

Effects of Anabolic-Androgenic Steroids on Lipid Profiles in Competitive Athletes: A Cross-Sectional Analysis

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ABSTRACT

Many young individuals pursue bodybuilding and weightlifting to achieve a muscular physique with broad shoulders and a lean waist. However, in their desire for rapid results, some resort to anabolic-androgenic steroids (AAS) without awareness of their potential health risks. This study investigated the effects of testosterone injections, administered at a dose of 600 mg weekly for five weeks, on selected biochemical variables in male athletes aged 15–55 years who attended training centers in Nineveh Governorate. Serum samples were analyzed for total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), and testosterone levels. Results demonstrated a significant elevation ($p < 0.01$) in serum testosterone, total cholesterol, triglycerides, LDL, and VLDL among steroid users compared to the control group. Conversely, HDL levels were significantly reduced ($p < 0.05$), indicating disruption of the lipid balance. Correlation analysis revealed a positive association between testosterone levels and total cholesterol, triglycerides, LDL, and VLDL, whereas a negative correlation was observed with HDL ($p < 0.01$). These findings highlight that unsupervised use of anabolic steroids can induce severe alterations in lipid metabolism, predisposing athletes to cardiovascular risks. The study underscores the importance of medical supervision, public awareness, and preventive strategies to mitigate steroid misuse in sports communities.

Keywords: Athletes, Testosterone Hormone, Steroids, Triglycerides with Testosterone, Triglycerides with Athletes.

INTRODUCTION

It has become known that healthy foods and exercise are essential for the external appearance of the body and the general health of the body [1, 2]. Hormones also play a crucial role in all aspects of life, as they affect the body through digestion processes, the amount of fat present, as well as the level of energy [3, 4]. Athletes in particular use hormone supplementation to accelerate body growth and muscle gain, along with exercises, regardless of the negative consequences caused by irregular hormone secretion, the excess hormones in the body affect muscle function and rebuilding, and on the other hand, these hormones motivate athletes to work harder in clubs' sports [5-7]. It is worth noting that when you have a huge body and huge muscles, these muscles are very weak, so athletes take growth hormones along with testosterone to enhance the strength and endurance of the body [8-13]. As for stimulating hormones, some athletes may resort to them for a significant increase in muscle mass. It also increases muscle mass. As well as improving the performance of athletes, in the event of taking steroids, in addition to practicing sports activities that double the effectiveness of the hormone [14-17]. It hormone works to speed up the athlete's recovery from some injuries and return to play, as the hormones work on the flow of blood and oxygen in the muscles and tissues, and this works to speed up their recovery immediately after the injury [18-26]. Some athletes use growth hormones to enhance their physical development and boost energy levels. It also breaks down existing fats and converts them into muscle, leading to a large and muscular body [27-30]. It is necessary to know the types of hormones used by athletes. Growth hormone, secreted by the pituitary gland, plays a crucial role in muscle building and replacement, and is also effective in delaying and restricting ageing. growth hormone cooperates well with insulin and testosterone in the process of muscle building, influenced by success in exercise [28, 29, 31]. Testosterone is the male hormone that produces masculine sexual characteristics

in men, and to a much lesser extent in women. It plays a vital role in building muscle and burning fat. Its production declines with age, and testosterone levels fluctuate. It can be increased through exercise [32-34]. Both growth hormone and testosterone are hormones that promote muscle building, energy, and fat burning. In contrast, cortisol is a destructive hormone that destroys muscles and stores unwanted fat in response to physical or psychological stress. Excessive training increases cortisol levels, leading to sleep deficiency and dangerous work. Most athletes avoid using anabolic steroids or anabolic steroids, only a small percentage of them use this hormone because some routine tests are conducted for athletes to ensure their safety, including checking the amount of the hormone, so most amateurs are those who use this hormone or athletes who are trying to increase their muscle mass [30, 35, 36]. The most important of these central sports stimulants that athletes take are testosterone, androstenedione, gonadotropin, erythropoietin, creatine, and energy drinks [37, 38]. The use of these hormone steroids and steroids may result in several side effects, including Sudden death. Suicide attempt. Mood and psychological disorders. The emergence of problems in the heart and blood vessels accompanies this. and some liver diseases. And also the growth of breasts in men [39]. The study aims to find out the effect of some hormonal steroids that are taken by athletes on some biochemical variables in the body of athletes.

EXPERIMENTAL

Materials and Methods

Forty-one blood samples were collected from athletes taking some hormonal steroids. Blood specimens were collected from the athletes in the training centers located in Mosul (Drakken Center), where their ages ranged between (15-55) years. The number of specimens

collected is (22) blood specimens from athletes who did not take any stimulants and who were considered as a control group. (5) ml of blood specimens was collected from each person and then left at room temperature for (15) minutes for clotting. After separating the serum by centrifugation, the serum was frozen at (-20 degrees Celsius) until it was used. The athletes were divided into three groups [which include group A (15-21) year n=13, group B (22-45) year n=16, and group C (46-55) year n=12] To find out the effect of these steroids on athletes, some biochemical variables were measured such as testosterone. Measuring the level of hormones in the blood serum of athletes: The level of hormones in the blood serum of athletes who took some stimulants was estimated by following the steps attached to the special ready-made test box according to the ELASIA technology, which was based on the principle of the double antibody sandwich technology, using immunoabsorption, where the Samples containing biotin-bound antibodies and antigens are added to the antibodies. Into the wells of the Elisa plate, the plates are then washed with wash buffer and then used to remove unbound antibodies. Avidin-peroxidase conjugate is then added, followed by the use of TMB substrate for

staining. Thus, TMB reacts with the peroxidase enzyme, causing the blue colour to appear and eventually turn blue, which indicates the presence of cholesterol, HDL, LDL, VLDL, and triglycerides. Ready-made analysis tools from the French company VEDALAB and the American company BIOMERIEUX were used to measure the previously mentioned variables.

Results and their Analysis Using Statistics

The results were analyzed statistically using SPSS software—version 25. A t-test was performed for all samples, and the probability level was at $p \leq 0.05$. The results are reported as the mean $\pm$ standard deviation

Results and Discussion

The table below represents the obtained results. The results showed that there is a significant difference between the Athletes group [which includes group A (15-21) years, group B (22-45), and group C (46-55)] and the control groups at the probability level $P < 0.05$.

Table 1: Biochemical Variables Measured for the Athletes and the Control Group

Parameters	Control Group (N=22) Men $\pm$ S.E.	Athletes Group (N=41) Men $\pm$ S.E.			P-Value
		A (15-21) Year N=13	B (22-45) Year N=16	C (46-55) Year N=12	
Testosterone ng/ml	4.89 $\pm$ 0.38	13.54 $\pm$ 0.25	11.5 $\pm$ 0.31	7.2 $\pm$ 0.81	$p \leq 0.01$
Cholesterol mg/dl	169.0 $\pm$ 4.15	245 $\pm$ 3.31	203 $\pm$ 4.15	263 $\pm$ 3.93	$p \leq 0.001$
HDL mg/dl	36.79 $\pm$ 2.24	27.5 $\pm$ 0.68	24.9 $\pm$ 1.12	26.6 $\pm$ 1.92	$p \leq 0.05$
LDL mg/dl	102.52 $\pm$ 5.04	132.55 $\pm$ 2.3	114.2 $\pm$ 3.65	126.6 $\pm$ 4.51	$p \leq 0.05$
VLDL mg/dl	31.03 $\pm$ 1.9	64.03 $\pm$ 2.9	51.86 $\pm$ 3.09	45.25 $\pm$ 2.83	$p \leq 0.01$
Triglyceride mg/dl	155.02 $\pm$ 6.36	322.02 $\pm$ 5.98	219 $\pm$ 7.18	203 $\pm$ 4.06	$p \leq 0.01$

The table above presents biochemical variables measured in both the control group (n=22) and the athlete group categorized by age ranges: A (15-21 one's age, n=13), B (22-45 one's age, n=16), and C (46-55 one's age, n=12). For testosterone levels (ng/ml), the control group shows 4.89 $\pm$ 0.38, while the athletes demonstrate significantly higher levels across all age categories: 13.54 $\pm$ 0.25 (A), 11.5 $\pm$ 0.31 (B), and 7.2 $\pm$ 0.81 (C), with $p \leq 0.01$ indicating statistical significance. Cholesterol (mg/dl) levels are markedly elevated in athletes compared to controls: 245 $\pm$ 3.31 (A), 203 $\pm$ 4.15 (B), and 263 $\pm$ 3.93 (C) versus 169.0 $\pm$ 4.15 in controls, all at $p \leq 0.001$. HDL (mg/dl) and LDL (mg/dl)

levels show significant differences with varying p-values (≤ 0.05), indicating lower HDL and higher LDL in athletes. VLDL (mg/dl) and triglyceride (mg/dl) levels also significantly increased in athletes compared to controls across all age categories, underscoring distinct metabolic profiles between the two groups. The scores in Figure (1) showed a significant increase in the level of testosterone hormone in the athletes' group [A, B, C] compared to the control group. This increase in the level of testosterone in the different age groups is perhaps the result of these athletes taking hormonal stimulants. Steroidality, this is consistent with [18-22, 27, 40].

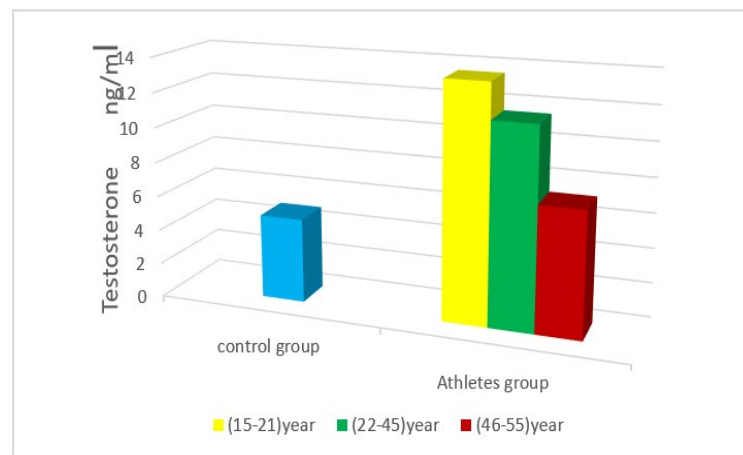


Figure 1: Testosterone Level in Athletes and Control Groups

While the results shown up in Figure (2) indicated a significant raise among level of cholesterol in the athlete's group [A, B, C] compared to the control group, this increase in the level of cholesterol

may be due to the rise in the level of testosterone hormones taken by athletes as stimulants to build their bodies. This is consistent with [11-13, 41].

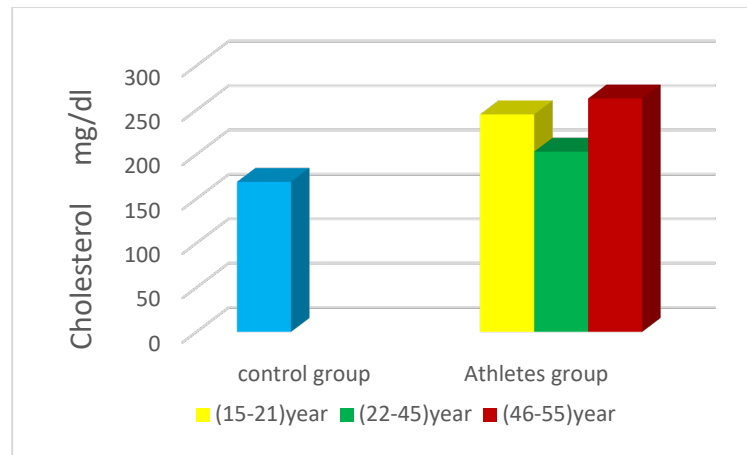


FIGURE 2: Cholesterol Level in Athletes and Control Groups

The results shown in Figure (3) also indicated that there was a significant decrease in HDL levels in the athlete group [A, B, C] comparison to the control group. This decrease in HDL levels is perhaps

due to the imbalance that occurs in liver function as a result of the increase in hormone levels. Masculinity in the body of athletes this is consistent with [9, 15, 20].

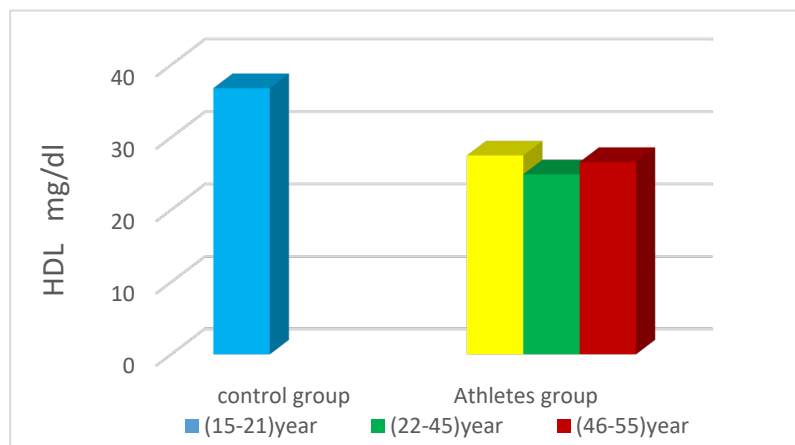


FIGURE 3: HDL level in Athletes and Control Groups

The results shown in Figure (4) revealed a respectable excess in the level of LDL in the athlete group [A, B, C] comparison to the control group. Some steroids that contain testosterone and other anabolic

steroids can reduce HDL levels. At the same time, they work It reduces the level of cholesterol (LDL), so these medications should be avoided, and this is consistent with [3, 19, 42].

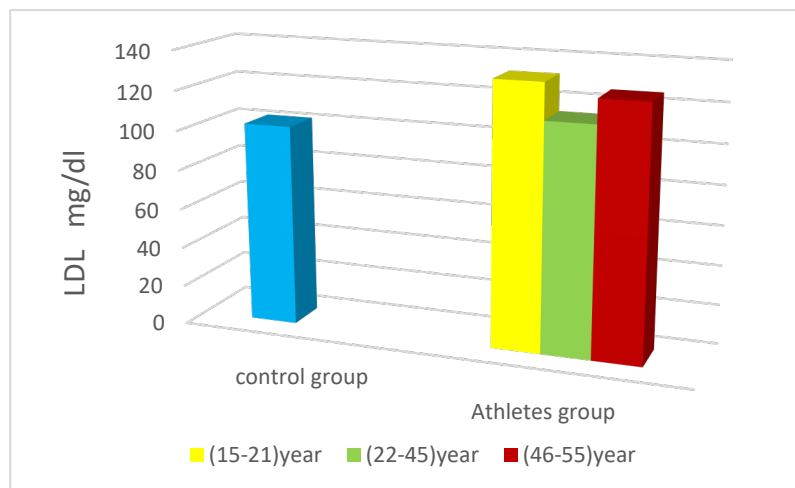


FIGURE 4: LDL level in Athletes and Control Groups

In Figure (5), the results indicate a significant decrease in the level of low-density lipoprotein (VLDL) in the athlete group [A, B, C] comparison to the control group. Perhaps this is a natural result of the

generally high level of fats in the blood serum of athletes who took steroids. Steroids are used to build a strong body with large muscle mass, and this is consistent with [25-27].

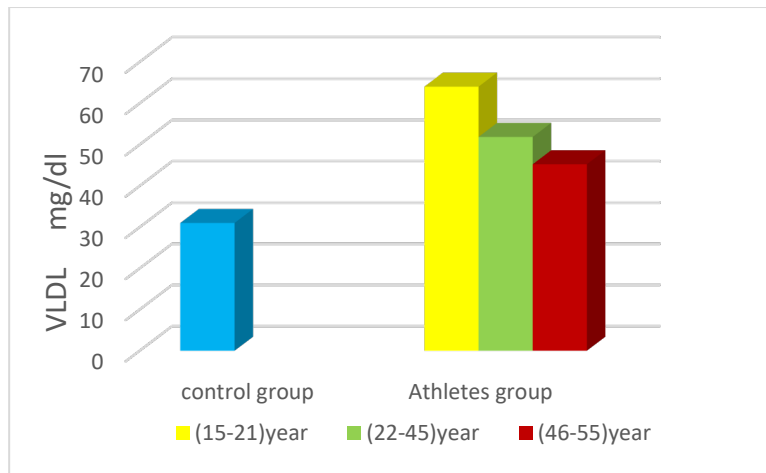


FIGURE 5: VLDL level in Athletes and Control Groups

In Figure (6), the results indicate that revealed a respectable excess in the level of Triglyceride in the athletes' group [A, B, C] when

compared with the control group, and this agrees with [20-27,44] [18-23, 39, 40, 43].

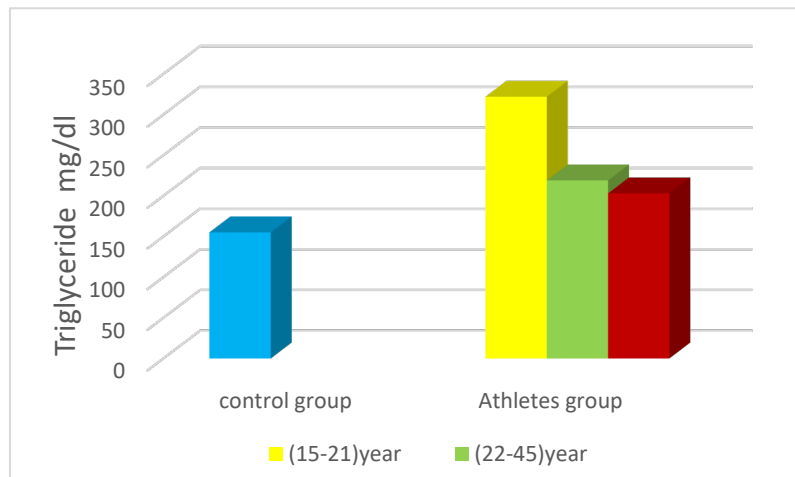


FIGURE 6: Triglyceride level in Athletes and Control Groups

When taking steroids by athletes and these doses are not under the supervision of specialized doctors, this has serious side effects on the body, including the appearance of severe acne, an increased risk of swelling or rupture of the tendons that connect muscles to bones, in addition to liver tumors, and other changes in the body liver .In addition to high quantity of "Not good" cholesterol, known as low-density lipoprotein (LDL) cholesterol, low quantity of "good"

cholesterol, known as high-density lipoprotein (HDL) cholesterol, and high blood pressure, which in turn increases the risk of cardiovascular disease, are also associated with increased levels of low-density lipoprotein (LDL) cholesterol. The results indicated in Figures (6,7,8,9) that there is a positive relationship at the Statistical significance level ($P < 0.001$) between the quantity of testosterone and (LDL) in athletes.

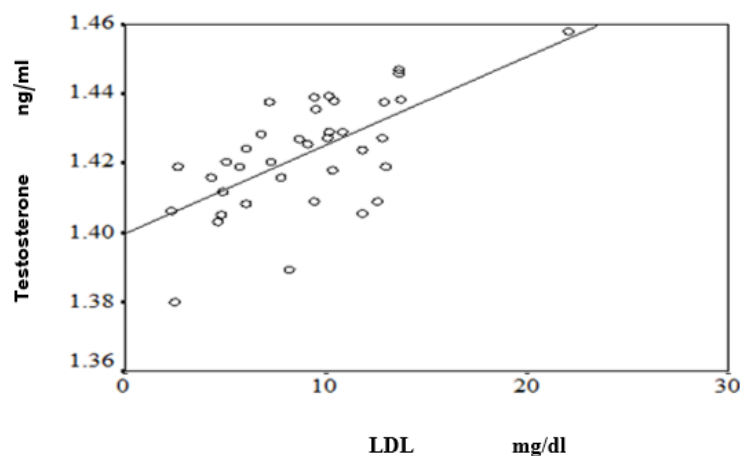


FIGURE 7: Correlation between the level of Testosterone in the Athlete's Group and the level of LDL in the Athlete's Group

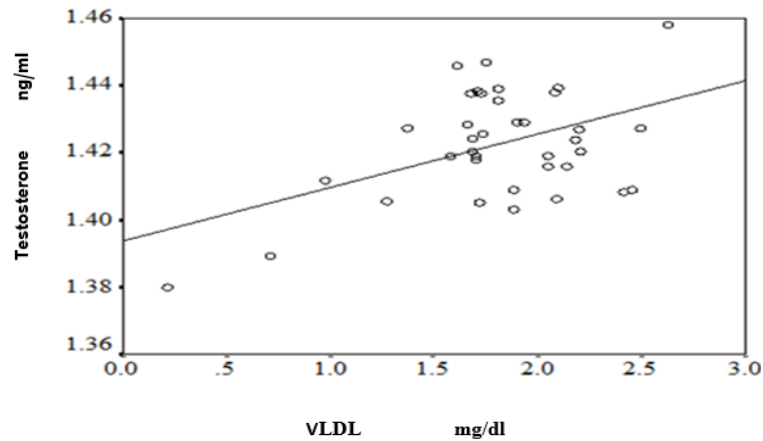


Figure 8: Correlation between the level of Testosterone in the Athlete's Group and the level of VLDL in the Athlete's Group

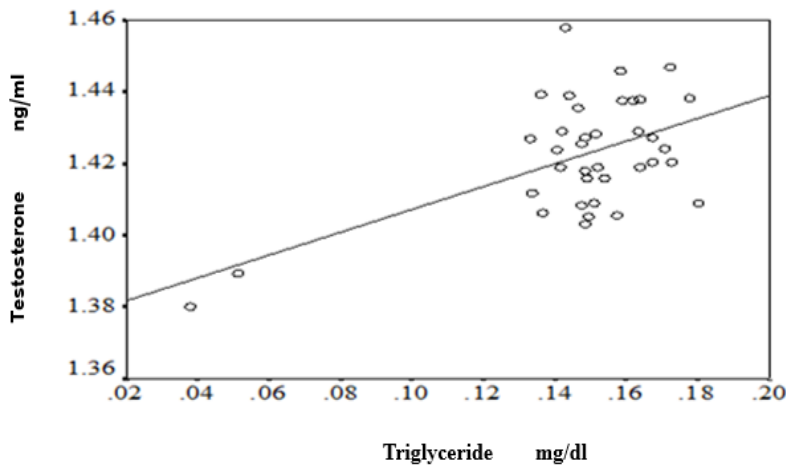


Figure 9: Correlation between the level of Testosterone in the Athlete's Group and the level of Triglyceride in the Athlete's Group

The data in Figure (10) showed that there is a statistically significant negative correlation ($P < 0.001$).

between concentration of testosterone and level of high-density lipoprotein (HDL) in blood serum of athletes.

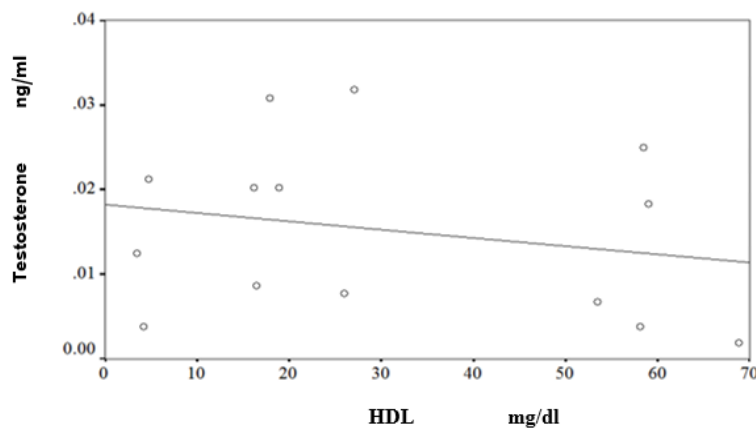


Figure 10: Correlation between the level of Testosterone in the Athlete's Group and the level of HDL in the Athlete's Group

If athletes take steroids or anabolic steroids in massive doses, these doses may be much more than what doctors can give for medical reasons. Steroids also have other side effects, such as breast growth, shrinkage of the testicles, and even the inability to conceive. Athletes who continue to take doses not recommended by doctors may experience other side effects, including acne, swelling, and tendon damage, which can affect liver function and lead to high levels of “bad” cholesterol (LDL). A decrease in levels of “good” cholesterol (HDL), high blood pressure, problems with blood flow, and heart disease. Teenagers who take anabolic steroids may negatively affect

their growth hormone, causing it to decline to unaccustomed rates. It can also affect the body's activities in general. Taking steroids and anabolic steroids by athletes is strictly prohibited by most sports organizations and sports federations. It is illegal.

Conclusion

Athletes sometimes resort to taking hormonal steroids to increase muscle size and strength, as these substances are considered illegal and pose significant health risks to the body that may lead to death.

Taking testosterone and bodybuilding drugs has side effects, including liver damage, arterial hypertension, high LDL, and low HDL cholesterol. This is what we found in our research: a rise in the level of testosterone, cholesterol, triglycerides, LDL, and VLDL, and a lower in HDL. Therefore, young people in particular must be made aware of the adverse effects of stimulants, especially those who practice sports, and dialogue with them about stimulants and their dangers.

Since hormones play a vital role in the body's functions, any change in their levels in the blood, even if it is slight, could seriously affect their health. Body health. This is called a hormonal imbalance, which can occur naturally at some stages of life. Continuing to take testosterone may affect some body functions, including cholesterol

levels in the blood, as some researchers found that testosterone reduces levels of HDL and low-density lipoprotein LDL, that is, the two types of good and harmful cholesterol. Other researchers found that testosterone does not affect either of them, so studies regarding the effect of male hormone (testosterone) on cholesterol are somewhat contradictory, and other studies have found that male hormone (testosterone) does not affect triglyceride levels.

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