

Effects of Steroid Use On Nutrition Knowledge and Attitude, Body Image Perception, And Cognitive Ability of Bodybuilders

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Abstracts: The use of steroids among bodybuilders is considered typical by many, probably due to the tendency to become exceptionally lean and masculine. However, as anabolic steroids may cause adverse effects, this may make steroid-using bodybuilders vulnerable to unhealthy eating and perception of body image. Therefore, a study was conducted to determine whether steroid-using bodybuilders have different nutrition knowledge and attitude, body image perception and cognitive ability compared to their non-steroid-using counterparts. Fourteen amateur bodybuilders, including seven self-claimed steroid users, voluntarily agreed to participate in this study. Nutrition knowledge and attitude were determined using established self-administered questionnaires. While body image perception and cognitive ability were assessed using the Adonis Complex questionnaire and mental rotation test, respectively. When comparing steroid and non-steroid users, there was no difference in nutrition knowledge and attitude. However, both groups significantly differed in body image perception ($p= 0.048$) and cognitive ability MRT ($p= 0.039$). Even though these findings show significant impacts of steroid use on certain factors among bodybuilders, due to the small sample size, further study with a larger sample size is recommended.

Keywords: Anabolic-Androgenic Steroid, Bodybuilder, Nutrition, Body Image, MRT.

1. INTRODUCTION

Anabolic-androgenic steroids (AAS) are common among athletes in various sports [1]. Professional and recreational athletes use the drug to increase muscle mass, improve strength and enhance physical appearance [2]. One of the sports that are pretty popular for anabolic steroids use is bodybuilding. According to Leifman et al. (2011) [3], about 6% of gymnasium users use anabolic steroids illegally, which was probably underreported. Physique, rather than athletic performance, is judged and acknowledged in bodybuilding. For bodybuilders, the ultimate goal is to develop a high definition of huge muscle mass and symmetrical muscle build. For this goal, bodybuilders usually engage in training regimes divided into bulking and cutting phases. The former phase is dedicated to increasing muscle mass, while the latter is emphasised body fat reduction weeks before the competition. To achieve these purposes, bodybuilders engage themselves with a regiment of resistance training, extreme diets, and nutrition supplements, some of which involve drugs [4]. However, many of these approaches are based on common sense rather than scientific evidence, which bodybuilders may put themselves at health risk [5].

Studies showed that nutrition knowledge is significant in nutrition practice. A lack of nutrition knowledge may lead to poor nutrition attitude practice [6]. On the contrary, good nutritional knowledge may lead to healthy food choices and lower the risk of diseases [7]. According to Vázquez-Espino (2022) [8], package labels, friends and family members, magazines, the internet and television are among athletes' favourite sources of nutrition knowledge. Besides, gym partners can be vital influencers for many bodybuilders who seek information on diet and nutrition devoted to muscle build and hypertrophy [9]. A study showed that bodybuilding trainers' poor nutrition knowledge and attitude led to poorly advising their bodybuilding trainees [10].

Body image is a component of self-esteem, defined as one's subjective perceptions and attitudes about his or her body and physical appearance [11]. Body image dissatisfaction is a common issue in both males and females, especially teenagers, even though they have different perceptions of ideal body image [12]. For example, females perceive themselves as too heavy, heavier than the others expressed, having disproportional body parts, and too

thin and too heavy for normal weight [13]. On the other hand, males believe the tag of the bigger, the better, and having a muscular body is a powerful symbol of strength, sexual virility, attractiveness, confidence, self-esteem, admiration and control [14]. Millions of men secretly suffered from body image issues with the culturally constructed ideal body image with a term called the Adonis Complex [15]. Several factors contributed to the changes in cultural views on the ideal male body image. Movies, television series and media advertisements spread the idea of bodybuilding culture worldwide by portraying the image of muscular and lean males to be accepted into the mainstream fitness culture [12]. Printed media such as magazines, books, and newspapers also portray and promote the image of muscularity and leanness, an ideal body image [16]. Muscular male models symbolise a healthy lifestyle, trendy fashion and fitness and sports icons. However, this may distort the perception of ideal body image appearances [17]. People, especially young adults, have become more obsessed with muscularity, especially around the neck, chest, arm, forearm, thigh and calf [18].

Bodybuilders had been exposed to the mesomorphic sociocultural as an ideal body type for men to develop a muscular and lean appearance [19]. The obsession towards having a muscular and lean body may lead to the muscles dysmorphia which is a desire to increase muscularity and reduce body fat percentage, which may lead to the cognitive distortion of body image, abnormal eating attitudes and excessive exercise, including substance abuse [20]. The symptoms of muscle dysmorphic disorder are almost similar to reverse anorexia, including disturbed body image, strict dietary practice, willingness to take illegal supplements, strict exercise regime concealment of their physique and low self-esteem [21]. Extreme eating, such as binge eating and strict dieting, such as caloric restriction, with a negative energy balance, also occurs among competitive bodybuilders [19]. Although bodybuilders can be accepted as having normal or healthy body weight and fat, they are high in body dissatisfaction which may lead them to anabolic androgenic steroid abuse [22]. Bodybuilders, especially males, were reported to show greater body dissatisfaction with high drive with bulky, thinness and bulimic tendencies, and inexperienced bodybuilders also tend to have lower self-esteem scores compared to the regular person [23].

Obsessive behaviour towards appearance may cause exercise dependence among bodybuilders [24]. As a result, bodybuilders may overtrain and damage muscle tissue profusely. Furthermore, since food and dietary supplements cannot replenish and help the recovery process fast enough following a tremendous exercise regime, bodybuilders may go for alternative ways, such as by taking illegal substances, i.e. anabolic androgenic steroids [21]. Using steroids may affect cognitive ability. For many years, studies have been conducted to see the effects of steroids on cognitive levels. However, the substances' effects on cognition were inconsistent [25]. For example, a study by LeBlanc et al. (2010) [26] demonstrated no association between cognition and testosterone levels in the normal range. On the contrary, Kanayama et al. (2013) [27] indicated that using steroids for long-term high-dose caused cognitive deficits, notably in visuospatial memory. Therefore, it is important to understand the impact of steroid use on bodybuilders' cognitive levels.

2. MATERIEL AND METHODS

2.1. Nutrition Knowledge and Attitude Questionnaire

The nutrition knowledge and attitude (NKA) questionnaires were adapted from the Technical Working Group on Food and Nutrition (1997) [28]. It consisted of eighteen multiple-choice questions about the knowledge of a balanced diet, food pyramid, nutrient function, disease related to an imbalanced diet, and food nutrients. One mark was given for correct answers and a 0 for wrong answers. Therefore, the total mark will be 18 points. The NKA also contains eleven questions on attitude toward a balanced diet and healthy nutrition. For each question, five 5-point Likert scales of not at all important, not too important, neutral, somewhat important and very important were used to determine the level of attitude. The level of knowledge and attitude were categorised based on the previous study by A. Karim et al. (2008) [29], which is poor and negative (0%-50%), fair and neutral (51%-74%), and good and positive (more than 75%), respectively.

2.2. Perception of Body Image

Perceived body image was determined using the Adonis Complex Questionnaire (ACQ) developed by Pope et al. (2000) [15]. ACQ consists of thirteen questions. Zero point was given for each question answered 'a', 1 point for 'b' and 3 points for 'c'. The total mark for ACQ is 39. A score above 9 indicated mild to moderate body image concerns, above 19 was serious, while above 29 indicated severe body image concerns.

2.3. Cognitive Ability

The cognitive ability of participants was determined using the Mental Rotation Test (MRT) adapted from Peters et al. (1995) [30] version that was revised from Vandenberg and Kuse's MRT (1978) [31]. The questionnaire consists of 24 questions, with each question providing four choices of answers with only two correct answers available in order to avoid guessing. The total marks were 24. Standard protocols for answering MRT were followed.

2.4. Pilot Study

A pilot study was conducted to confirm the reliability of the questionnaire's dual-language version (English and Malay). Twenty volunteers were recruited from the Universiti Teknologi MARA's gymnasium members. The pilot study consisted of two phases: subjects answered all questionnaires in the first phase, followed by answering the same questionnaires in the second phase after two weeks intervals (according to a method by Salkind (2010) [32]).

2.5. Participants

Convenience sampling was applied to recruit the subjects by visiting as many gymnasiums in the Klang Valley as possible. As a result, around 20 male amateur bodybuilders who initially confessed to taking anabolic steroids and agreed to participate voluntarily in this study were reduced to 7 due to confidentiality issues. On the other hand, seven out of 10 male amateur bodybuilders who admitted not using anabolic steroids agreed to participate. All participants had a minimum of three years of experience in bodybuilding, with at least three times per week of strength training. In addition, the participants must have been administering anabolic steroids for at least three years as AAS users. The last dose was at least one week before answering the questionnaire. Any participant with a mental health history, neurological and endocrine abnormalities, learning disabilities, other medical problems (e.g., head injury) and current alcohol or drug abuse problems were excluded. The university's ethics committee approved this study. All volunteers were required to fill out a self-administered screening questionnaire, asking about their background information, current health status, medical history and mental health history. The demographic data consisted of questions about age, weight, height, education level, annual income, marital status and training places.

2.6. Data Analysis

The IBM Statistical Package for Social Sciences (SPSS) was used to analyse the data. First, a normality test was performed to determine the data distribution. Since the data were collected from random sampling and a small sample size, they were assumed to be non-parametric. Therefore, Mann Whitney U Test was used to compare the total score of nutrition knowledge and attitude, body image satisfaction, and MRT score between groups [33]. For the pilot study, the reliability and internal consistency of the questionnaires were determined using Cronbach's alpha. All data variables were expressed as means and the standard deviation (SD). In all cases, the significance value was set at $p < 0.05$.

3. RESULTS AND DISCUSSIONS

3.1. Reliability of Questionnaires

The Cronbach's alpha for the reliability of the knowledge questions of the NKA questionnaire was 0.655, which was acceptable. However, the test-retest for the repeatability of the questionnaire was $r=0.886$. For the attitude questions of the NKA questionnaire, Cronbach's alpha was 0.899, and the test-retest was $r=0.991$. The coefficient alpha for the ACQ questionnaire was 0.763, which was consistent with Peterson's (2005) [34] alpha of 0.70. Meanwhile, the test-retest for ACQ produced $r=0.966$. Finally, the pilot study for the MRT questionnaire created coefficient alpha and test-retest of 0.771 and $r=0.991$, which were quite similar to Janda et al. (2012) [35] of 0.88 and $r=0.83$, respectively.

3.2. Demographics of Participants

Fourteen bodybuilders completed the questionnaires, and seven declared themselves steroid users. Table 1 shows that bodybuilders using steroids (SU) were slightly older and had greater BMI and training duration than non-steroid users (NSU). However, those variables were statistically comparable except for training time per session—steroid-use bodybuilders trained significantly longer than their steroid-free counterparts. Several studies show that behaviour changes in bodybuilders could be related to anabolic steroid use. According to Piacentino et al. (2015) [36], using steroid substances may develop specific psychopathology, mood destabilisation, psychosis, and increased aggressiveness. However, whether these behavioural changes are related to longer training time in steroid-used bodybuilders is unclear.

Table 1. Demographics of non-steroid (NSU) and steroid use (SU) bodybuilders

Variables	NSU (n=7)		SU (n=7)		Comparison, p value
	Mean	SD	Mean	SD	
Age (year)	22	3	25	4	0.145
BMI (kg.m^{-2})	24.7	2.4	26.6	3.7	0.291
Training hours per week (hour)	383	86	460	72	0.094
Training time per session (minute)	133	16	171	15	0.000*

* Significantly difference between groups

3.3. Nutrition Knowledge and Attitude

Table 2 shows that, based on the NKA score category, NSU's nutrition knowledge level was fair, whereas SU's was good. However, the groups found no significant difference in the score. Five of SU had good knowledge, one had a fair level, and one had a poor level. The one who scored poorly did not study in college and deviated from SU's average nutrition knowledge score. Meanwhile, among the non-users, all bodybuilders in that group had a fair level of knowledge. Previous studies showed that the level of education is one factor that may influence the level of nutritional knowledge. Their studies found a significant difference in nutrition knowledge between the groups with different levels of education, where participants with tertiary education had better knowledge [7,37]. There is supposed to be a positive relationship between nutrition knowledge and level of education [38].

Table 2. Nutrition knowledge, nutrition attitude, body image score and MRT score of NSU and SU bodybuilders

Variables	NSU (n=7)		SU (n=7)		Comparison, p value
	Mean	SD	Mean	SD	
Nutrition knowledge level (%)	68.3	4.2	74.6	17.8	0.390
Nutrition attitude score	42	8	39	12	0.565
Body image score	11	3	14	2	0.030*
MRT score	14	3	11	2	0.040*

* Significantly difference between groups

Both NSU and SU showed similar negative attitudes towards nutrition, consistent with their similarity in nutrition knowledge. The nutrition attitude scores of both groups were against the findings of some previous studies. Azizi et al. (2010) [39] found that nutrition knowledge positively correlates with nutrition attitudes in athletes. In another study, many athletes believe a healthy diet can help improve their performance, which shows a positive nutrition attitude [40]. Our bodybuilders' negative attitude toward nutrition may have been due to the attitude questionnaire that was out of context from bodybuilding perceptions. For many bodybuilders, a proper diet can help muscle hypertrophy and recovery following a training regime [41]. However, in many people, the actual dietary practice only partially follows such attitudes for many days [42]. Bodybuilders are known for having rigid attitudes toward nutrition timing, food choice, meal frequency, and supplementation [43]. In order to improve one's nutrition attitude and perception, one should be well-equipped with good nutrition knowledge [8]. Nutrition knowledge, attitude and practice correlate with the strength performance of athletes [44].

3.4. Body Image Perception

The Adonis Complex Questionnaire (ACQ) was used to determine respondents' body image dissatisfaction. Both NSU and SU bodybuilders showed mild to moderate body image dissatisfaction based on ACQ categorisation by Pope et al. (2000) [15]. However, steroid users are significantly more concerned about body image than non-users. Among NSU, four bodybuilders were categorised as normal, and only three were included in mild to moderate body image concerns. Meanwhile, six SU bodybuilders were categorised as having mild to moderate body image concerns, and only one showed a severe perception of body image. Body image issues among bodybuilders may influence the decision to take illegal drugs, as seen by Petersen (2005) [34], where 100 per cent of the bodybuilders with body image issues are willing to take AAS if given a choice. Our findings are pretty consistent with the previous findings. Baghurst and Lirgg (2009) [45] also reported that steroid-use bodybuilders exhibited slightly greater dysmorphia than their natural counterparts. In bodybuilding, the bigger, the better, as it reflects more weight gain and a bulky body. Bodybuilders tend to gain more weight than other athletes [23]. A higher tendency to become bulky as soon as possible for a more satisfying appearance leads to steroid use [46,47].

According to Devrim et al. (2018) [48], there was a positive relationship between eating disorder psychopathology and body dissatisfaction and body dysmorphic disorders in male bodybuilders. This means the eating attitude positively correlates with fat and muscle dissatisfaction. Bodybuilders commonly have exercise dependence symptoms regarding body image concerns [21]. Among the SU group, five respondents admitted to spending 30 minutes to 60 minutes per day for exercise. Two AAS users and one non-user spend more than 120 minutes daily on physical activities to increase their appearance. Two AAS users also claimed to feel distressed because of their appearance frequently. Four respondents admitted to involve dieting frequently by taking supplements. Our records show that 78.6 per cent of the bodybuilders consumed at least one type of supplement for their appearance goal. According to Mitchell et al. (2017) [49], symptoms of muscle dysmorphia, such as social physique anxiety, depression, neuroticism, and perfectionism, in bodybuilders are more significant than in non-bodybuilder resistance trainers, while self-esteem was negatively associated. There is a relationship between body image perception and AAS use. AAS use was associated with increased symptoms of muscle dysmorphia, and this symptomatology was higher in those who were highly dependent on the AAS use [50]. Multivariate analyses conducted by Griffiths et al. (2018) [51] also revealed that greater social physique anxiety was uniquely associated with more severe symptoms of both AAS dependence and depression.

3.5. Cognitive Performance

The statistical test showed a significant difference in MRT between NSU and SU. A similar result was recorded in a previous study by Mish (2008) [52], where steroid users scored lower in MRT than non-users. Although the study by Ostatníková et al. (2002) [53] found that peak testosterone may increase cognitive performance, the inverted U shape between testosterone level and spatial abilities was probably the reason why the steroid users in this study had a lower median score of MRT compared to the non-users. Unfortunately, our study did not measure testosterone levels to support the argument. However, this theory was supported by Yonker et al. (2006) [54], who

studied men between 35 and 80 years and found a pattern similar to this study. As the testosterone level increases, cognitive performance drops, but at a certain level, performance may increase again. Testosterone and estradiol have been found to influence intra-individual mental rotation test performance [55]. Estradiol is converted from testosterone by the aromatase enzyme, and it binds to oestrogen receptors before being distributed in the human body, including the brain [56]. This theory may explain why AAS users had lower median MRT scores than non-users. Understanding the complexity of testosterone's effects on cognitive performance is highly related to the effects of the hormone on brain function [57]. Testosterone levels seem to interact with the brain's amygdala and frontal cortex, which may drive a variety of behavioural aspects that are further associated with psychiatric illnesses [58].

CONCLUSIONS

In conclusion, the use of AAS did not influence bodybuilders' nutrition knowledge and attitudes. The results suggest that male bodybuilders are at risk for body image distortion, but AAS users are more disturbed by body image compared to non-users. Our findings also raise the ominous possibility that AAS exposure may cause cognitive deficits in bodybuilders. A bigger sample size for further study is recommended amid reluctance from AAS users, which can be a considerable obstacle.

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