European Journal of Clinical Pharmacy
Print ISSN: 2385-409X **Online ISSN**: 3105-0409
Website: https://farmclin.com/

Original Research Article

TESTOBUSTERS AND THEIR EFFECTS ON TESTOSTERONE LEVELS AND REPRODUCTIVE HEALTH IN MEN WITH TYPE 1 DIABETES

Article History:

Name of Author:
Bogdan V. Pavlov[1]*, Ibrohimdzhon J. Kuziev[1], Olga A. Platukhina[1], Victoria O. Fetisova[1], Mikhail V. Kuznetsov[2], Vladimir S. Lutcev[1], Oleg Y. Bastrykin[2], Polina G. Sidorenko[1]

Affiliation: *[1]Institute of Medicine and Health Preservation named after. G.R. Derzhavin, Tambov, Russia*
[2]Institute of Education and Social Sciences, Tambov State University named after. G.R. Derzhavin, Tambov, Russia.

Corresponding Author:

Received: 13-01-2026
Revised: 10-02-2026
Accepted: 25-02-2026
Published: 19-03-2026

Abstract: ***Background:*** The study focuses on the effect of testobusters on the reproductive health of men aged 25-45 years with type 1 diabetes and emphasizes the importance of an individualized approach to the use of such drugs. Given the growing interest in testobusters and their potential effects on testosterone levels and reproductive function, a comprehensive analysis of their efficacy and safety is needed. ***AIM:*** The purpose of this study is to evaluate the effects of testobusters on testosterone levels, reproductive function, and general health outcomes in men with type 1 diabetes. ***MATERIALS AND METHODS:*** 511 men with type 1 diabetes participated in the study. The participants were divided into four groups depending on the drugs taken: testosterone preparations "Androgel" and test boosters Andromatrix, TribulusMetaJow and ProSupps Halo-X Icon". Laboratory tests were performed to determine testosterone levels, blood glucose and spermogram parameters. ANOVA and Tukey's HSD methods were used to analyze the data. ***RESULTS:*** The results showed that each of the drugs had both positive and negative effects. A general trend of improvement in reproductive function indicators, such as ejaculate volume, sperm viability and motility, was observed in all study groups. The results of the study emphasize the need for an individualized approach to the prescription of test boosters, focusing on a careful assessment of possible risks and benefits. ***CONCLUSION:*** Prolonged use of testobusters may lead to hormonal imbalance and increased risk of cardiovascular disease. Potential side effects require regular monitoring of patients' health status. Future studies should aim to better understand the mechanisms of action of testobusters and factors influencing individual responses to treatment, which will optimize therapeutic approaches to improve the reproductive health of men with type 1 diabetes.

Keywords: Testobusters; male reproductive function; diabetes mellitus; testosterone; spermogram; glucose; glycated hemoglobin.

INTRODUCTION

The relevance of the study of testobusters and their effects on testosterone levels and reproductive health in men with type 1 diabetes is due to a set of different factors, both clinical and social [1]. Type 1 diabetes mellitus is an autoimmune disease [2, 3], characterized by impairment of pancreatic beta cells and leading to absolute insulin deficiency and the development of chronic hyperglycemia (elevated blood glucose levels) [4-6]. This leads to severe limitations in patients' health, particularly endocrine function, which can lead to both physiological and psycho-emotional changes [7-9]. In addition, men with this type of diabetes often have decreased

testosterone levels, which can lead to decreased libido, erectile dysfunction and inhibition of spermatogenesis, ultimately affecting quality of life and fertility [10-12].

In recent years, there has been a growing interest in testobusters, substances aimed at stimulating a natural increase in testosterone levels in the body [13,14]. Although many testobusters have already gained popularity among certain categories of men, their effects on specific groups of patients, namely men with type 1 diabetes, remain poorly understood [15]. The above emphasizes the need for in-depth research to determine the potential benefits and possible risks of testobusters in this group.

Clinical studies show that correction of testosterone levels can have a positive effect on reproductive function, giving hope for improvement in diabetic patients [16]. However, it should be taken into account that testosterone is the main androgen that not only affects libido and qualitative ejaculate volume, but also plays a significant role in metabolism, regulation of cardiovascular system and muscle mass [17-20]. A healthy male produces between 4 and 8 mg of testosterone per day, approximately 95% of which is synthesized by the testes and 5% by the adrenal cortex, with the greatest amount produced in the morning hours and the least in the evening hours [21-23]. Accordingly, studying the effects of testosterone boosters may provide information on how they can compensate for testosterone deficiency and improve the overall health of these patients [24].

The relevance of the study also lies in the fact that it may help physicians to develop individualized treatment approaches to address the health characteristics of men with type 1 diabetes [25]. With a clear statistical basis for how testobusters affect testosterone levels and reproductive performance, the medical community will be able to better inform the selection of therapies and support for this patient population [26].

In addition, it is worth noting the social aspect of the problem. The increasing number of men with diabetes mellitus suffering from reproductive problems also affects demographic indicators [27]. Given that reproductive health is an important part of overall well-being, the results of this study will be useful not only for health care providers, but also for creating awareness and support programs for men with diabetes, their partners and families [28].

Thus, this study may make a valuable contribution to the understanding of the interaction between endocrine disorders and reproductive health, opening horizons for further research and the development of new, effective treatments [29]. The relevance of this work is undoubted, enriching both the academic environment and clinical practice with knowledge about the important link between testosterone and diabetes.

These findings have significant implications not only for the scientific community, but also for clinical practice, as they may help in developing effective strategies to treat and support the reproductive health of men with diabetes, as well as to improve their quality of life [30].

RESEARCH AIM

To evaluate the effect of testosterone stimulating drugs on the reproductive system of men aged 25 to 45 years with type 1 diabetes mellitus with a disease duration of 5 to 30 years.

MATERIALS AND METHODS

The study involved 511 participants who were divided into four groups depending on the medication taken. The first group was a control group consisting of 94 participants who received the testosterone drug Androgel in a dosage of 50 mg daily. This gel was applied to the skin of the upper arm or thigh and used for three months. The second group included 99 patients who took the test-booster “Andromatrix X-Man” in tablet form. The dosage was 100 mg and the drug was taken orally twice a day for three months. The third group consisted of 256 people who used the test-booster “Tribulus Meta Joy” in tablet form. The dosage of the drug was 500 mg per day, taken orally for three months. The fourth group was represented by 62 men who took testobuster “ProSupps Halo-X Icon” in tablet form and was taken at a dosage of 250 mg every day for three months. The study evaluated testosterone levels, blood biochemical parameters, ejaculate sediment cytology and laboratory analysis of spermogram after 1 and 3 months of medication. In addition, in the study groups, patients' history was collected about their general health and complaints during the medication periods, including blood pressure levels, digestive system, mental well-being and sexual function.

The norms for the evaluation were used: fasting glucose level should be less than 100 mg/dL, glycated hemoglobin (HbA1c) - less than 5.7%, testosterone level should be within 300-1000 ng/dL. Norms for spermogram parameters were also defined: total sperm count should be more than 15 million/mL, concentration - more than 20 million/mL, total motility - more than 40%, viability - more than 58%, morphology of normal forms - more than 4%, and morphology of pathological forms - less than 4%. This approach allowed us to comprehensively analyze the effect of different drugs on the health of the study participants and their

reproductive functions. SPSS Statistics 26.0 software was used for statistical data analysis, which allowed us to apply ANOVA and Tukey's HSD test methods to assess the significance of differences between groups. Online databases of scientific articles including PubMed, eLibrary MEDLINE, Google Scholar, and others were used to search for relevant information. In addition, data from meta-analyses of the literature, literature reviews, radiology and osteopathic clinical guidelines were used.

RESULTS

The testosterone drug Androgel. The results of the study showed that 19.1% of the participants observed high ejaculate volume, 17% were at the upper limit of normal, 23.4% showed very low volume, and 18.1% had no ejaculation.

Positive side effects of Androgel, such as improved libido and general well-being, were reported during the observational study. However, negative effects were also observed among participants, including changes in mood, acne and increased blood pressure.

Andromatrix X-Man. 17.2% showed a potentially positive effect, 13.1% showed possible improvement, 26.3% showed no significant change, 14.1% were below average, 8.1% showed very low ejaculate volume, and 21.2% had no ejaculation.

Positive side effects of Andromatrix were observed, including increased energy and improved physical endurance. At the same time, negative effects, such as headache and digestive disorders, were reported among the participants.

Tribulus Meta Joy. 21.5% reported a positive effect, 10.5% showed improvement, 14.8% saw no change, 26.2% had low ejaculate volume, 8.6% had very low ejaculate volume, and 18.4% had no ejaculate.

Positive side effects of Tribulus, such as increased energy levels and improved mood, have been observed in participants. At the same time, negative effects were observed, including gastrointestinal disorders and possible allergic reactions.

ProSupps Halo-X Icon. 19.4% had high ejaculate volume, 16.1% were at the upper limit of normal, 8.1% were at a medium level, 24.2% had low volume, 17.7% had very low volume, and 14.5% had no ejaculation.

Positive side effects such as improved physical activity and increased libido have been reported during observations of ProSupps Halo-X Icon. However, negative effects such as increased anxiety levels and changes in appetite have also been reported.

Table 1 shows the dynamics of changes in laboratory and cytological parameters during the administration of test-booster preparations (AndromatrixX-Man, TribulusMetaJow, ProSuppsHalo-X Icon) in comparison with testosterone preparation (Androgel), during 3 months.

Table 1. Changes in performance with testobusters and testosterone over three months

Name of test-boosters	***Pre-drug values***	***Anr X-Man***	***Anr X-Man***	***Tribulus Meta Joy***	***Tribulus Meta Joy***	***ProSupps Halo-X Icon***	***ProSupps Halo-X Icon***	***Androgel***	***Androgel***
Month		***1 month***	***3 months***	***1 month***	***3 months***	***1 month***	***3 months***	***1 month***	***3 months***
Fasting blood glucose	22,7 ±2,2	21,6±2,4	16,5±2,6	24,3±2,3	20,2±2,6	25,1±2,3	20,9±2,2	17,6±2.6	11,3±2,4
Glycated hemoglobin	10,8 ±2,1	10,6±2,2	9,7±2,4	11,2±2,5	10,5±3,3	10,9±2,9	10,2±2,7	9,8±3.1	9,2±3,3
Testosterone	18,7 ±1,4	18,3±1,2	22±2.2	23,8±2.4	26,1±2,5	19,8±2.2	23,8±2,9	26,3±2,6	32±2,3
Total sperm count, mln	29,7 ±2.6	28,5±2.7	16,5±4.3	31,4±3.2	30,1±3.1	27,1±3.2	27,4±2,8	31,7±4.1	31,6±2.9
Concentration of spermatozoa, mln in 1 ml	11,4 ±3.1	11±3.3	9,7±3,3	10,4±3,5	10±3,1	11±4,1	9,8±3,2	15,4±4,2	15,3±3,9
Total sperm motility, %	39,7±2,6	39,4±2,9	22±3,1	38,2±2,9	34,5±3,3	38,6±3,2	34,8±3,1	47±3,2	43,8± 3,1
Spermatozoa		31,4±3,	27,3±3,	31,6±3	28,1±3,	30±3,5	27,3±3,9	35±3,2	32,1± 3,2

with progressive movement, %	31,7±3,0	3	1	,3	2				
Viability, %	58,4±3,2	56,6±3,3	9,3±3,4	56,6±3,2	51±3,1	56,2±3,6	53,5±3,5	61,8±3,7	58,1± 3,4
Morphology: normal forms, %	3,6±3,0	3,5±3,1	3,8±2,8	3,3±3,0	3,01±2,9	3,6±2,9	3,1±3,1	4,1±3.1	3,5±3,3
Morphology: pathological forms, %	2,3±3.1	2,4±3.2	2,1±2,9	2,2±2,7	2,1±3,1	2,5±3,2	2,3±2.9	2,4±3.2	2,1±3,5

In the analysis of laboratory results, it was found that fasting glucose levels in the group of patients receiving Androgel decreased by 8.77%. In the groups using alternative drugs, the decrease in glucose levels was 6.87% for Andromatrix, 7.32% for Tribulus Meta Joy and 6.96% for ProSupps Halcon.

Similar changes were observed for glycated hemoglobin levels: in participants taking Androgel, this indicator decreased by 4.57%. At the same time, in the other groups the decrease was 3.9% for Andromatrix, 3.4% for Tribulus Meta Joy and 3.6% for ProSupps Halcon.

Testosterone levels increased by 10.69% in patients taking Androgel. Compared to other participants, the increase for Andromatrix was 9.2%, for Tribulus Meta Joy it was 10.01%, and for ProSupps Falcon it was 9.6%.

In terms of total sperm count, the group receiving Androgel showed a decrease of 12.48%. In the other groups, the decrease was 14.2% for Andromatrix, 12.9% for Tribulus Meta Joy and 12.3% for ProSupps Halcon.

When sperm concentration was evaluated in patients taking Androgel, the level decreased by 5.15%. In the groups using alternative preparations, the decrease was 7.1% for Andromatrix, 5.45% for Tribulus Meta Joy and 6.9% for ProSupps Halcon.

Total sperm motility in the group receiving Androgel also showed a decrease of 16.6%. The other groups showed a decrease of 19.2% for Andromatrix, 17.1% for Tribulus Meta Joy and 16.9% for ProSupps Halcon.

The level of spermatozoa with progressive movement decreased by 13.51% in the group taking Androgel. In the comparable groups, the decrease was 15.1% for Andromatrix, 14.9% for Tribulus Meta Joy and 13.9% for ProSupps Halcon.

In terms of sperm viability, patients taking Androgel showed a 22.4% decrease. In the other groups, the reduction was 25.2% for Andromatrix, 23.8% for Tribulus Meta Joy and 23.6% for ProSupps Halcon.

And the level of morphology of normal sperm forms in the group taking Androgel decreased by 3.33%. In the comparable groups, the decrease was 4.5% for Andromatrix, 5.01% for Tribulus Meta Joy and 3.86% for ProSupps Halcon.

Figures 1, 2 show the graphs with 3-month dynamics of changes in laboratory and cytological parameters when taking test-booster preparations (AndromatrixX-Man, TribulusMetaJow, ProSuppsHalo-X Icon) in comparison with testosterone preparation (Androgel).

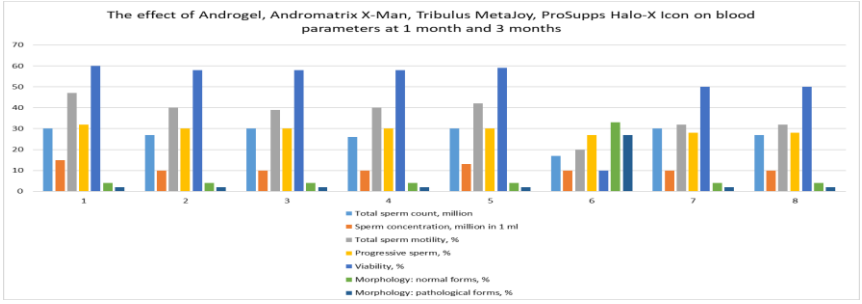

Figure 1. Comparative analysis of the effect of Androgel and testosterone preparations on spermatozoa: results after 1 and 3 months.

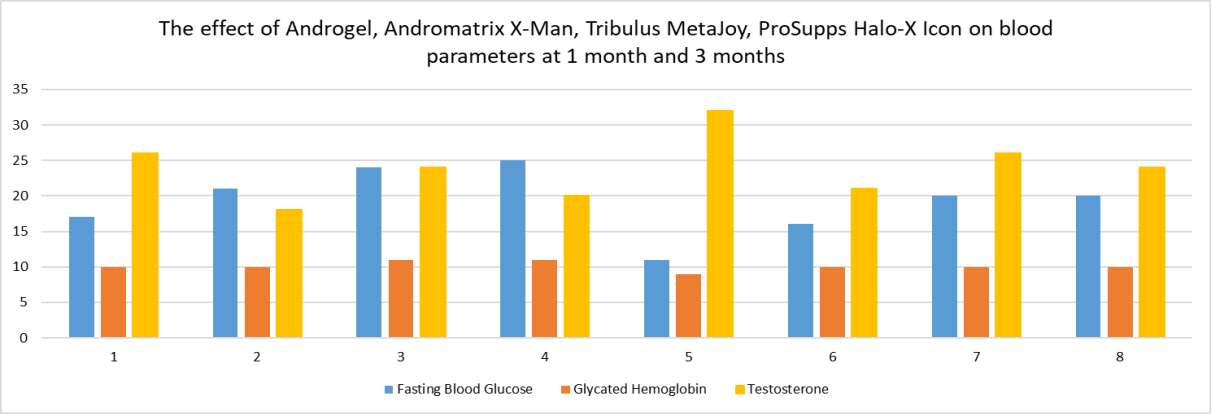

Figure 2. Comparative analysis of the effect of Androgel and test-booster preparations on blood parameters: results after 1 and 3 months.

Table 2 presents the effect of glycated hemoglobin level and disease history on unmedicated semen parameters. The data demonstrate that these factors have a significant impact on ejaculate quantity and other parameters of spermatogenesis, which is critical for fertility assessment.

Table 2. Effect of glycated hemoglobin level and disease history on sperm parameters without the use of drugs

Semen parameters, volume (ml)	***2.5 -2.0 ml***	***1.9- 1.5 ml***	***1.4- 1.0 ml***	***0.9-0.5 ml***	***0.4- 0.1 ml***	***0 ml***
Total number of spermatozoa, mln	45,15±5,2	38,25± 4,4	30,28± 4,7	26,15± 5,9	15,27± 4,1	**0**
Concentration of spermatozoa, mln in 1 ml	19,15± 3,8	14,38± 4,1	10,35± 4,0	7,9,13± 4,0	3,6,15± 2,9	**0**
Total sperm motility, %	55,26± 4,2	47,95± 4,9	40,26± 3,9	32,26± 4,2	22,65± 4,7	**0**
Spermatozoa with progressive movement, %	46,25± 3.5	37,65± 3.9	31,46± 4.0	26,26± 3.3	19,26± 3.1	**0**
Viability, %	73,13± 3.8	69,14± 5.5	55,46± 3.5	47,33± 5.1	38,33± 5.1	**0**
Morphology: normal forms, %	4,9± 6,2	4,3±5.0	3,5± 6,2	2,7± 3.9	5,3± 2.9	**0**
Morphology: pathological forms, %	1,3± 4.1	1,4± 2,6	2,8± 3,1	3,9± 2,5	4,5± 3,0	**0**

The table includes several key indicators. Semen volume ranges from 2.5 to 0 ml, indicating the diversity in results. Total sperm count also ranges from 45.15 million to 0, emphasizing the variation in patients' fertility. Sperm concentration per milliliter shows a range from 19.15 million to 0 million, indicating variation in fertility.

The total sperm motility ranges from 55.26% to 0%, indicating significant differences in sperm activity among the study groups. The percentage of spermatozoa with progressive movement ranges from 46.25% to 0%, which also affects the chances of successful fertilization. Sperm viability ranges from 73.13% to 0%, which is an important indicator of sperm health.

Sperm morphology parameters demonstrate that the percentage of normal forms ranges from 4.9% to 0%, while the percentage of pathologic forms ranges from 1.3% to 0%. These data emphasize the importance of morphology for reproductive function.

Thus, Table 2 provides valuable data on the relationship between glycated hemoglobin levels, disease stage, and

semen parameters, which is important for developing effective treatment strategies and improving fertility in patients.

Table 3 provides comparative analysis between testosterone and testosterone preparations on biochemical and cytological parameters at 3 months.

Table 3. Comparative analysis of the effect of different test-boosters on biochemical and reproductive parameters

Name of test-boosters	*ANOVA and a posthoc Tukey HSD test (Анр X-Man and Androgel)*	*ANOVA and a posthoc Tukey HSD test (Анр X-Man and Androgel)*	*ANOVA and a posthoc Tukey HSD test (Tribulus Meta Joy and Androgel)*	*ANOVA and a posthoc Tukey HSD test (Tribulus MetaJoy and Androgel)*	*ANOVA and a posthoc Tukey HSD test (ProSupps Halo-X Icon and Androgel)*	*ANOVA and a posthoc Tukey HSD test (ProSupps Halo-X Icon and Androgel)*
Month	***1 month***	***3 months***	***1 month***	***3 months***	***1 month***	***3 months***
Fasting blood glucose	F: 52. P: 0.005468	F: 22.406897 P: 0.017872	F:27.105882 P: 0.013772	F: 176.4 P: 0.000922	F: 36.984906 P: 0.008927	F: 8.376923 P: 0.062793
Glycated hemoglobin	F: 43.56 P: 0.00708	F: 29.16 P: 0.012448	F:43.56 P:0.00708	F:29.16 P:0.012448	F:43.56 P:0.00708	F:29.16 P:0.012448
Testosterone	F:30.6 P:0.011642	F:33.507692 P: 0.010255	F:360 P:0.00032	F:103.68 P:0.002019	F:58.32 P:0.004662	F:56.011765 P:0.004941
Total number of spermatozoa, mln	F:360.138462 P:0.000319	F:11.955459 P:0.040709	F:1011.24 P:0.000068	F:608.4 P:0.000146	F:149.027586 P:0.001184	F:149.027586 P:0.001184
Concentration of spermatozoa, mln in 1 ml	F:23.04 P:0.017208	F:13.96551 P:0.033412	F:13.965517 P:0.033412	F:13.965517 P:0.033412	F:23.04 P:0.017208	F:13.965517 P:0.033412
Total sperm motility, %	F:152.894118 P:0.00114	F:11.567213 P:0.042428	F:119.117647 P:0.001646	F:100.821176 P:0.002103	F:152.894118 P:0.00114	F:100.821176 P:0.002103
Spermatozoa with progressive movement, %	F:282.24 P:0.000459	F:149.027586 P: 0.001184	F:449.861538 P:0.000229	F:225 P:0.000643	F:187.758621 P:0.000841	F:149.027586 P:0.001184
Viability, %	F:737.441379 P:0.00011	F:2.431684 P: 0.216803	F:737.441379 P:0.00011	F:332.864151 P:0.000359	F:524.88 P:0.000182	F:658.489655 P:0.00013
Morphology: normal forms, %	F:1.8 P:0.272228	F:1.575875 P:0.298238	F:3.24 P:0.16968	F:3.24 P:0.16968	F:1.8 P:0.272228	F:3.24 P:0.16968
Morphology: pathological forms, %	F:16.2 P:0.027556	F:1.058824 P:0.379187	F:16.2 P:0.027556	F:9 P:0.057669	F:16.2 P:0.027556	F:16.2 P:0.027556

Table 4 shows the ejaculate dynamics in the groups over 3 months by ANOVA and Tukey's HSD.

The study analyzed changes in glucose and testosterone levels and spermatogenesis parameters in patients taking different pharmacological agents.

The fasting glucose level changed by 2.64% from baseline. In patients receiving Andromatrix, the fasting glucose level in the first month was 2.27%, and by the third month it increased to 3.35%. Subjects taking Tribulus Meta Joy had a glucose level of 6.33% in the first month and saw a decrease to 5.27% in the third month. In subjects using ProSupps Halo-X, glucose levels changed from 6.21% at month one to 5.32% at month three. In subjects taking Androgel, glucose levels were 4.23% at month one and decreased to 2.32% at month three.

Testosterone levels changed by 2.74% from baseline. In patients taking Andromatrix, testosterone levels were 2.17% in the first month and increased to 3.45% by the third month. In the group using Tribulus Meta Joy, testosterone levels dropped from 6.33% in the first month to 5.42% in the third month. In patients taking ProSupps Halo-X, testosterone levels also decreased from 6.21% to 5.14%. In the androgel group, testosterone levels changed from 4.37% in the first month to 2.74% in the third month.

Table 4. Comparative analysis of ejaculate secretion results by groups :ANOVA and Tzkeuz HSD test three-month period

	ANOVA и HSD от Tukey for 3 months total ejaculate production
Concentration of spermatozoa, mln in 1 ml	Significance F: 23.573705 Significance P: 0.000706 HSD Tukey (alpha = 0,05): |Group1-Group 4|=22 (p= 0,0215); |Group1-Group 5|=31,5 (p= 0,0036); |Group 1-Group 6|=41 (p= 0,0009); |Group2-Group 5|=27 (p=0,0079); |Group2-Group 6|=36,5 (p=0,0016); |Group3-Group 6|=25,5 (p=0,0106); |Group4-Group6|= 19 (p=0,0416);
Total sperm motility, %	Significance F: 121.177778 Significance P: 0.000006 HSD Tukey (alpha = 0,05): |Group1-Group2|=4 (p=0,026); |Group1-Group3|=9 (p=0,0004); |Group1-Group4|=11,5 (p= 0,0001); |Group1-Group5|=15 (p=0); |Group1-Group6|=18 (p=0); |Group2-Group3|=5 (p=0,0089); |Group2-Group4|=7,5 (p=0,001) ; |Group2-Group5|=11 (p=0,0001); |Group2-Group6|=14 (p=0); |Group3-Group5|=6 (p=0,0035); |Group3-Group6|=9 (p=0,0004); |Group4-Group5|=3,5 (p=0,0469); |Group4-Group6|=6,5 (p=0,0023);
Spermatozoa with progressive movement, %	Significance F: 43.39548 Significance P: 0.000124 HSD Tukey (alpha =0,05): |Group1-Group3|=16 (p=0,0411); |Group1-Group4|=24,5 (p=0,0053); |Group1-Group5|=33 (p=0,0011); |Group1-Group6|=49 (p=0,0001); |Group2-Group4|=17,5 (p=0,0276); |Group2-Group5|=26 (p=0,0039); |Group2-Group6|= 42 (p=0,0003); |Group3-Group5|=17 (p=0,0315); |Group3-Group6|=33 (p=0,0011); |Group4-Group6|=24,5 (p=0,0053); |Group5-Group6|=16 (p=0,0411);
Viability, %	Significance F: 96.428571 Significance P: 0.000012 HSD Tukey (alpha = 0,05): |Group1-Group3|=16,5 (p= 0,0021); |Group1-Group4|=22 (p= 0,0004); |Group1-Group5|=27 (p=0,0001); |Group1-Group6|=43 (p=0); |Group2-Group4|=13,5 (p=0,0059); |Group2-Group5|=18,5 (p=0,0011); |Group2-Group6|=34,5 (p=0); |Group3-Group5|=10,5 (p=0,0205); |Group3-Group6|=26,5 (p=0,0001); |Group4-Group6|=21 (p=0,0005); |Group5-Group6|=16 (p=0,0024);
Morphology: normal forms, %	Significance F: 65.875229 Significance P: 0.000037 HSD Tukey (alpha =0,05): |Group1-Group 4|=24 (p= 0,0101); |Group1-Group 5|=34 (p=0,0016); |Group1-Group 6|=66,5 (p=0); |Group2-Group4|=20 (p=0,0241); |Group2-Group 5|=30 (p=0,0032); |Group2-Group 6|=62,5 (p=0,0001); |Group3-Group 5|=20,5 (p=0,0215); |Group3-Group 6|=53 (p=0,0001); |Group4-Group 6|=42,5 (p=0,0005); |Group5-Group 6|=32,5 (p=0,0021);
Morphology: pathological forms, %	Significance F: 97 Significance P: 0.000012 HSD Tukey (alpha =0,05): |Group1-Group4|=2 (p= 0,0035); |Group1-Group5|=3,5 (p=0,0002); |Group1-Group6|=5 (p=0); |Group2-Group4|=2 (p=0,0035); |Group2-Group5|=3,5 (p=0,0002); |Group2-Group6|=5 (p=0); |Group3-Group5|=2,5 (p=0,001) ; |Группа3-Группа6|=4 (p=0,0001); |Группа4-Группа5|=1,5 (p=0,0149); |Группа4-Группа6|=3 (p=0,0004); |Группа5-Группа6|=1,5 (p=0,0149);

Analysis of sperm concentration showed a 2.9% change from baseline. In patients taking Andromatrix, the sperm concentration level in the first month was 2.23%, increasing to 3.1% by the third month. In the Tribulus Meta Joy group, sperm levels changed from 6.43% to 5.51%, and in the ProSupps Halo-X group, from 6.48% to 5.64%. In patients who used Androgel, the sperm concentration level changed from 4.4% to 3.1%.

The level of total sperm motility changed by 3.34%. Patients taking Andromatrix showed a sperm motility level that increased from 2.92% to 3.65%. Patients using Tribulus Meta Joy showed a change in motility rate from 5.73% to 5.41%. In the ProSupps Halo-X group, the level of motility decreased from 6.28% to 5.14%. In patients taking Androgel, the sperm motility rate changed from 4.12% to 2.79%.

Analysis of sperm with progressive movement showed a change of 2.84%. In the patients taking Andromatrix, the sperm level with progressive movement increased from 2.12% to 3.675%. In the Tribulus Meta Joy group, the level of sperm with progressive movement changed from 6.33% to 5.41%. In patients using ProSupps Halo-X, the rate changed from 6.57% to 5.24%. In patients on androgel, the level of sperm with progressive movement decreased from 4.1% to 2.74%.

The sperm viability rate changed by 2.52%. In patients taking Andromatrix, the viability rate increased from 2.12% to 3.73%. In the Tribulus Meta Joy group, the viability rate changed from 6.23% to 5.61%. Patients taking ProSupps Halo-X had a viability rate of 6.58% at month one and 5.24% at month three. In patients using Androgel, the viability rate changed from 4.12% to 2.68%.

As for the morphology of normal spermatozoa, the change was 2.41%. In patients taking Andromatrix, the level of morphology of normal forms increased from 2.11% to 3.68%. In patients using Tribulus MetaJob, the level of morphology of normal forms changed from 6.23% to 5.45%. In the ProSuppsHalo-X group, the rate of normal mold morphology was 6.21% at month one and 5.09% at month three. In patients on androgel, the rate of normal mold morphology decreased from 4.32% to 2.86%.

Finally, the morphology rate of pathologic forms changed by 2.46%. In patients taking Andromatrix, the morphology rate of pathologic molds was 1.99% in the first month and increased to 3.89% in the third month. In patients using Tribulus Meta Joy, the morphology rate of pathologic molds changed from 6.23% to 5.3%. In the ProSupps Halo-X group, the morphology rate of pathologic molds was 6.18% at month one and 5.24% at month three. In patients on androgel, the morphology rate of pathologic forms changed from 4.32% to 2.67%.

DISCUSSION

The findings highlight the need for an individualized approach to the use of test boosters. The results of the analysis using Tukey's ANOVA and HSD over a three-month period showed that the reliability coefficient for androgel versus andromatrikos ranged from 15.3% to 23%, with the difference not being statistically significant ($P = 0.69$). At the same time, the comparative analysis of tribulus and androgel demonstrated a reliability coefficient ranging from 15.3% to 54% ($P < 0.001$), indicating that the findings for tribulus were statistically significant.

In addition, analysis of recent data showed that the confidence ratio for androgel ranged from 9.6% to 23.3% ($P = 0.01$), confirming its statistical significance.

However, given the heterogeneity of patient responses to testobusters, caution should be exercised when using them. Prolonged use of testobusters may lead to hormonal imbalance and increased risk of cardiovascular complications. In addition, testobusters can have toxic effects on the liver, cause psychological problems, and affect libido and myocardial functioning. They can lead to skin manifestations, gastrointestinal problems, addiction and withdrawal. Thus, long-term use of testobusters requires careful evaluation and monitoring.

CONCLUSION

This study evaluated the effects of Tribulus test boosters MetaJoy and ProSupps Halo-X Icon on sperm counts in men over a period of three months. The results indicate a positive effect of both drugs on reproductive health, which is important in the context of increasing infertility among men.

The total sperm count in patients taking Tribulus Meta Joy increased from 43.5±3.0 million to 47.0±4.2 million, indicating significant improvements in spermatogenesis. Similar results were obtained in patients using ProSupps Halo-X Icon, where sperm count increased from 44.3±3.5 million to 47.7±4.4 million, indicating that both drugs can help improve sperm quality.
However, it should be noted that despite the positive changes in sperm count, testosterone levels in patients, Tribulus Meta Joy, decreased from 6.33% to 5.42%. Halo-X also showed a decrease in testosterone levels, indicating potential risks associated with the use of these products.

An important aspect of the study is the stability of the percentage of normal sperm forms, which was 4.8±0.2% for Tribulus Meta Joy and 4.9±0.1% for ProSupps Halo-X. This may indicate that although the drugs contribute to an increase in total sperm count, they may not have a significant effect on sperm morphology. An increase in the number of abnormal sperm forms also requires attention.

In addition, statistical analysis revealed significant differences between the drugs, which emphasizes the need for an individualized approach to their use. It is important to note that although testobusters may have a positive effect on reproductive performance, their use should be carefully monitored. Тувне study emphasizes the need for a comprehensive approach to the treatment of male infertility and the importance of taking into account the individual characteristics of patients when choosing therapy.
Further studies are recommended to assess the long-term effects of the drugs and their impact on men's health. This will help not only to improve the understanding of the mechanism of action of testobusters, but also to develop approaches to their safe and effective use in clinical practice.

MORE INFORMATION

Ethical expertise
Federal State Budgetary Educational Institution OF Higher Education Tambov State University named after G.R. Derzhavin hereby informs you that the scientific research presented in the manuscript Bogdan V. Pavlov, Ibrohimdzhon J. Kuziev, Olga A. Platukhina, Victoria O. Fetisova, Mikhail V. Kuznetsov, Vladimir S. Lutcev, Oleg Y. Bastrykin, Polina G. Sidorenko "TESTOBUSTERS AND THEIR EFFECTS ON TESTOSTERONE LEVELS AND REPRODUCTIVE HEALTH IN MEN WITH TYPE 1 DIABETES", it fully complies with ethical standards and does not contradict the provisions of the World Medical Association's Helsinki Declaration. During the study, all necessary ethical standards were observed, the rights and safety of the participants were ensured, informed consent was obtained, and the principles of scientific ethics and integrity were respected. The university confirms the reliability of the presented research results and their compliance with the established ethical standards of the scientific community (protocol No 838 of 09/26/2025, TSU named after G.R. Derzhavin.)

Sources of funding.

Grant support
This work participates in the grant support of small student research teams led by a supervisor on the basis of Tambov State University named after. G.R. Derzhavin, Institute of Medicine and Health Preservation.

Conflict of interesta
The researchers declare that no conflicts of interest exist for this research work.

Authors' contributions
Bogdan V. Pavlov: Study concept and design; Olga A. Platukhina, Victoria O. Fetisova: collection of material, collection of literature data; Ibrohimdzhon J. Kuziev,Vladimir S. Lutcev,: statistical processing of data, interpretation of results; Polina G. Sidorenko, Ibrohimdzhon J. Kuziev: text writing; Bogdan V. Pavlov, Ibrohimdzhon J. Kuziev, Mikhail V. Kuznetsov, Oleg Y. Bastrykin text editing.

Acknowledgments. "We are sincerely grateful to the team of endocrinologists for their invaluable contribution to our work. Thank you for opening the doors of your department to us, sharing your experience and helping us at all stages of the study. Without your participation, this project would not have taken place."

"We would like to express our separate, most heartfelt gratitude to the urologist Sklyarov Bogdan Alexandrovich. Thank you very much for your professionalism and sensitive attitude to our work. You did not just consult us, but approached each stage with heart: you helped to correctly build the process of patient management, shared valuable observations when collecting material and generously gave advice on the selection of drugs. Special thanks for your attention to detail and willingness to always help. Working with you was not only useful, but also truly pleasant. Thank you for your contribution!"

REFERENCES

1. Lepetukhin AE, Goncharov NP, Mordik AI, Biskaeva NY. Hormonal and metabolic characteristics of androgen deficiency and its correction by testosterone preparation in men with type 1 diabetes mellitus in the conditions of program hemodialysis. Diabetes Mellitus. 2010;1:27-32. https://doi.org/10.14341/2072-0351-6013
2. Bhasin S, et al. Testosterone therapy in men with androgen deficiency syndromes. The Journal of Clinical Endocrinology & Metabolism. 2010;95(6):2546-2561. https://doi.org/10.1210/jc.2009-0456
3. Xhardo E, Agaçi F. Autoimmune polyglandular syndrome: type 1 diabetes mellitus, Hashimoto's thyroiditis, systemic lupus erythematosus, rheumatoid arthritis and celiac disease. MEJ. 2020;3. https://doi.org/10.22141/2224-0721/16.3.2020.205281
4. Dedov II, et al. Type 1 diabetes mellitus in adults. Diabetes mellitus. 2020;23(1S):42-114. https://doi.org/10.14341/DM12505
5. Peterkova VA, et al. Diabetes mellitus type 1 in children. Diabetes mellitus. 2020;23(S1). https://doi.org/10.14341/DM23S1
6. Titovich EV, Kuraeva TL. Markers of beta-cell destruction at the stages of development of diabetes mellitus type 1. Diabetes mellitus. 2002;5(2):17-17 https://doi.org/10.14341/2072-0351-5472
7. Mazer NA, Bhasin S. Hormonal regulation of

male reproductive function. Endocrine Reviews. 2008;29(6)7:27-753. https://doi.org/10.1210/er.2008-0005
8. Demicheva TP, Atamanov VM. Psychological, neurovegetative features and quality of life of patients with diabetes. SGN. 2018;1(2).
9. Popykhova EB, et al. The role of diabetes mellitus in the emergence and development of endothelial dysfunction. Probl. endocr. 2020;1.
10. Basaria S, et al. Adverse events associated with testosterone administration. The New England Journal of Medicine. 2010;363(2):109-122. https://doi.org/10.1056/NEJMoa1003158
11. Khuzhamberdiev UE. Influence of diabetes mellitus on male sexual life. Economy and socium. 2024;8(123).
12. Kurbatov DG, et al. Erectile dysfunction in patients with type 1 diabetes mellitus: methods of diagnosis and treatment. Bulletin of Urology. 2014;2.
13. Wang C, et al. Influence of testosterone replacement therapy on metabolic parameters in men with type 2 diabetes. Diabetes Care. 2004;27(5):1074-1080. https://doi.org/10.2337/diacare.27.5.1074
14. Morgado A, et al. Do "testosterone boosters" really increase serum total testosterone? A systematic review. Int J Impot Res. 2024;36(4):348-364. https://doi.org/10.1038/s41443-023-00763-9
15. Efremov EA, et al. Current view of the physiologic effects of testosterone in men. ECU. 2017;3:64-69.
16. Müller MJ, et al. Impact of testosterone replacement therapy on glucose metabolism in men with type 2 diabetes. Diabetes. 2009;58(11):2782-2786. https://doi.org/10.2337/db09-0690
17. Cunningham GR. Testosterone replacement in men: a review. The Journal of Urology. 2005;173(5):1577-1583. https://doi.org/10.1097/01.ju.0000151621.16835.b4
18. Alemany M. The Roles of Androgens in Humans: Biology, Metabolic Regulation and Health. Int J MolSci. 2022;23(19):11952. https://doi.org/10.3390/ijms231911952
19. Volkova NI, et al. Clinical and pharmacologic bases for the use of testosterone drugs for hormone replacement therapy in hypogonadism in men. Obesity and metabolism. 2022;19(2):233-241. https://doi.org/10.14341/omet12850
20. Khripun IA, et al. Testosterone as a tool of metabolic control of male health (literature review). Medical Bulletin of the South of Russia. 2014;4.
21. Basaria S, Dobs AS. Hypogonadism and androgen replacement therapy in elderly men. Am J Med. 2001;110:563-572. https://doi.org/dx.doi.org/10.1016/S0002-9343(01)00663-5
22. Kulikov AV, Arkhipova LV. Testosterone and life expectancy, or why women live longer than men. hypothesis. Bulletin of Moscow University. Series 16. Biology. 2021;76(3):163-168.
23. Ametov AS, Pashkova EYu. Evolution of testosterone replacement therapy. New forms - new opportunities. Endocrinology: news, opinions, training. 2017;2:55-65. https://doi.org/10.24411/2304-9529-2017-00006
24. Esaulenko DI, Rozhivanov RV, Shishkina VV. Quality of ejaculate in men with type 2 diabetes. Endocrinology: News. Opinions. Education. 2022;2(39):14-20. https://doi.org/10.14341/DM12775
25. Gooren LJ, Giltay EJ. Testosterone and the regulation of body composition. International Journal of Andrology. 2008;31(6):558-566. DOI: https://doi.org/10.1111/j.1365-2605.2008.00937.x.
26. Chedid R, et al. Testosterone therapy in the diabetic patient. Diabetes Research and Clinical Practice. 2016;1163:05-315. https://doi.org/10.1016/j.diabres.2016.05.028
27. Kerry S.W, et al. Influence of testosterone on the health of men with diabetes. Nature Reviews Endocrinology. 2006;2(12):664-670. https://doi.org/10.1038/nrendo.2006.141
28. Dobrzynski M, et al. Endocrine and metabolic effects of testosterone. Maturitas. 2017;93:56-62. https://doi.org/10.1016/j.maturitas.2016.10.005
29. Pinnelli M, et al. The role of testosterone in male reproductive health. Nature Reviews Urology. 2018;15(11):632-645. https://doi.org/10.1038/s41585-018-0068-x
30. Kumar S, Kaur P. Effects of testosterone on male fertility. Asian Journal of Andrology. 2014; 16(1): 3-12. https://10.4103/1008-682X.122128
31. Bogdan V. Pavlov, ORCID: 0000-0002-1231-8695 ; DewollS@yandex.ru Endocrinologist, Assistant of the Department of Propaedeutics of Internal Diseases and Faculty Therapy of the Institute of Medicine and Health Preservation named after G. R. Derzhavin, Russian Federation
32. Ibrohimjon J. Kuziev, ORCID: 0000-0002-3461-8285; kuzievibrohim@gmail.com Student of the Institute of Medicine and Health Preservation named after G. R. Derzhavin, Russian Federation, Tambov
33. Olga A. Platukhina, ORCID:0009-0008-8819-8184; ole2004platushik@gmail.com Student of the Institute of Medicine and Health Preservation named after G. R. Derzhavin, Russian Federation, Tambov
34. Victoria O. Fetisova, ORCID: 0009-0002-1220-2809; viktoriafetisova63@gmail.com Student of

the Institute of Medicine and Health Preservation named after G. R. Derzhavin, Russian Federation, Tambov

35. Mikhail V. Kuznetsov, ORCID: 0009-0007-8359-4295; kuznetsov.mv.tsu@mail.ru : Candidate of Pedagogical Sciences, Associate Professor of the Department of Foreign Languages and Professional Translation, Faculty of Philology and Linguistics, Institute of Education and Social Sciences, Tambov State University G.R. Derzhavin
36. Vladimir S. Lutcev, ORCID: 0009-0004-2701-6181; Lutcev2503@mail.ru Student of Tambov State University, Institute of Medicine
37. Oleg Y, Bastrykin, ORCID: 0009-0001-9437-8930; oleg.bastrykin.0@mail.ru Student of the Institute of Medicine and Health Care named after G.R. Derzhavin, Russia, Tambov
38. Polina G. Sidorenko, ORCID: 0009-0007-8128-3979; tolko_polina@mail.ru Student at the Derzhavin Institute of Medicine and Health Care, Russia, Tambov.

