

# Anabolic Androgenic Steroid Abuse and their Health Impacts: A Cross-sectional Study among Body Builders in a City of Eastern India

## Abstract

**Background:** Anabolic-androgenic steroids (AASs), when taken in supraphysiologic doses, increase muscle strength and athletic performance. Evidence suggests that long-term use of AAS in supraphysiologic doses have adverse effects on health. Therefore, the study was conducted to find crude estimate of the prevalence of AAS use among attendees of the gymnasium, the factors that could have influenced them for AAS abuse and to assess the short- and long-term side effects as perceived by them. **Methods:** A cross-sectional study was conducted in selected gymnasiums of a smart city of India using a predesigned and pretested questionnaire. Snowball sampling method was undertaken. The study was from July 2015 to June 2016. Informed written consent was taken. The analysis was done using SPSS v. 20.0. **Results:** Of 84 bodybuilders approached, 74 participants used AAS. All users were male with mean age of 26.5 + 0.55 years. The mean age of initiation of AAS abuse was 23 years, and 66.2% (49) were unmarried. Eighty-five percent (63) preferred injectable. Seventy percent (52) abusers were influenced by trainers for abuse. Most commonly abused was Nandrolone decanoate (55.4%). Seventy-three percent were not aware of any legal ban on steroids. Reported benefits include increased strength, muscle size, and power, while harms were increased acne, deepening of voice, swelling of feet, increased irritability, depressive thoughts, impaired judgment, panic disorder, and withdrawal effect. **Conclusions:** Frequency of ASS use was substantial among young bodybuilders. Awareness about side effects was not a deterrent factor. Abusers were highly influenced by coaches. Efforts should be made for preventing easy access to AAS.

**Keywords:** Fitness centers, steroids, substance-related disorders

## Introduction

The anabolic-androgenic steroids (AASs) are a family of hormones that includes the natural male hormone testosterone together with its many synthetic relatives, all of which exhibit both anabolic (“muscle building”) and androgenic (“masculinizing”) properties.<sup>[1-3]</sup> When taken in supraphysiologic doses, AAS allows users to enhance muscle strength and athletic performance, often well beyond the limit attainable by natural means.<sup>[1,4]</sup> The majority of illicit AAS users are not elite athletes; indeed, many are not competitive athletes at all, but simply individuals who want to become more muscular.<sup>[1]</sup> A recent meta-analysis estimated the lifetime prevalence of AAS abuse worldwide is 6.4% among men and 18.4% among recreational athletes.<sup>[5]</sup>

AAS abuse is commonly seen in the case of bodybuilders, weightlifters, and other athletes, to improve their performances,

increase muscle growth and lean mass.<sup>[6,7]</sup> Most individuals with current or past AAS use are young men.<sup>[1]</sup> A limitation of human studies is represented by the fact that information about the intake of AAS is generally self-reported and it is hardly possible to assess the exact dosage. Furthermore, AASs are used in combination with other drugs or substances (so-called “steroid-accessory drugs,” such as ephedrine, growth hormone, diuretics) for which it is difficult to separate their toxic effects.<sup>[6,7]</sup> AASs are used in diseases, such as testosterone deficiency, malnutrition, aplastic anemia, hypogonadism, and delayed male puberty.<sup>[4]</sup> Insulin sensitivity is lowered by the use of AAS.<sup>[8]</sup> They can be administered orally, parenterally by intramuscular injection and transdermally.<sup>[2,7,9]</sup> The most common routes are oral and injectable routes.<sup>[7,9]</sup>

Evidence suggests that long-term use of supraphysiologic doses of AAS may have adverse effects on several organ systems,

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**Table 1: Effects of anabolic-androgenic steroids and the time for the effect to appear as perceived abusers**

	n (%)	Time for effect to appear (months)±SE
<b>Beneficial effect</b>		
Increased strength	46 (62.2)	3.17±0.335
Improved appetite	50 (67.5)	3.82±0.413
Improved muscle size	65 (87.8)	5.64±0.342
Decreased body fat	36 (48.6)	6.78±0.572
Improved healing	22 (29.7)	8.33±3.184
<b>Adverse effect</b>		
Increased acne	28 (37.8)	5.29±0.626
Hair loss from scalp	24 (32.4)	11.29±1.054
Deepening of voice	15 (20.3)	19.67±2.410
Increased body and face hair	14 (18.9)	17.29±2.624
Fluid retention in body	16 (21.6)	11.06±1.822
Swelling of feet	12 (16.2)	9.33±2.353
Joint tenderness	13 (17.6)	8.85±1.713
Skin striae	19 (25.7)	7.89±1.230
Insomnia	26 (35.1)	4.19±0.656
Violent feelings	22 (29.7)	7.82±1.450
Depressive feelings	7 (9.5)	4.86±1.625
Irritability	20 (27)	8.5±1.389
Panic disorders	22 (29.7)	6.27±1.026
Reduced metalizing capacity	9 (12.2)	16.33±3.771
Impaired judgment	6 (8.1)	15.5±3.324
Withdrawal effect	6 (8.1)	19.33±5.077
Craving	20 (27)	13.33±4.828
Palpitation	20 (27)	7.65±1.996
Tendon and muscle tears	5 (6.8)	8.60±4.297
Testicular atrophy	3 (4.1)	17.33±6.667
Erectile dysfunction	8 (10.8)	7.75±2.637
Altered sex drive	8 (10.8)	10.38±3.854
Hypertension	8 (10.8)	5±0.681

SE=Standard error

leading to both medical and psychiatric pathology.<sup>[1]</sup> AAS adverse effects range from hirsutism, acne, clitoral enlargement and deepened voice in women to hypertension, heart hypertrophy, myocardial infarction, decreased high-density lipoprotein, fluid retention, liver failure, kidney damage, personality disturbance, mood fluctuation, prostatic hypertrophy, and certain cancers.<sup>[1,10,11]</sup>

The researchers hence did this study to find reasons that could influence bodybuilders for AAS abuse, and the possible side effects they might have encountered during use. Simultaneously, a crude estimate of the prevalence of the AAS use could also be done. Therefore, the study was conducted to know the factors that could have influenced the bodybuilders for AAS abuse and to assess the short- and long-term side effects as perceived by them.

## Methods

It was a cross-sectional study conducted in selected gymnasiums of Bhubaneswar which is the capital city

of Odisha, India, for 12 months (July 2015–June 2016). Persons attending gymnasium with a basic purpose of bodybuilding and professional bodybuilders who had given consent were included in the study. Persons not willing to participate in the study and those attending gymnasium for body fitness (such as yoga, aerobics, and weight loss) were excluded from the study.

Data were collected using a predesigned, pretested schedule developed from available tools. Content validity was done by experts in the field from the Department of Biochemistry, Pharmacology, and Endocrinology.

Snowball sampling method was used to identify AAS abusers. The gymnasium of a University was the starting point for snowball sampling. AAS abusers identified at each level were asked to suggest the names of other AAS abusers known to them. The first and the second case were identified by the lead investigator as two bodybuilders in the gymnasium. Both the cases led to subsequent cases and name of gymnasium they were attending. The end of the study was taken as the point where no cases were detected from the sampled gymnasiums. In this way, 87 AAS abusers were approached, and 13 were excluded who either fell into the category of exclusion or did not give consent for the study. In this way, a total of 74 participants were included in the study.

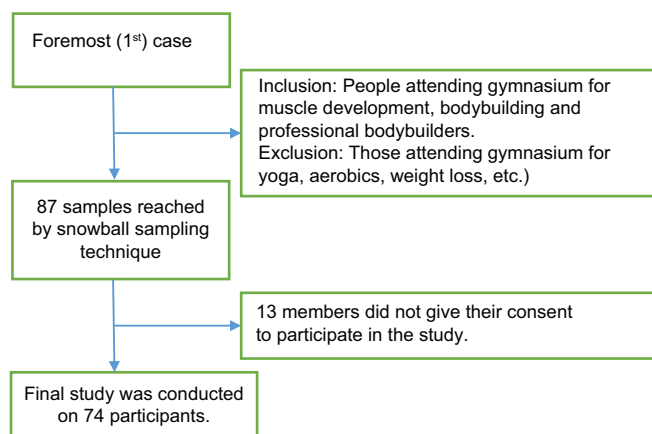
Data were cleaned on the day of data collection and entered into Excel sheet on the same day. The data thus collected were processed and analyzed using SPSS v20.0 software (IBM Corp., Armonk, NY, USA) and wherever necessary through manual calculation.

Ethical clearance was obtained from Institutional Ethics Committee of IMS and SUM Hospital. Informed and written consent was taken from the participants. Confidentiality was ensured at all stages. Participants were informed about the right to discontinue participation at any time during the interview without giving reasons, and that refraining should not influence their individual care.

## Results

A total of 87 AAS abusers were approached and 13 were excluded. Hence, the results presented in the study were drawn from 74 participants [Figure 1]. The mean age of the participants was 26.5 ± 0.55 years and all were male. Among them, 66.2% were unmarried. The average family size was 5 and median family income of INR 20,000 (interquartile range [IQR]: 12,000–30,000). Maximum participants were students 18.9% and only one participant was exclusively a bodybuilder by profession. Mean age of initiation of AAS use was 23 years.

Many study participants, i.e., 67.6% (50) did not have regular health check-up although some of them did certain laboratory investigations on their own. Those having health checkup visited a physician once in a month or two. Most



**Figure 1: Sampling method of study participants**

of the participants, i.e., 74.3% (55) did not assess health parameters (such as blood and urine tests) regularly and only a quarter of them i.e., 25.74% (19) did assess their health parameters, infrequently.

The mean days of gymnasium attendance were  $5.14 \pm 0.42$  months among the AAS abusers. The mean age of onset of steroid abuse is  $22.99 \pm 0.33$  years. The median number of steroids abused by the participants was two (IQR = 2–3).

Maximum participants (85.1%, 63) preferred using AAS in injectable form followed by oral (40.5%, 30) and transdermal (6.7%, 5). Only injectable abusers were 55.4% (41) while oral abusers were 14.8% (11). None of the AAS abusers used transdermally singly (it was always used in combination). The combination of oral and injectable form was used by 22.9% (17); injectable and transdermal form by three; and oral, injectable, and transdermal form by two of the participants.

Majority of the participants (81.1%) used steroids regularly. Regularly, irregular pattern was found to be present in 16.2% (12) cases while 2.7% (2) used in irregularly irregular pattern. While exploring the purpose behind steroid abuse, it was found that 19.9% (27) of the participants used AAS for bulking up, followed by shredding 22.9% (17), attaining competitions 21.6% (16), and maintenance of existing physique 18.9% (14). However, the reason for the use of multiple AAS simultaneously could not be assessed it was assumed that combination of AAS produced synergistic effect.

All the participants used additional supplements such as proteins, pre/postworkouts, mass gainers, amino acids, creatinine supplements (chemical forms such as creatinine anhydride and monohydrate), and fat burners concurrently to AAS. Proteins and amino acid supplement users were the largest (62.1%, 46) followed by pre-/intra-/post-workout drinks (23.0%, 17) and creatinine (14.9%, 11).

Apart from these human growth hormones (HGH), female steroid hormone (FSH) (like progesterone and estrogen),

insulin (rapid and long-acting), triiodothyronine, and clenbuterol were used by the study participants. HGH was most commonly used (11, 14.86%) followed by FSH use (5, 6.75%). Some participants (27, 36.48%) used some over the counter pharmaceutical drugs in addition. Dexamethasone was most commonly used (10, 13.5%) followed by Metformin (9, 12.16%), Cyproheptadine (7, 9.45%), Tribulus Terrestris (4, 5.4%), and Prednisolone (2, 2.7%) [Figure 2].

Majority of participants, i.e., Seventy percent (52) were persuaded by trainers for AAS use, while 17.5% (13) were persuaded by peers. Some used by self-learning (4, 5.4%), using sources such as Internet and magazines. A meager number participant consulted health-care professionals (6.75%, 5) before abusing AAS. Among all the participants, 47.3% (35) had received guidance from multiple sources (gymnasium trainer, peers, and self-learning).

The frequently used steroids were listed and among them it was found that Nandrolone/deca durabolin was most commonly used (41, 55.4%) followed by testosterone/sustanon (29, 39.2%), methandienone/Dianabol (27, 36.48%), stanozolol/winstrol (22, 29.72%), boldenone/equipoise (19, 25.67%), oxandrolone/anavar (11, 14.86%), trenbolone/parabola (8, 10.81%), and oxymetholone/anadrol (6, 8.10%) [Figure 3].

While interrogating on knowledge about the legal ban on steroid abuse, it was found that 27% (20) users were aware of some sort of legal ban on steroids while the remaining majority (54, 73%) were not aware.

There were observed beneficial and harmful effects of AAS as reported by the abusers. The most common benefits included improved muscle size, appetite, strength, and power; while the most common harms included panic disorders, insomnia, acne, and hair loss from the scalp. The effects and the time for the effect to appear have been presented in Table 1.

## Discussion

In our study, the AAS abusers belonged to mid-twenties and mostly unmarried. According to Sagoe *et al.*, 3.9% of men reported lifetime use of AAS, 1.4% use during the past 12 months and 0.4% AAS use during the past 30 days.<sup>[12]</sup> Injectable form of abuse was rampant followed by oral, while transdermal form was less acceptable because of a presumption that it does not get inside the body. Combination of steroids was taken in different forms, doses, and cycles. Steroid abusers typically used to “stack” the drugs, meaning that they used to simultaneously take two or more AAS, of different forms (oral/injectable/topical) and sometimes even including compounds that are meant for veterinary use. The idea behind taking combination steroids is that they interact to produce an effect on muscle size that is greater than the effects of each drug individually,

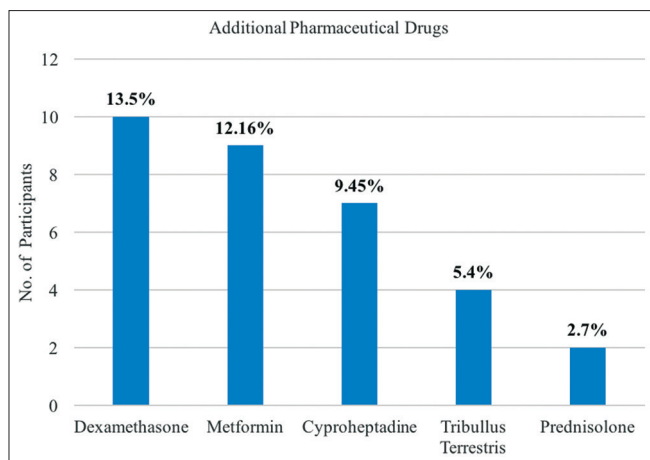


Figure 2: Representing use of additional pharmaceutical drugs along with anabolic-androgenic steroids

a theory that has not been tested scientifically.<sup>[2]</sup> These findings of taking multiple drugs at one time are also similarly depicted in other studies.<sup>[13]</sup> Often, steroid abusers were found to “pyramid” their doses in cycles of weeks to months. In this, at the beginning of a cycle, the abuser starts with low doses and then increases the dose. In the second half of the cycle, the doses are tapered. Abusers believe that pyramiding allows the body to adjust to high doses and the drug-free cycle allows the body’s hormonal and immune system to recuperate.<sup>[2,14,15]</sup>

By 1970s, bodybuilding had gained its popularity.<sup>[1,3]</sup> Fitness and bodybuilding magazines, usually with a male model on front cover, began to proliferate, and increasing numbers of young men became aware of the dramatic muscle gains that they could achieve with AAS.<sup>[1,11]</sup> The main persuasion for the use of AAS was from gymnasium trainers along with encouragement and support from peers. However, other studies have reported peer pressure to be an important persuasion for AAS abuse.<sup>[15]</sup> The Internet proved a handy resource providing knowledge on cycling patterns and usage guidelines. The purpose for many abusers was to build a muscular physique, a shredded or bulkier look based on their vision about their role model. The number of steroid abuse at one time ranged from two to three as reported in similar articles.<sup>[16,17]</sup> The most commonly abused AAS was Nandrolone decanoate followed by Testosterone and Methandienone, and these are known to promote muscle bulk.

Many participants were unaware of legal ban on steroids and others even knowing about the stringency of law regarding AAS abused it. There were observed short- and long-term health effects of AAS abuse.<sup>[15,18]</sup> Some beneficiary effects were increased strength, power, muscle size, healing, and appetite with a decreasing percentage of body fat. The harmful effects were increased acne, deepening of voice, increased body, and facial hairs, swelling of feet and body.<sup>[10,15,16]</sup> There was increased irritability, depressive thoughts among many participants. Some reported impaired

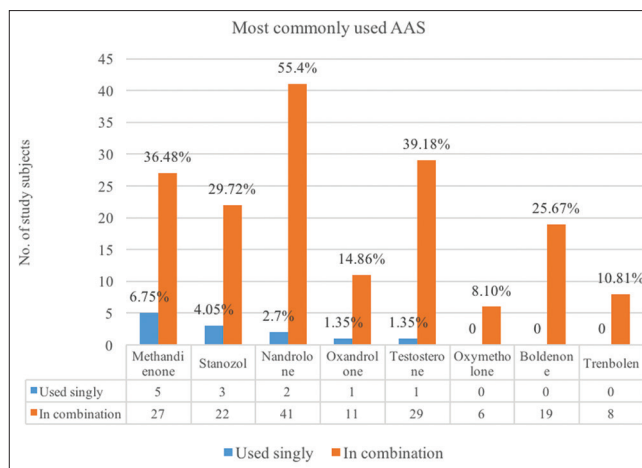


Figure 3: Most commonly used anabolic-androgenic steroids by study subjects

judgment, panic disorder, and withdrawal effect. A minority of participants even reported issues such as altered sex drive and erectile dysfunction. These findings have also been documented in other studies.<sup>[6,10,15,19]</sup>

### Conclusions

Results show that frequency of ASS use is high among young bodybuilders. Awareness of side effects of AAS and education may not be a deterrent factor for their abuse. In-depth research is needed to understand the psychology underlying and psychological reasons for AAS use. Abusers are highly influenced by groups and coaches. Efforts should be also expanded for prevention of the easy access to these drugs.

### Limitations

The assessment of AAS side effects was not objective but was only based on reports by the abusers. This is a major limitation. The exact doses of steroid abuse were not assessed, and the knowledge level about the harms of AAS abuse has also not been assessed. The study is only a one time (cross-sectional) study and more research is necessary.

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### Conflicts of interest

There are no conflicts of interest.

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