ± 14.24	27.3 (5-166)	1210.000	0.607
Parathormone	31.78 ± 6.71	33.72 (3.62-36.2)	33.46 ± 3.62	33.72 (17.5-50.69)	1311.000	0.654
Progesterone	0.21 ± 0.04	0.22 (0.05-0.27)	0.22 ± 0.04	0.22 (0.05-0.43)	1298.000	0.704
D. Bilirubin	0.19 ± 0.07	0.19 (0.1-0.33)	0.22 ± 0.09	0.21 (0.1-0.68)	1503.000	0.161
Glucose	98.86 ± 13.62	94.5 (81-143)	98.99 ± 18.29	96 (40-187)	1256.000	0.958
Total Bilirubin	0.54 ± 0.23	0.53(0.14-1.01)	0.65 ± 0.35	0.64 (0.2-2.78)	1497.500	0.171
Urea	29.59 ± 8.99	31.3 (4.1-43.4)	31.85 ± 7.73	30.3 (16.3-52.5)	1385.500	0.480
Cholesterol	191.34 ± 34.13	184.8 (144-281)	180.19 ± 30.27	184.8 (114-286)	1128.000	0.416
Magnesium	1.99 ± 0.1	1.95 (1.89-2.34)	1.93 ± 0.1	1.95 (1.64-2.33)	**909.500**	**0.010***
Triglyceride	232.45 ± 201.46	162.36 (62-1000)	157.53 ± 83.97	161 (43-574)	**877.000**	**0.021***

SD; standard deviation, M; median, *$p < 0.050$

Limitations

This study has several limitations. Its observational, retrospective design precludes causal inference regarding earthquake exposure, psychiatric disorders, hormonal changes, and semen parameters. The study compared unmatched samples, relied on a single semen analysis per patient, and included unequal numbers of patients in the two periods. Individual earthquake exposure, perceived stress, and changes in the source population were not measured. Although all semen analyses were performed in the same andrology laboratory, age, lifestyle, compliance with the recommended abstinence period, and medication use could not be fully controlled.

Objective biomarkers of psychological stress, such as cortisol and other neuroendocrine markers, were unavailable because the study relied on routinely collected records. Psychiatric diagnosis should therefore not be treated as a direct measure of earthquake-related stress, and the findings should be interpreted as associations rather than evidence of a biological effect of psychological stress.

Psychiatric diagnoses were obtained from routine electronic medical records rather than standardized research assessments. Information on medication use, treatment duration, and symptom severity was incomplete and could not be incorporated into the analyses. In addition, numerous laboratory outcomes were compared, and the manuscript does not report an adjustment for multiple testing; consequently, the risk of type I error should be considered. Prospective longitudinal studies with standardized psychiatric assessments, objective stress biomarkers, prespecified primary outcomes, and repeated semen measurements are needed.

CONCLUSION

In this retrospective study, the post-earthquake period was associated with lower sperm motility and differences in several serum parameters among men undergoing infertility evaluation. Among those with recorded psychiatric diagnoses, sperm concentration and total testosterone were higher in the post-earthquake period. These findings reflect differences between unmatched samples and should not be interpreted as evidence that earthquake-related stress caused the observed changes. Future prospective studies should combine repeated semen analyses with standardized assessments of earthquake exposure, psychiatric symptoms, medication use, and objective stress biomarkers.

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Informed Consent: For this retrospective study, formal informed consent was waived by the Institutional Ethics Committee because all patient data were anonymized and confidential hospital records were used. The study was conducted in accordance with the Declaration of Helsinki.

Data Availability Statement: The raw data of this study cannot be shared publicly due to hospital data privacy policies and the protection of patient confidentiality.

Ethics Committee Statement: Ethics committee approval has been obtained from the Non-Interventional Clinical Research Ethics Committee of Malatya Turgut Özal University with the date January 6, 2025 and number 2025/5.

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