



Say No to Anabolic Androgenic Steroids

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ABSTRACT

Anabolic Androgenic steroids are substances synthetic in nature and are related to male sex hormones (Testosterone). They promote the growth and development of skeletal muscles and the development of male sex characteristics in both males and females. In this review paper, we have discussed about what are steroids, their significance, effects and side effects. The main focus of the paper is on the effects of Anabolic Androgenic Steroids on athletes. They use this for Doping hence, some of these drugs are not approved by FDA and various tests are conducted for testing presence of these steroids in human body. We have discussed different types of steroids, their metabolism, enhancement and their market value. Research is still going on this topic and it is a matter of concern nowadays in the field of sports.

Keywords-Androgenic, Doping, Enhancement, Metabolism, Steroids

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I. INTRODUCTION

AAS or Anabolic Androgenic Steroids are synthetic steroids that resembles male hormones or testosterone. It helps in promoting growth and development. There are around 100 varieties of anabolic steroids developed. ^[1]The most common forms are Dianabol, Methandienone, Stanozol etc. They are often taken orally, by injections, capsules, gel tablets and by applying directly on skin as ointment. ^[2] It enhances protein, hepatic, cortisol, carbohydrate metabolism. They are banned in some countries due to their harmful effects like acne, high cholesterol, low blood pressure, hair loss, sterility and used in doping by many athletes. ASS were first synthesized in 1930 and are being user therapeutically for stimulation of muscle growth and development, induces puberty in males and increases the bodyweight. ^[3]

Many scientists have worked on the adverse effects of these Anabolic steroids. Pascal Kintz in 2017 experimented a new series of hair test resulting in involving anabolic steroids. This technology is accepted by most of the people but is not yet recognized by world Anti-Doping agency. They compared this with urine test and concluded urine specimen cannot distinguish between chronic specimen and single exposure. Urine test doesn't indicate the frequency of drug intake in subjects which might deliberately abstain for several days before screening but in case the hair result is negative and urine result is positive they can't say that athletes have no drug content in their body. ^[4] On November 09 /2016 an article published by Crazy Bulk that carried out information on "Is Dianabol legal to buy from the USA as of 2017?". In this they explained that after having dosage of this the athletes see amazing body transformation. They get strength, body faces physical changes, increase in muscles mass, endurance, more aggressiveness and doping. These drugs also result in blotting and water retention in human body. Hence they concluded that these drugs are illegal to buy. ^[5] Another work by R.solmini and his colleagues on 'Hepatotoxicity associated with illicit use AAS in Doping' explained that anabolic steroids abuse and misuse is nowadays harmful habits involving both professional and recreational athletes as well as general public. Hepatotoxicity may be correlated to individual's susceptibility and genetic factor and is associated with increase in infiltrations of lymphocytes, eosinophil's in liver. Later by this study they concluded that AAS and poly drug abuse can be harmful causing variety of side effects including liver injuries which can be life threatening. Individuals should be warned because of the adverse effects of the AAS. ^[6]

The purpose of our review paper is to create awareness about the adverse effects of anabolic androgenic steroids.

II. WHAT ARE ANABOLIC ANDROGENIC STEROIDS?

AAS or anabolic androgenic steroids are steroidal androgens. It includes natural androgens like testosterone and some similar androgens which are synthetic in nature. They can exert strong effects on human body and are responsible for increase in protein level in cell walls. It is often used for the treatment of chronic wasting disorders like cancer and AIDS.

Most of its effects are seen in skeletal muscles. Basically it results in an increase in bodyweight and lean mass. Proper exercise and diet is very necessary along with these drugs. It is a controlled substance in some countries but when they are sold illegally in some countries then the market is called black market in which smuggled, clandestinely manufactured or even counterfeit drugs are sold to the users.



According to NIDA Community of Drug Alert Bulletin AAS are anabolic and synthetic in nature mainly used by athletes for sports. It increases the development of body.

III. METABOLISM AND ENHANCEMENT

Anabolic steroids are the drugs resembling the male hormones or the androgenic hormones. They are consumed by athletes to enhance their performance. Male hormones especially testosterone is responsible for the changes that occur during puberty. They affect the changes in primary characters and secondary characters. These include the facial hair growth, deepening of voice.

Steroid hormone normally works by stimulation of receptor molecules present in muscle cells that activate the specific genes responsible for the production of specific proteins.

They also enhance the enzyme system involved in protein metabolism thus enhancing protein synthesis and preventing the degradation of proteins, which is known as anabolic effect or anti-catabolic effect.

Anabolic steroids work more effectively by heavy resistance but increase the number of receptor site in muscles upon which the effectiveness of anabolic steroids depends. According to reports many athletes have said that many anabolic steroids help them train harder and recover faster and when the leave using the drug their work and performance decreases comparatively.

Anabolic steroids help in intense workout by blocking the effect hormones such as cortisol that are involved in tissue breakdown during exercise.

3.1 Basics of cortisol metabolism

Cortisol released hormones are secreted by adrenal cortex having receptor sites within skeletal muscle cells. Cortisol causes protein breakdown during exercise to enhance the protein as a fuel. Anabolic steroids may block the bi receptor sites of cortisol by binding to it which would prevent muscle breakdown and enhances the recovery. It is beneficial which the athlete is taking the drug and it shows adverse effect. Hormonal adaptation takes place as a result of abnormal amount of male hormones present in athlete's body. It also decreases the testosterone secretion.

Cortisol suppresses the immune system that makes the steroid user more prone to diseases such as cold and flu, during the period immediately following steroid administration. Testosterone combined directly to bind receptors. In the target tissue where the cellular enzymes are present the action of testosterone is mediated by the metabolism. It is irreversibly converted by the enzyme 5Dreductase to 5D-Dihydrotestosterone which binds with higher affinity to Aromatase which binds to the testosterone receptor.

Various factors are reported to enhance the growth of skeletal muscle tissue. Activation of PI3 kinase pathway can induce skeletal muscle that causes an increase in skeletal muscle mass. The effect of PI3 kinase pathway mostly takes place in downstream of IGF-1 signalling. Skeletal muscle stretches increase the mRNA expression of IGF-1 splicing variant mechanic growth factor.^[7]

3.2 Basics of protein synthesis

The basic flow of genetic information within the muscle takes place from,



The information in a particular cell is embedded within the DNA as DNA is the genetic material. Different proteins of DNA may be transcribed for the formation of different type of protein. The transcribed portion of

DNA occurred in the cell nucleus result in the formation of messenger RNA. The m RNA combines with ribosomal RNA (cytoplasmic RNA) which is specific for particular amino acid. The main amino acids together were arranged in a specific manner as determined by the initial copy of DNA which was transcribed. This rise in formation of different types of proteins in which some of them are used for the increased size of the stimulated skeletal muscles.

3.3. Anabolic steroids and protein synthesis

They play a major role in process of protein synthesis. The process begins when the anaerobic steroids enter the muscle cells through the cell membrane. The molecule then binds to an intracellular receptor molecule within cell's cytoplasm resulting in formation of steroid receptor complex. This complex molecule then enters the muscle cell's nucleus after entering it binds to the DNA and the transcription is enhanced by the increased in formation of m RNA. The increased quantity of m RNA leaves the muscle cell and binds to the m RNA within the cell cytoplasm. Then translation of m RNA takes place allowing for protein synthesis to occur within Golgi apparatus of the cell. The additional protein processed are then incorporated into the muscle cell resulting in increase in mass of the muscle cells.^[8]

IV. STRUCTURES OF AAS

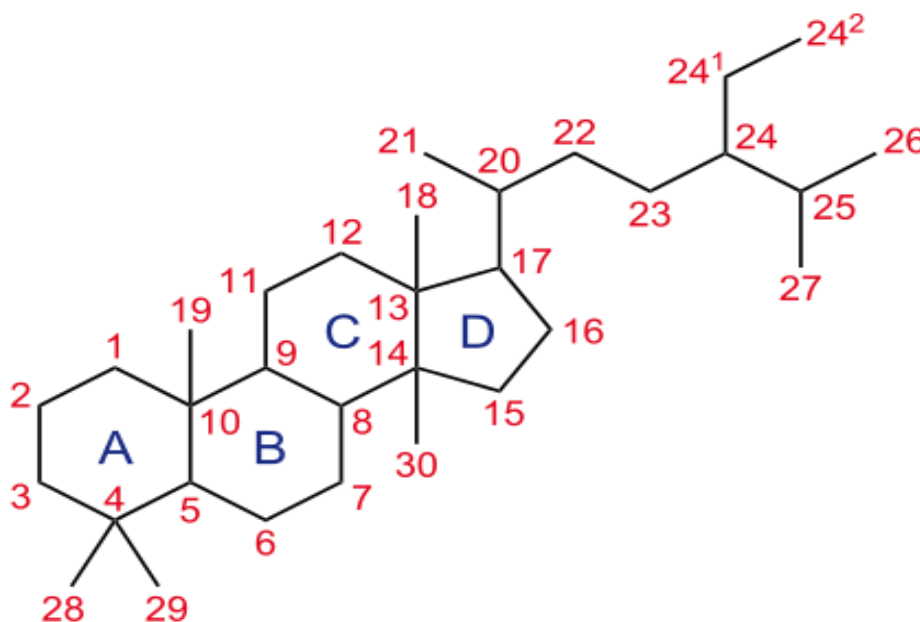


Fig A. Basic ring structure of steroids

Structures of these steroids are made up of steroid rings. It is a combination of “one 5 carbon ring and six carbon rings”. Cholesterol is its primary structure. The synthetic steroids are versions of male testosterone. As it enters the human body it gets absorbed and fits into the receptor site. This results in increase of protein and phosphate synthesis in body due to entry of RNA polymerase. Phosphate synthesis produces additional phosphocreatine which allows greater work in the absence of oxygen while the increase in protein synthesis results in increase of transcription. Methanediene is the most common form of AAS used now a days.^[9]

Table 1 Effect and Side Effects

	<u><i>EFFECTS</i></u>	<u><i>SIDE EFFECTS</i></u>
<u>Women</u>	<ol style="list-style-type: none"> 1.Gives stamina 2.Growth of body muscles 	<ol style="list-style-type: none"> 1.Infertility 2.Uterine atrophy 3.Clitoral hypertrophy 4.Menstrual irregularities 5.Breast atrophy
<u>Men</u>	<ol style="list-style-type: none"> 1.Gives energy for body building 2.Helps in development 	<ol style="list-style-type: none"> 1.Testicular atrophy 2.Impotence 3.Prostatic hypertrophy 4.Gynecomastia 5.Hair loss
<u>Cardiovascular</u>	<ol style="list-style-type: none"> 1.Positive accelerator of RBC production 	<ol style="list-style-type: none"> 1. Hyper tension 2. Stroke 3.Myocarditis 4.Thrombosis
<u>Metabolic</u>	<ol style="list-style-type: none"> 1.Enhances protein, carbohydrate, hepatic and cortisol metabolism 	<ol style="list-style-type: none"> 1. Increase in LDL cholesterol. 2. Decrease in HDL cholesterol.
<u>Behavioural</u>	<ol style="list-style-type: none"> 1. It gives user physical strength and high endurances due to which they are attracted more to these steroids and become drug dependent. 	<ol style="list-style-type: none"> 1.Agressiveness 2.Depression 3.Maniac Behaviour 4.Suicidal thoughts 5.Multiple drug dependence
<u>Skin</u>	<ol style="list-style-type: none"> 1. Increases the growth of muscles. 	<ol style="list-style-type: none"> 1.Acne 2.Sebaceous cyst 3.Profuse sweating 4.Allopecia 5.Allergic Eruptions
<u>Skeletal</u>	<ol style="list-style-type: none"> 1.Enhances athletes performance 	<ol style="list-style-type: none"> 1.Premature growth cessation 2.Ligament injuries 3.Disc herniation



<u>Liver</u>		1.Impaired liver function 2.Peliosis hepatitis 3.Tumors
<u>Immune System</u>		1.Hep B or Hep C, HIV infections if needles are shared

VI. FEW CASES OF DOPING

6.1 NarsinghYadav andIndrajeet Singh Doping Scandal

In Rio Olympics 2016, NarsinghYadav and Indrajeet Singh were tested positive for banned substances by the National Doping Agency (NADA).According to sources he was tested positive for methanedieneone (a banned anabolic steroid).

6.2 Rajeew Tomar and SourabhVij Case

Arjuna Award winner wrestler was tested positive for methyl hexaneamine in 2010 along with eleven other athletes.

6.3 Tyson Gay Case

In case 2013, US Track and field Athlete Tyson Gay was found to have tested positive for banned substances forcing his withdrawal from the world championship in Moscow. He was suspended and his 2012 summer Olympics medal was stripped off.

VII. USES OF AAS

7.1 Clinical uses

- Treats Anaemia
- Wounds
- Malnutrition
- Burns
- Osteoporosis
- Hypogonadism
- Corticosteroids
- IV
- Intractable arthritis
- Cancer
- Blood disorders

7.2. Sports

- Boosts the athletic performance
- Builds muscle tissue
- Increases body mass

- Promote aggressiveness in athletes
- Endurance

VII. CONCLUSION

We concluded that there are huge side effects of using Anabolic Steroids as compared to the one who doesn't use steroids. According to the metabolism it's not a necessary drug and can cause harmful effects to our body. It might result in failure of Liver and Kidney.

So, we should create awareness about its effects as the cases of Doping are increasing day by day and due to this the performance level of players enhances which might result in bias results in the field of sports. Main purpose of our paper is that we want everyone to have a look at this article so that they get aware about these synthetic steroids as some of the people don't know what these are. Specially, the teenagers who are willing to create good body or career in sports or are going to gym should avoid these drugs as these are not approved by Drug society or FDA. The work on these drugs is still going on and new tests are still carried out.

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