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Anabolic Steroids in a Contest Preparation of the Top World-Class Bodybuilder

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Authors' contributions

This work was carried out in collaboration between all authors. Authors IZZ and MW written significant manuscript. Authors IZZ, MW, ZO and BT designed Concept. Authors IZZ and MW performed Data analysis and interpretation. Authors performed IZZ Statistical expertise. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: The aim of this study was to assess adverse effects of self-administration of anabolic androgenic steroids (AAS) by a world-class bodybuilder.
Study Design: It is an overt observational research performed on a top-class bodybuilder before, between, and after world-class competitions.
Methodology: We monitored: (1) cardiovascular health using total cholesterol, triglyceride, high-density lipoprotein, and low-density lipoprotein levels, systolic blood pressure and diastolic blood pressure, creatine phosphokinase concentration, and total fat tissue percentage; (2) hepatic health using aspartate aminotransferase, alanine transaminase, bilirubin, and serum albumin levels; (3) renal health using urea and serum creatinine concentrations, (4) health of a musculoskeletal apparatus using concentration of lactate dehydrogenase and an average bone mineral density of

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both *Trochanters*.
Results: The results of this study did not confirm the earlier reports indicating possible detrimental influence of AAS on hepatic and cardiovascular health.
Conclusions: When ruminating on the results of this study one has to take into consideration the fact that the subject has been continuously self-administering AAS for the last 16 years. From this perspective the observed detrimental changes are not as severe as suggested previously. Health related changes outlined in this study should also be contemplated form an objective and a subjective point of view. Objectively, we have to admit that use/abuse AAS may increase a risk of cardiovascular and hepatic diseases. Form a subjective point of view, administration of AAS not only increases self confidence but also, in the case of competitive bodybuilding, has a clear financial weight.

Keywords: AAS–anabolic androgenic steroids; hepatic health; cardiovascular health; musculoskeletal health; competitive bodybuilding.

1. INTRODUCTION

Anabolic androgenic steroids (AAS) are synthetic derivatives of testosterone which principal function is to stimulate synthesis of cellular proteins. This combined with stimulation or suppression of specific genes and changing permeability of cell membranes, results in anabolic effect [1]. A potency of AAS is modulated not only by a genetic capability for muscle growth [2,3] but also by amount of nutrients that are available in the body [4,5].

Due to ability for exerting strong beneficial role in athletes, including increase in lean body mass and strength [6-8], popularity of AAS, despite their illegality, is still growing [9-11]. Notwithstanding reports indicating multiple adverse effects of steroids use [12-15] the anticipated gain - financial and psychological - of using anabolic steroids overweighs those concerns.

An extensive literature review on an influence of AAS on strength training athletes [16], *ibid* Table 1, showed that the vast majority of studies encompassed athletes who emplyed only one or two brands of anabolic steroids. Although, such an approach is valid from a clinical point of view, it is of little practical relevance to contemporary strength sports, including bodybuilding and weight-lifting.

To overcome dearth of information on real extend of use/abuse of AAS during preparation for top level bodybuilding competitions we performed an overt observational research on a professional bodybuilder during the preparation period for two world-class international bodybuilding competitions. In the presented study scheme, we followed the competitor for nine moths i.e., during the pre-competition preparation period, between competitions, and during the post-competition period. Throughout all periods a vista of physiological parameters defining general health status was monitored.

It has to be noted that it is the first ever report on AAS use by a world-class bodybuilder.

2. MATERIALS AND METHODS

2.1 Subject

This study was performed on a world-class bodybuilder, who was at the time of the study 34 years of age. The subject has been self administering AAS for 16 years. During the observation period lasting 181 days, Table 1, the subject used many different brands of AAS, human growth hormone (HGH), and “fat burning” drugs, combined with the specific diet, Table 2 and Table 3, respectively. The subject provided a written informed consent to participate in this study.

2.2 Study Protocol

To assess the subject health level as a function of a preparation stage for two international world-class competitions we analyzed time depended changes in parameters defining 1) cardiovascular health, 2) hepatic health, 3) renal health, and 4) musculoskeletal health.

A level of cardiovascular health was assessed by monitoring: 1) Total Cholesterol (TC), 2) Triglyceride levels (TG), 3) High-Density Lipoprotein levels (HDL-C), 4) Low-Density Lipoprotein levels (LDL-C), 5) systolic blood pressure (SBD), 6) diastolic blood pressure (DBP), 7) creatine phosphokinase (CPK) concentration, and 8) total fat tissue percentage (TF%).

Table 1. Changes in parameters defining a general health level of a competition as a function of preparation period

Parameter/Preparation day	-10A	A	+22A/ -31B	+49A/ -4B	+51A/ -2B	B	+18B	+54B	+84B	+118B
BM (kg)	105.2		106.1	102.3	101.0		107.3	107.5	109.0	110.2
TC (mmol/L)	4.01		4.64	3.65	3.52		4.14	4.84	5.21	4.71
TG (mol/L)	2.15		2.18	2.1	1.99		2.05	2.15	1.99	1.86
HDL-C (mmol/L)	0.16		0.26	0.31	0.28		0.13	0.28	0.57	0.39
LDL-C (mmol/L)	3.39		3.89	3.11	2.93		3.6	4.17	4.27	3.89
SBP (mmHg)	127		129	130	135		125	133	137	128
DBP (mmHg)	85		89	88	92		86	90	93	88
Total fat %	4.4		5.9	4.5	4.4		5.7	6.5	6.7	7.7
AST (μkat/L)	1.59		1.04	1.47	1.82		0.89	1.24	0.67	1.39
ALT (μkta/L)	1.92		1.24	2.15	2.27		1.19	1.64	0.99	3.14
BI (μmol/L)	6.84		6.84	7.35	6.33		8.21	8.04	9.92	8.72
ALB (g/L)	44.1		42.8	39.9	41.9		41	39.6	41.6	40.9
UE (mmol/L)	8.49		6.99	9.66	9.82		5.33	4.66	4.5	4.0
SCR (μmol/L)	79.56		82.21	79.56	79.56		71.61	75.14	74.26	80.45
LDH (U/L)	255		203	253	300		195	210	193	216
BMD (troch/ave) (g/cm^2)	1.41		1.42	1.41	1.42		1.42	1.41	1.43	1.42
TT (nmol/L) >	52.1		52.1	52.1	52.1		52.1	52.1	52.1	52.1

BM – body mass; UE – urea; SCR – serum creatinine, BI – bilirubin, TP – total protein; ALB – albumin; CPK - creatine phosphokinase, AST – aspartate aminotransferase; ALT - alanine transaminase; TG - Triglyceride levels, TC - Total Cholesterol; HDL-C - High-Density Lipoprotein levels, LDL-C - Low-Density Lipoprotein levels; SBP – systolic blood pressure, DBP – diastolic blood pressure, BMD – bone mineral density, TT – testosterone, LDH- lactate dehydrogenase. -10A – ten days before competition A, +22A/-31B – 22 days after competition A and -31days before competition B etc

Table 2. A pre-, between- and post-competition AAS regime employed by the study subject

Androgenic anabolic steroid	Dosages: one month before competition A and one month before competition B	Dosage competition A till one month before competition B	Dosage per day after competition B
Testosterone propionate	100 mg every second day	100 mg every second day	100 mg every second day
Drostanolone propionate (Masteron)	100 mg every second day	X	X
Trenbolone acetate	75 mg every second day	X	X
Oxandrolone (Anavar)	5x10 mg per day	X	X
Winstrol (Stanozolol)	100 mg every second day	X	X
Boldenone undecylenate	600 mg per week	X	X
Triiodothyronine (t3)	25 mg per day	X	X
Clenbuterol	2 x 0,040 mg per day	X	X
Proviron (Masterolone)	25mg per day	X	X
Nolvadex (Tamoxifen citrate)	2 x 20 mg per day	X	X
HGH (human growth hormone)	2 x 4IU per day	2 x 2 IU per day	2 x 2 IU per day
2,4XDinitrophenol	200 mg 6 days per week (7th day off)	X	X

Table 3. Dietary regime, protein, carbo-hydrates, and fat (g) and (cal) per kg of body mas during the contest preparation period

Meal 1: 7:30 AM		
Protein (g)/cal	0.75	3
Fat (g)/cal	0.08	0.72
Carbohydrates (g)/cal	0.64	2.56
Sum of calories (cal)		6.28
Meal 2: 10:30 AM		
Protein (g)/cal	0.64	2.56
Fat (g)/cal	0.07	0.63
Carbohydrates (g)/cal	0.92	3.68
Sum of calories (cal)		6.87
Meal 3: 02:00 PM		
Protein (g)/cal	0.7	2.8
Fat (g)/cal	0.21	1.89
Carbohydrates (g)/cal	0.84	3.36
Sum of calories (cal)/cal		8.05
Meal 4: 05:00 PM		
Protein (g)/cal	0.7	2.8
Fat (g)/cal	0.02	0.18
Carbohydrates (g)/cal	0.84	3.36
Sum of calories (cal)		6.34
Meal 5: 08:00 PM		
Protein (g)/cal	0.72	2.88
Fat (g)/cal	0.2	1.8
Carbohydrates (g)/cal	0.7	2.8
Sum of calories (cal)		7.48
Meal 6: 11:00 PM		
Protein (g)/cal	0.6	2.4
Fat (g)/cal	0.6	5.4
Carbohydrates (g)/cal	0.5	2
Sum of calories (cal)		9.8
Sum per day		
Protein (g)/cal	3.44	14.16
Fat (g)/cal	1.74	12.46
Carbohydrates (g)/cal	3.8	21.48
Calories (cal)		38.54

Hepatic health was assessed through an analysis of changes in 1) aspartate aminotransferase (AST), 2) alanine transaminase (ALT), 3) bilirubin (BI), and 4) serum albumin levels (ALB).

Renal health was monitored by means of 1) concentration of urea (UE), and 2) serum creatinine concentration (SCR).

A musculoskeletal health was examined using 1) a concentration of lactate dehydrogenase (LDH), and 2) an average bone mineral density (BMD) of both *Trochanters*.

Blood analysis was performed using Sysmex XE-2100 automated hematology blood analyzer. Bone density and total fat tissue was measured using dual-energy X-ray absorptiometry (DXA) GE Lunar Prodigy Primo apparatus.

Blood pressure was an average of 10 measurements performed using BOSO MEDISTAR apparatus performed accordingly to the standards reviewed elsewhere [17]. Relative changes for a specific parameter, were calculated using the "natural" relative difference, employing natural logarithm, denoted as log percent (L%) [18].

3. RESULTS AND DISCUSSION

3.1 Results

An analysis of Table 1 shows that body mass of the subject varied between 101.0 kg (+51A/-2B) and 110.2 kg at (+118B) during the experiment period. Changes in body mass (BM) were coarsely associated with changes in total fat percentage: 4.4% and 1.1% for the respective body masses. The graphical representation of relations between body mass and total fat percentage is presented in Fig. 1A-B.

A scrutiny of blood urea and serum creatinine levels reveals fairly high values of these two parameters prior to the second competition. High levels of blood urea and serum creatinine are followed by a distinct drop in the urea concentration equal to -61.1 L% (+51A/-2B vs. +18B) associated with a moderate decrease in serum creatinine concentration equal to -10.5 L%, *vide* Fig. 2A-B.

An analysis of serum lipid profiles exposed low concentration of HDL-C and high concentrations of LDL-C, TG, and TC. During the post competition period (+18B - +84B) an acute increase in HDL-C equal to 147.8 L%, was observed. Although nn analogous change was observed for LDL-C a corresponding increase in LDL-C concentration was much less and equal only to 17.1 L%. Graphical representation of changes in serum lipids levels as a function of competition preparation period is presented in Fig. 3A-B.

An examination of changes in SBP and DBP as a function of a preparation period showed lowest blood pressures right after the completion of competitions A (+22A/-31B) and B (+18B); where the respective SBP/DBP ratios were 129/89 and 125/86. An examination of levels of markers defining hepatic health as a function of preparation period exposed random variations in

AST and ALT concentrations. Nevertheless, an analysis of changes in bilirubin concentration revealed a progressive increase in its values between the first and the last measurement. An analysis of UE and SCR concentration as a function of preparation period revealed reverse proportional relation between these parameters in the second post-competition period (+18B – 118B). Such a relation is absent in competitions preceding periods (-10A - +51A/-2B). An analysis of changes in LDH revealed high LDH values only before competitions: measurement at -10A revealed the activity of LDH equal to 255 U/L, and at +51A/-2B equal to 300 U/L. Post-competition period is defined by a marked decrease in LDH activity.

The values of BMD are constant during the experimental period and vary between 1.41 – 1.42 g/cm^2.

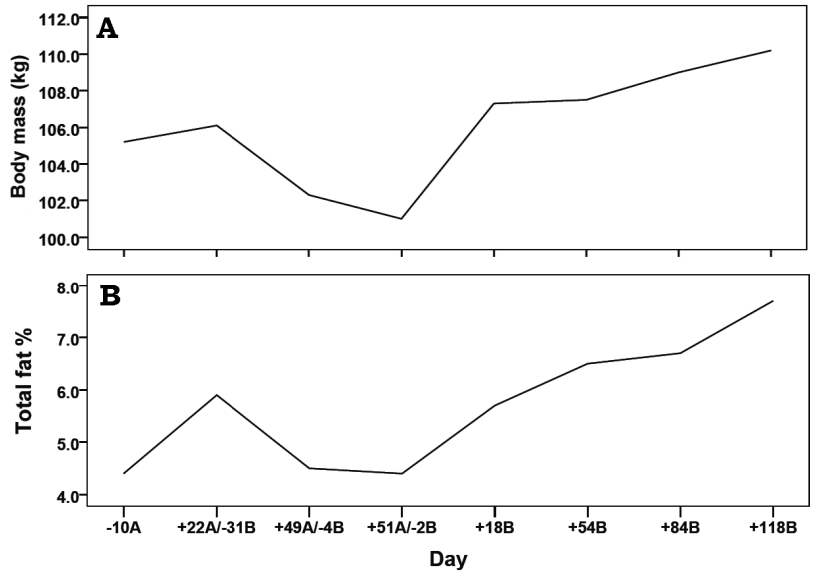

Fig. 1. Changes in body mass (A) and total fat tissue percentage (B) as a function of competition preparation period

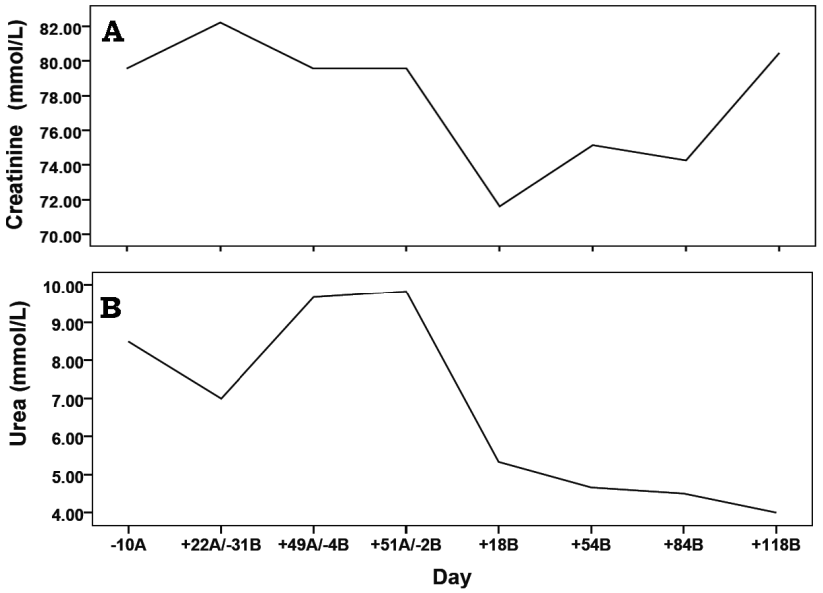

Fig. 2. Changes in serum creatinine concentration (A) and serum urea concentration (B) as a function of competition preparation period

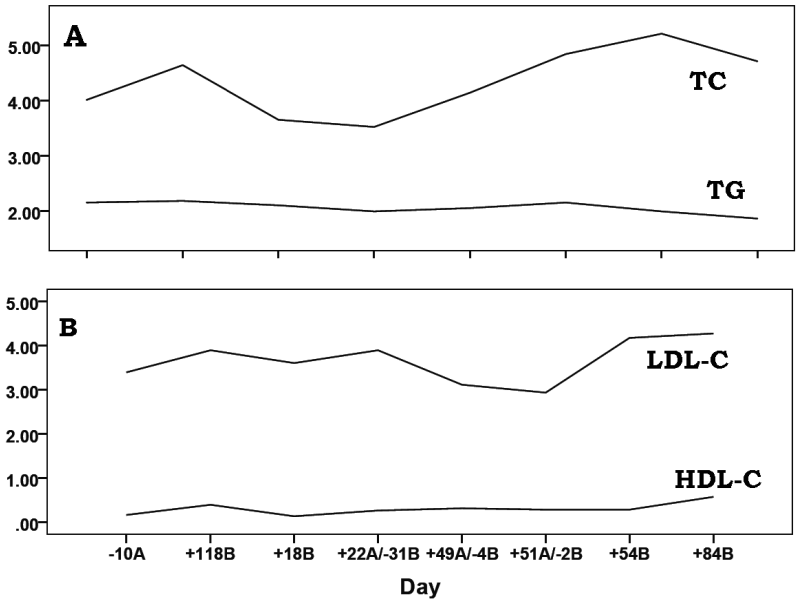

Fig. 3. Changes in serum lipid profile as a function competition preparation period. A) Serum Total cholesterol (TC) and Triglycerides (TG) levels; B) High-Density Lipoprotein (HDL-C) and Low-Density Lipoprotein (LDL-C) levels

3.2 DISCUSSION

In this first ever study performed on a world-class competitive bodybuilder we showed that a superior physique, a modern body-building condition *sine qua non*, is rendered by employment of a mixture of not only supraphysiogical doses of AAS but also "fat burning" substances. Such an extensive administration of physics enhancing drugs was also associated by a specific diet. Accordingly to our dietary review an average intake of was on the order of ~ 4g per kilogram of body mass per day. This observation led us to a conjecture that supraphysiological doses of AAS allowed for full utilization of proteins required for muscle recuperation due to this hyper-rich protein diet.

An analysis of serum lipid profiles indicated an extremely low level of HDL-C across all sampling times: an average concentration of HDL-C was equal to 0.3 mmol/L. Nevertheless, a level LDL-C was in norm, and only at +54B and +84B crossed the high concentration threshold. Total cholesterol and TG levels were in the norm across all measurements. A scrutiny of changes in the level of LDH revealed values within the generally accepted range and, in our opinion, and confirmed an earlier report that indicated that use of AAS does not influence LDH concentration [17].

An examination of changes in AST, ALT, and bilirubin revealed the values 2 to 3 times higher than those currently adopted as the upper reference range for these parameters: 0.55 μkat/L (32 U/L), 0.56 μkat/L (33 U/L), and 5.14 μmol/L (0.3 mg/dL), for in AST, ALT, and BI respectively.

4. CONCLUSION

An analysis of the current literature exposed a dearth of information on side effects of stacking of different brands of steroids and/or side effects of long-term cyclical patterns of steroids. The results of this research partially confirmed previous reports exposing potentially detrimental influence of AAS on hepatic, and cardiovascular health.

However, when contemplating the risks of AAS use one has to take into consideration the fact, that the studied subject has been continuously self-administering AAS for the last 16 years. In this context the observed changes were not as severe detrimental as suggested by others.

Objectively one has to admit that use/abuse AAS may increase a risk of cardiovascular and hepatic diseases. However, form a subjective point of view employment of AAS not only

increase self confidence but also, in the case of competitive bodybuilding, has a clear financial weight.

CONSENT

All authors declare that written informed consent was obtained from the patient for publication of this case report and accompanying images.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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