

# Chronic High Doses of Nandrolone Decanoate on Blood Cell, Lipoprotein Profile, and Liver Enzymes in Male Rats

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## Abstract

**Background:** Nandrolone decanoate (ND) is a doping agent and it is used by athletes.

**Objectives:** This study was carried out to evaluate the chronic, high doses of ND administration on Blood cell, lipid profile, and Liver enzymes in male rats.

**Materials and Methods:** This experiment was executed on 30 wistar- Albino male rats divided, after weighing, in control, placebo, and test groups (n = 10). Test group received 15 mg/kg intramuscular (IM) ND for duration of 8 weeks. Group placebo received the same volume of placebo although control group did not receive any agent during the trial period. At the end, animals were anesthetized by diethyl ether, scarified, and then blood samples were collected from cervical vessels immediately. Blood cell, lipoprotein profile, and liver enzymes were measured by ordinary methods. Obtained data were analyzed by SPSS V.15, via ANOVA and Tukey test. Results were expressed as mean  $\pm$  SD. Statistical difference was significantly recognized by  $P \leq 0.05$ .

**Results:** Results showed that AST, ALT, cell blood count, hemoglobin, hematocrite, and cholesterol values in group test were increased significantly compared to those of other groups; however, HDL value in this group decreased noticeably compared to control and Placebo groups.

**Conclusions:** Present study revealed that chronic high doses of ND administration alter the liver enzymes, lipid profile, and blood parameter in male rats.

**Keywords:** Nandrolone Decanoate, AST, ALT, Lipoprotein Profile

## 1. Background

Taken in high doses by athletes by the purpose of enhancing muscular strength in athletic performance [1], ND is a synthetic androgen. Gold et al. reported that ND administration in patients suffering from HIV infection improved body weight and lean body mass [2]. Saitoh et al. revealed that injection of ND into young and old mice clearly induced an increase in erythroid colony-forming units (CFU-E); erythroid burst-forming units (BFU-E); and granulocytic-macrophage committed progenitor cells (CFU-GM) in bone marrow in both groups [3]. Moreover, low-dose administration of a considerable number of androgens alters hemoglobin concentrations, while producing potent hypertrophy actions in skeletal muscle [4]. The investigation showed that the use of anabolic-androgenic steroids (AAS) could also be a risk factor to toxicant-associated with fatty liver disease [5]. Combination therapy of Erythropoietin, ND and low-dose of methylprednisolone can be effective as an alternative treatment for Red Blood Cells (RBC) transfusion-dependent to the refractory anemia [6]. Solomon et al. reported that ND ther-

apy reason direct increases in RBC mass [7] among patients suffering from chronic renal failure and were hemodialysis. The anabolic steroid ND is able to alter the muscle restore process in rats [8]. The studies showed that ND administration leads to rise in serum levels of the aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) compared to the control group [9]. ND causes considerably enhanced markers such as hematocrit in hemodialysis patients [10]. On the other hands ND expresses an anabolic effect on lean body mass (LBM) without altering the renal function [11]. The biochemical studies indicated that ND administration cause increase in serum levels of the AST, ALT, and ALP [12]. The studies revealed that the use of anabolic-androgenic steroids (AAS) could also be a risk factor to toxicant-associated fatty liver disease development [5]. The utilization of ND would agree to us a satisfactory management of anemia in addition to an improved nutritional stipulation in old male patients on dialysis [13].

## 2. Objectives

Since ND is a doping agent and used by athletes, this survey was carried out to evaluate the chronic of high doses of ND on Blood cell, lipid profile, and Liver enzymes in male rats.

## 3. Materials and Methods

The present study was performed on 20 mature male Wistar-Albino rats, weighing  $180 \pm 30$  g; ages were 5 - 7 months separately housed in cages (one rat per cage). Animals had free access to water and food. Rats were maintained in a room at  $24 \pm 2^\circ\text{C}$  with a fixed 12 hours artificial light period (Timer Model: SUL180a, AC220V. China, 6 Am to 6 Pm). Rats were divided in control(C), placebo (P) and test (T) groups (n = 10) as following: Group T received 15 mg/kg iM of ND on a daily basis for eight weeks. Group P did the same volume of sterile Peanut oil (oil vehicle) during the trial period but group C did not receive any agents in experimental period [14]. All groups received standard rodent diet and tap water during handling period. ND was purchased from Caspian pharmaceuticals cooperation and was placed in suitable temperature. All injections were performed between 8-11 o'clock a.m. At the end of experimentation, rats were fasted for 14 - 16 hours, and then all were sacrificed by cervical decapitation under high dose of diethyl ether anesthesia. Blood samples were collected from cervical vessels immediately. Cell bloods were counted by coulter counted. Serum high density lipoprotein (HDL); total cholesterol (TC) and triglyceride (TG) levels; serum AST; and ALT activity were measured by ordinary methods (Technicon, USA). Low density lipoprotein (LDL) was calculated by Friedwald formula [15]. Data were analyzed by SPSS V.17, using ANOVA and Tukey statistical tests. Results were expressed as mean  $\pm$  SD. Statistical differences were significantly recognized by  $P \leq 0.05$ . These experiments on animals were carried out in accordance with recommendations from the pronouncement of Helsinki and internationally conventional principles for the use of experimental animals, and they received institutional ethical approval from the committee for Animal Research of Zahedan University of Medical Sciences.

## 4. Results

After 8 weeks of handling, there were no significant differences ( $P > 0.05$ ) in LDL and triglyceride values between control and test group; although, HDL value in group T decreased substantially compared to that of group C (Table 1,  $P = 0.007$ ). On the other hand, the serum AST and ALT activity, and cholesterol values in animals treated with ND were

increased significantly ( $P = 0.001$ ,  $P = 0.02$ ), in comparison with those of group C (Table 1).

Based on ANOV and Tukey testes, AST, ALT and cholesterol values in male group T were increased significantly compared to those of other groups but HDL value in group T was significantly decreased compared to that of other groups ( $P < 0.05$ ). In addition, Blood cell parameter, final weight, food, and water intake in group T rose sharply compared to those of group C and P (Table 2,  $P < 0.05$ ). The comparison of other parameters values in all groups did not showed any differences.

Based on ANOV and Tukey testes: Blood parameter, Final weight, Food, and Water intake values in group T were significantly increased compared to those of other groups ( $P < 0.05$ ).

## 5. Discussion

Anabolic-androgenic steroids (AAS) such as ND are artificial androgen agents used in high doses by athletes to enhance muscular potency and performance. Vieira et al. in a biochemical studies investigated that one time administration of dose-dependent ND leads to increases of serum levels activity of AST, ALT, and ALP in wistar male rats. In addition, the Kupffer cells in portal space and in the liver parenchyma increased significantly compared to control group [12]. Clark et al. studies in 2005 revealed that blood biochemical analysis had shown the symptoms of acute hepatitis [16] for a healthy 40-year-old man using ND. In addition, Stimac et al. reported that bilirubin, AST, ALT and ALP level were higher than normal rang [17] for a 26-year-old male bodybuilder who administered high doses of androgenic/anabolic steroids (500 mg intramuscularly, twice weekly). Pertusi et al. investigated that, in male bodybuilder who uses anabolic steroids, the blood serum biochemistries liver enzymes such as AST, ALT, and creatine kinas (CK) levels showed higher values compared to those of male bodybuilder who did not consume anabolic steroid [18]. In addition, studies revealed that blood chemistry profiles such as AST, ALT are higher than those of controls [19] in case of taking self-directed regimens of anabolic steroids bodybuilders (n = 15). Our findings in the present study indicated that eight - week ND administration causes significantly increased serum AST and ALT activity compared to those of control groups. Likewise, they are confirmed by previous study. In addition, our results revealed that HDL value in group T declined noticeably compared to other groups but cholesterol values in this group were significantly higher than group C and P. Previous study revealed that AAS administration provoked protein synthesis, and fiber type composition in skeletal

**Table 1.** Chronic, of High Doses of ND on Liver Enzymes and Serum Lipid Profiles in Male Rats (N = 10)

Parameters	Groups			P Value
	C	P	T	
LDL, mg/dL	8.9 ± 3.9	9.1 ± 2.8	11.2 ± 7.1	> 0.05
HDL, mg/dL	40.1 ± 8.2	38.1 ± 7.6	22.7 ± 3.6 <sup>a</sup>	< 0.007
Chol, mg/dL	54.1 ± 11.4	55.2 ± 10.7	64.4 ± 6.2 <sup>a</sup>	< 0.02
TG, mg/dL	65.2 ± 13.4	63.2 ± 12.7	61.4 ± 12.1	> 0.05
AST, iu/L	169.7 ± 4.24	172.1 ± 6.24	255 ± 32 <sup>a</sup>	< 0.001
ALT, iu/L	71.6 ± 8.9	69.2 ± 7.7	84.3 ± 3.87 <sup>a</sup>	< 0.02

<sup>a</sup>P < 0.05.**Table 2.** Chronic, of High Doses of ND on Blood Cells, Food and Water Intake in Male Rats (N = 10)

Parameters	Groups			P Value
	C	P	T	
Hemoglobin, g/dL	13.1 ± 1.8	12.8 ± 2.1	16.4 ± 3.1 <sup>a</sup>	< 0.03
Hematocrit, %	43.2 ± 3.3	42.7 ± 2.9	48.6 ± 4.1 <sup>a</sup>	< 0.01
RBC, × 10 <sup>6</sup>	6.21 ± 2.17	6.81 ± 1.62	8.68 ± 1.23 <sup>a</sup>	< 0.03
WBC, × 10 <sup>3</sup>	3.6 ± 0.6	4.2 ± 0.4	5.3 ± 1.23 <sup>a</sup>	> 0.01
Platelets, × 10 <sup>3</sup>	724 ± 76.6	678 ± 68.4	939.9 ± 147.9 <sup>a</sup>	< 0.001
Final weight, g	212.8 ± 12.4	215.2 ± 11.1	236 ± 11.2 <sup>a</sup>	< 0.02
Food intake, g	13.2 ± 3.1	12.9 ± 2.8	15.7 ± 2.7 <sup>a</sup>	< 0.03
Water intake, mL	40.2 ± 5.6	41.7 ± 4.8	48.6 ± 6.6 <sup>a</sup>	< 0.001

<sup>a</sup>P < 0.05.

muscles cell and it causes increases body weight in wistar rats [20]. Gold et al. reported that that N D administration in patients suffering from HIV infection causes improved body weight and lean body mass [2]. Our results in the present study similar to previous study indicated that eight weeks administration of ND causes significantly increased body weight. Frankenfeld et al. reported that administration of supraphysiological doses of ND alters glucose metabolism and lipid profile in wistar rats [21]. Experimental study indicated that ND administration in hemodialysis patients has beneficial effects but alters lipid profile by increasing the serum cholesterol and triglyceride [22]. Our findings showed that HDL value in group T was significantly increased compared to other groups and are in agreement with those of lectures and they showed that supraphysiological ND administration for eight weeks in male rats alters the lipid profile. Ghorbanihghjo et al. investigated that hemoglobin and hematocrit value in hemodialysis patients improved after ND administration [22]. Urhausen in 2003 showed that Blood

parameters (hemoglobin, leucocytes and platelets) in 32 male bodybuilders and power lifters who consumed anabolic steroids were significantly higher than references [23]. In addition, they showed that, in this group, AST and ALT value were over limited [23]. Moreover, our finding revealed that that eight-week high dose of ND administration causes increased blood cell in rats. This finding is completed with Saitoh et al. who reported that injection of ND into young and old mice induced an increase in erythroid colony-forming units, erythroid burst-forming units, and granulocytic-macrophage committed progenitor cells in bone marrow in both groups [3]. Our finding revealed that blood parameters in group T were increased substantially compared to that of C and P groups. This section of finding is similar to previous studies. Our finding in the present study revealed that chronic administration of ND causes increased liver toxicity in male rats by altering the blood parameter, gain of weight, food and water intake in male rats.

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## Footnote

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