

Short Communication

The morphometrical response of the combined nandrolone and testosterone usage to the femur

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The aim of this study is to determine the effects of the combined testosterone and nandrolone usages, which are frequently use in athletics was tested on the femur bone of rabbits. Sixty day old twenty-four New Zealand White rabbits were used. Male and female rabbits were divided into two groups as control group (no application) testosterone (10 mg/kg, IM, one day in a week during 12 weeks) + 10 mg/kg nandrolone deaconate (10 mg/kg, IM, one day in a week during 12 weeks). Back extremity bones of materials were revealed by making diseke and were subjected to maceration operation. Combined testosterone and nandrolone usage depressed ($p < 0.05$) the growth of femur length in males compared to the other groups. Although, the drugs depressed the growth of femur length in females, it was no statistically significant. Effects of drugs on the diameters of corpus, cortex thickness and caliber of cavum medulla were no statistically significant ($p > 0.05$). In conclusion, while the combined nandrolone and testosterone usage on males has suspended the growth of the femur bone significantly, the same effects has not been found significant on females compared to males.

Key words: nandrolone, testosterone, morphometric, femur.

INTRODUCTION

Anabolic androgenic steroids (AAS) are consumed frequently by athletes generally out of curiosity and are posing anabolical, anti-catabolical and motivating effects thus making athletes more durable to intense and lengthy workloads (Bonetti et al., 2008). The analogous synthetic derivatives of AAS are known as the testosterone. AAS are consume nowadays not just for their medical indications but also for and more likely to increase athletically performance (effect of doping) and also for altering the physical appearance as well. Such drugs have been first consumed particularly by runners, weightlifters and body builders (Vardar et al., 2002). The frequently consumed AAS by athletes are particularly testosterone and nandrolone. Both testosterone and nandrolone are posing effects on bone cells, bone growth

and homeostasis by reacting to the receptors of both androgen and estrogen (Clarke and Khosla, 2009). Testosterone is known as a chemical derivative of AAS. ASSs are specifically consumed to invoke anabolic effects on the protein synthesis stimulation and thus to increase the performance (Schanzer and Thevis, 2007).

Human body skeleton is composed of long, plain, short, irregular and sesamoidal bones. Femur is one of the long bones and has two major parts which are diaphysis and epiphysis. Diaphysis is the hull of the bone while epiphysis is the upper and lower ends (Rogol and Yesalis, 1992). Growth and development of the bones are continuous for a long time during postnatal period. Until the growth has completed in an individual, bones are growing longitudinally which is taking place in epiphysis. After this time period has passed epiphysis line is becoming ossificated and thus growth will be ended (Hörner and Dreseher, 1992).

AAS have many adverse effects on psychology in addition to their adverse effects on locomotor, endocrine, genital systems also on the liver and the heart (Maravelias et al., 2005; Brand and van der Schouw,

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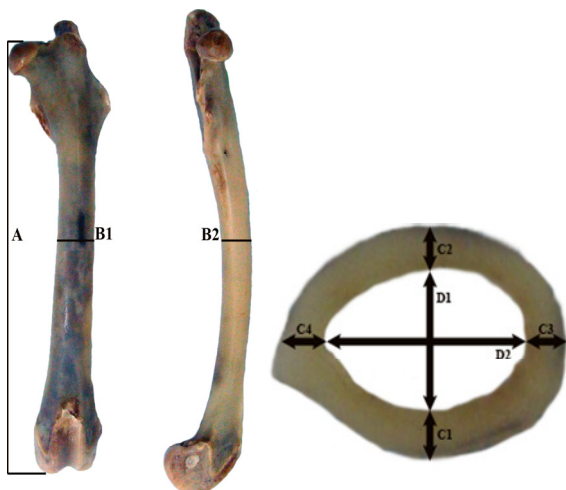


Figure 1. Reference points of femur Height (A), Corpus ($B1+B2/2$), Cortex ($C1+C2+C3+C4/4$) and Medullar calibers ($D1+D2/2$). A, Pitch between terminal points of rag ossis femoris and trochlea ossis femoris; $B1+B2/2$, corpus thickness of femur; $C1+C2+C3+C4/4$, cortex thickness (cortical bone-substantiate compacta) of femur level; $D1+D2/2$, caliber of cavum medullar of femur in corpus level.

2010). Development of the skeleton is significantly manipulated if AAS are consumed during early developmental and adolescent ages (Bonetti et al., 2008). Effects of androgens on the bone structure are clear and diffusive. Androgens can make manipulations on the healthy development of the bone structure via osteoblasts and osteocytes (Wiren and Orwoll, 2001). Effects of androgens are much more significant on males especially however on females they are also making significant differences (Wiren and Orwoll, 1999). This study has carried out to examine the effects of the combined testosterone and nandrolone consumption which are frequently used in the athletes on the femur bone of rabbits.

MATERIALS AND METHODS

Twenty-four New Zealand White rabbits (60 days old, Selcuk University Experimental Medical Research and Application Center, Konya, Turkey) were used. Study protocol was approved by Ethic Committee of Selcuk University, Faculty Veterinary Medicine. Rabbits were feed on *ad libitum* and put in standard cages as male and female individually. The temperature of laboratory which the study was made was nearly 25°C and moisture rate of it was fixed at 52.00% Rh. Male and female rabbits were divided into two groups. Control group (male n:6, female n:6) was feed during 12 weeks without any application. 10 mg/kg of testosterone (Sustanon® 250 amp, Organon Ilaclari A.S, Istanbul, Turkey) + 10 mg/kg of nandrolone deaconate (DECA 1000 flk. Gen-shi labs.co. Osaka, Japan). 10 mg/kg intramuscular were applied on experimental group (male n: 6, female n: 6) one day in a week during 12 weeks. After 12 weeks, all rabbits were made euthanasia

with the injection of pentobarbitalin intraperitoneal (Nembutal sodium, Abfar Ilac San). Back extremity bones of materials were revealed by making diseke and were subjected to maceration operation. Femur bones which were got were dried. Anatomical reference points of left side femur bones would be measured as length (A). By reference to the mid point of each femur bone, (Figure 1) corpus thickness [$B1$ (mediolateral) + $B2$ (craniocaudal) / 2], cortex-cortical bones thickness [$C1$ (caudal) + $C2$ (cranial) + $C3$ (medial) + $C4$ (lateral) / 4] medullar thickness-cavum medullare measures [$D1$ (craniocaudal) + $D2$ (mediolateral) / 2] were determined by calipers (Stainless hardened digital caliper, China). To write the anatomical terms "Nomina Anatomica Veterinaria" (N.A.V. 2005) was used.

To evaluate the data, ANOVA and Duncan test was used. (SPSS 12.0) $p < 0.05$ value was accepted statistically significant.

RESULTS

Lengths and diameters of corpus, cortex and medulla of femurs of both subject (nandrolone + testosterone) and control rabbits have been compared. If the length of the femur of rabbits is examined it is seen that the drug has shorten the femur length significantly on males and differences are statistically significant ($p < 0.05$). On females subject rabbits have shown shorter lengths of the femur bone however differences are statistically insignificant ($p > 0.05$). It is seen that, there are no significant differences on diameters of corpus, cortex and medulla of both subject and control rabbits femur bones ($p > 0.05$).

DISCUSSION

The morphometrical effects of the combined testosterone and nandrolone, which are of AAS, consummation on the femur bone of rabbits have been examined. Growth of the lengths of the femur among male subject rabbits are significantly suspended comparing to those of the control. Similar studies have been carried out, for example, Lok and Yalcin (2010) carried out a study on this matter and stated that, the nandrolone is posing effect on female femur bone epiphysis and thus resulting with early epiphysis closure. In a study by Vajda et al. (2009), it is stated that anabolic androgenic steroids have been suspended the growth of femur bones on females, but differences are insignificant. In another study by Miles et al. (1992), it was reported that the usage of anabolic androgenic steroids are resulting to epiphysial closure on the femur epiphysis. It is seen in the study that female femur lengths of subjects is numerically shorter compared to those of control, but the differences are statistically insignificant (Table 1). In another study, it is stated that the nandrolone has suspended epiphysial growth of the femur on females; this conclusion has similarity with our study (Lok and Yalcin, 2010). Literature has revealed that, the consummation of the testosterone has result to shortness of the femur and early epiphysial closure (Wiren and Orwoll, 2001). The findings of this

Table 1. Comparisons of the Length, Corpus, cortex and medulla of the femur bone (Mean \pm SD).

	Control fem.	Control male	Subject fem.	Subject male
Length	87.3 \pm 2.35b	90.0 \pm 3.32a	85.4 \pm 1.10bc	83.3 \pm 1.18c
Corpus	7.30 \pm 0.37	7.50 \pm 0.24	7.30 \pm 0.31	7.20 \pm 0.26
Cortex	1.10 \pm 0.11	1.00 \pm 0.05	1.10 \pm 0.07	1.10 \pm 0.08
Medulla	5.00 \pm 0.39	5.20 \pm 0.30	5.00 \pm 0.42	5.00 \pm 0.43

a, b, c: Different letters on the same line are statistically significant (Duncan test, $p < 0.05$).

study are similar to literature.

In this study, subjects (nandrolone + testosterone) have posed no significant effects on the thickness of both corpus and cortex and on the diameter of medulla on both female and male femur bones. In a study carried by Gunness and Orwoll (1995) it was stated that, the consummation of AAS has resulted to no significant differences on the corpus of femurs. Wiren (2008) on the other hand has stated that, the consummation of the testosterone has resulted in increase of the cortex thickness of femurs. His conclusion shows no similarity to recent findings.

Conclusion

Effects of the combined AAS that is nandrolone and testosterone consummation on the rabbit femur bone have been examined. The combined nandrolone and testosterone consummation on males' rabbit has suspended the growth of the femur bone significantly; these same effects have not been found significant on females compared to males. Accordingly, testosterone is a male gonadotroph hormone, so it is naturally found more in blood circulation of males than females. Thus it can be stated that epiphysial closure is seen more significant on males compared to females.

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