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ORIGINAL ARTICLE

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The State of Knowledge of Dietary, Physiological and Pharmacological Supplementation and the Preferential Use of These Substances by Persons Practising Recreational Bodybuilding

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Key words: *supplementation agents, training, recreation, bodybuilding*

Abstract

Background: *The aim of the study was to establish preferential use of dietary, physiological and pharmacological supplementation by persons practising recreational bodybuilding and to check whether it results from the respondents' knowledge or whether it is accidental.*

Material/Methods: *The group of subjects comprised 100 persons practising recreational bodybuilding in four well-known Lodz gyms. In the study the method of a diagnostic survey was used. A questionnaire containing 31 closed and opened questions constituted the research tool.*

Results: *It was demonstrated that the state of knowledge concerning dietary supplementation is insufficient, despite its optimistic self-assessment, and because of that the preferences as to the applied nutrients are inappropriate. The knowledge of physiological supplementation substances and preferences of their use seem appropriate, although the multitude of the mentioned means can attest to information chaos in this respect. Results of the poll seem to show that the problem of illegal pharmacological supplementation refers not only to professional sports but also, unfortunately, to recreation.*

Conclusions: *It is recommended to conduct a widespread informative action among persons practising recreational bodybuilding to make them aware of dietary supplementation. The majority of respondents have a sufficient level of knowledge of means of physiological supplementation, and preferences of using them seem correct. Even though the state of knowledge concerning health complications hazards when taking prohibited pharmacological supplementation should be regarded as high, still the majority of the subjects (58%) do not reject the possibility of using it. Inconsistencies of attitudes among persons practising bodybuilding recreationally manifest themselves through simultaneous support for anti-doping tests and the desire to take advantage of unlawful pharmacological supplementation.*

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Introduction

A constant and dynamic evolution of the training process has led to the situation in which using supplementation in sport has nowadays become a widespread phenomenon. Still in 2004 during the Olympic Games in Sydney it was reported that 78.6% of athletes use ergogenic agents, and then it was already pointed out that 19.7% of them applied 6-7 substances simultaneously, and even a case of using 26 types of supplements by one participant was shown [2]. According to numerous sources, it is estimated that at present 80-98% of athletes use supplements of different kind, and taking 10-12 of them simultaneously has become almost universal [7, 15, 18, 19, 20].

Also numerous scientific reports showing that many substances can indeed influence the improvement in sports results without creating the risk of negative health effects support the development of this situation. It is proved that they can reduce tiredness, support an effective course of adaptation processes and regeneration and safeguard against overexerting the functional systems [1, 8].

According to Williams [20, 22], it is possible to divide supplementation agents into three groups:

- dietary supplementation – dietary supplementation agents can affect the growth of the muscular tissue mass, physical strength, mechanical efficiency, psychological resilience, improvement in supplying muscles with energy substrates and an increase in the pace of producing energy in the muscular tissue (carbohydrates, fats, proteins, vitamins, mineral elements and water);
- physiological supplementation – physiological supplementation agents are substances or techniques specially intended to precipitate natural physiological processes, generate physical strength, correct cellular metabolism (l-carnitine, creatine, Q10coenzyme, sodium bicarbonate), increase the hormone and neurotransmitter activity (choline, growth hormone hGH, dehydroepiandrosterone DHEA, testosterone, horionic gonadotropin), improve the transport of oxygen (doping with blood, erythropoietin EPO, inosine, oxygen);
- pharmacological supplementation – pharmacological supplementation agents are substances acting similarly to hormones or neurotransmitters, found naturally in a human body. They can increase mechanical power through an influence on metabolic processes, streamline physiological processes involved in the production of energy and influence psychological resistance and the technique of movement. Here one can single out: pharmacological substances (stimulants, drugs, anabolic drugs, peptide and glycoprotein hormones and their derivatives), methods (doping with blood, pharmacological and physical manipulations) and agents subject to certain restrictions (alcohol, corticoids, beta-2 agonist inhalations, beta blockers and others).

The majority of supplements can, however, prove ineffective not to say harmful [11, 15, 19]. Their appearance on the market is strengthened by unethical advertising as well as a lack of reliable, objective verification of these agents by subjecting them to empirical scientific evaluation [9, 16]. There appear more and more enunciations for the need to make athletes aware that "more not always means better" [7, 12, 20]. Furthermore, many authors are inclined to a proposition that a well-balanced diet, adjusted to athletes' physical activity, is the safest way for health to satisfy the demand for energy, nutrients, minerals and vitamins [7, 13, 19, 20].

These problems gain special significance in recreational bodybuilding, where there is no control and the number of persons working out, especially young people, is growing considerably every year. Also the available literature lacks information defining the scale of this problem.

Therefore, determining the preferences of using means of dietary, physiological and pharmacological supplementation by persons practising recreational bodybuilding is the main aim of the present study. Moreover, settling the matter whether these preferences result from the respondents' knowledge or whether they are accidental constitutes an additional purpose of the study.

Material and Methods

The group of subjects comprised 100 persons practising recreational bodybuilding in four well-known gyms in Lodz (25 from each club).The majority were men (83%) and young persons from 21 to 35 years of age (67%) (Fig. 1).

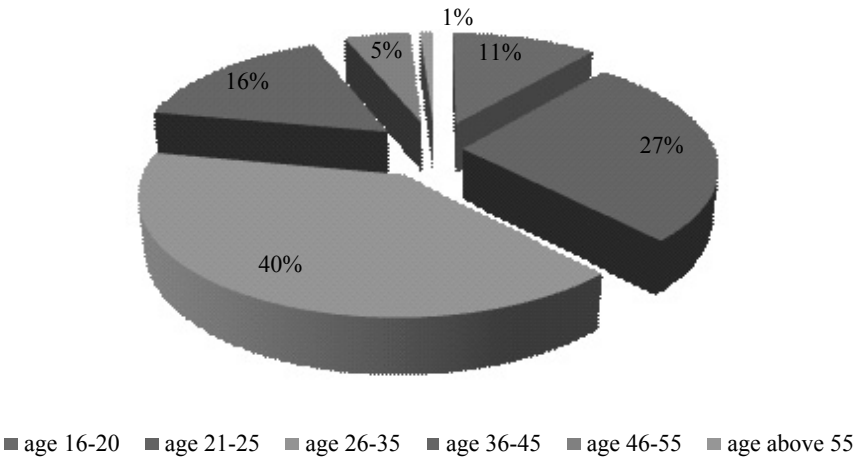

Fig. 1. Structure of the subjects' age (n = 100)

The most persons had secondary education (n=57), then higher education (n=18), vocational (n=16) and primary one (n=9). 37 persons did intellectual work, but adding pupils and students (n=27) clearly polarizes the group insofar as the performed work (labourers n=36).The majority of the subjects (n=71) are residents of a big city with above 100,000 inhabitants, 23 persons live in a town from 10,000-100,000 inhabitants, 2 persons in a small town (up to 10,000 inhabitants) and 4 persons live in a village.

In the study the method of a diagnostic survey was used. A questionnaire which contained 31 closed and opened questions was the research tool. The questionnaire consisted of four parts. The first one concerned personal details (sex, age, education, performed job, the place of residence). The second one dealt with problems of nutrition, dietary supplementation and the state of the respondents' knowledge of the subject. The third part of the questionnaire concerned means of permitted physiological supplementation, sources of acquiring them and the state of knowledge about them. The last part of the questionnaire dealt with the problem of prohibited supplementation agents. It served to define the state of knowledge of this subject, the attitude towards using illegal substances, and the currently applied anti-doping tests as well as the awareness of hazards posed by using these means. By asking open-end questions, the respondents' statements concerning their use of doping, its form, and even names of specific substances were obtained. Respondents answered the questionnaire points alone remaining anonymous.

According to requirements of the Helsinki Declaration, participants were informed of the aim of the study, its methodology, a possibility of resignation at any stage of the study, and they gave written consent to participate in the research. There were no cases of refusal to be involved in the study.

Results

Dietary supplementation

In the subjects' self-assessment of their state of knowledge concerning dietary supplementation (78%) optimistic declarations prevailed. They assessed their level of knowledge as: very high (25%), high (5%), average (48%), and only 20% as low and 2% as very low.

The respondents regarded proteins as the most important means of dietary supplementation (63%), and 17% mentioned them in the second or third place. Carbohydrates (27%), vitamins (5%), and fats (2%) were mentioned as less important. Little percentage of the respondents (3%) regarded other than the above mentioned substances as the most important means of dietary supplementation (Tab. 1).

Tab. 1. Preferences of using means of dietary supplementation by persons practising recreational bodybuilding

Means of dietary supplementation	The percentage of persons mentioning the agent as the first most important one [%]	The percentage of persons mentioning the agent in a further position [%]	The total percentage of persons mentioning the agent in their answers [%]
Proteins	63	17	80
Carbohydrates	27	26	53
Vitamins	5	28	33
Fats	2	27	29
Microelements	-	12	12
Others	3	11	11

Conscious planning of a diet was declared by only 43% of the subjects. The majority do not plan their diet (46%) and are not concerned with this issue (11%), nor do they use the help of specialists (55%) or do it only occasionally (22%).

The respondents' knowledge of dietary supplementation most often comes from magazines (42%) and from sources indicated in Table 2.

Tab. 2. Sources of knowledge of dietary supplementation among persons practising recreational bodybuilding

Sources of knowledge of dietary supplementation	Answers [%]
Magazines	42
Coach or dietician	35
Friends	31
The Internet	28
Professional literature	17

Physiological supplementation

A regular use of physiological supplementation was declared by 38% of respondents, which constitutes a group similar in number to those not administering such agents (37%). The remaining ones (25%) uses this type of supplementation occasionally.

The most frequently used means of physiological supplementation turned out to be: creatine (38%), protein supplements (36%), BCAA (16%), carbo-proteine supplements – the so-called "gainers" (15%), glutamine (14%), l-carnitine (12%), HMB (11%), vitamins and minerals (7%), ZMA (6%), fat-burners (6%), Tribulus (4%), carbo (4%), glucosamine (4%).

Respondents indicated the gym/trainer (43%), mass media (37%) and friends (36%) almost in the same degree as basic sources of information about physiological supplementation. Only one person mentioned parents, four – bodybuilding magazines, but nobody listed school. The complete ignorance of these agents was indicated by 12% of the subjects.

Respondents mentioned specialist shops (40%) as the basic source of supplying the means of physiological supplementation. Only then was the Internet (20%), gyms (16%) and friends (4%). Table 3 shows the state of knowledge of physiological supplementation.

Tab. 3. State of knowledge of physiological supplementation among persons practising recreational bodybuilding

Questions	Means of physiological supplementation	Answers [%]
Which of the mentioned substances would you take to increase muscle power?	Creatine	62
	Protein supplements	34
	Glutamine	16
	Vitamins	9
	Carnitine	8
Which of the mentioned substances would you take to increase muscle mass?	Gainer	61
	ZMA	13
	Isotonic drinks	12
	Vitamins	9
	Fat burner supplements	6
What is a substance called "ZMA" made of?	Zinc, magnesium, vitamin B6	49
	Whey protein with added creatine	14
	Magnesium, zinc, vitamin C	13
	Vitamin A, C, B12	12
Which of the mentioned supplements would you take to replenish muscular glycogen after workout?	Carbohydrate-protein supplement	53
	Vitamins and minerals	15
	Creatine	14
	Fat burner supplement	13
	ZMA	3
Is the Carbo supplement a carbohydrate, protein or carbohydrate-protein one?	Carbohydrate	71
	Carbohydrate-protein	19
	Protein	4
Which of the mentioned substances will help best burn the fat tissue?	Fat burner	78
	Creatine	10
	Carbo	7
	Gainer	3
	Protein supplement	3

** choose the correct answer*

Pharmacological supplementation

As pharmacological supplementation respondents understood: anabolic steroids (68%), forbidden and illegal substances (14%), harmful substances (9%), taking medications (4%), substances raising the level of testosterone (3%), and as many as 27% failed to answer the question.

Testosterone proved to be the best-known agent of pharmacological supplementation (51%), methanabol (44%), winstrol (32%), omnadren (27%), insulin (25%), deca-durabolin (12%), growth hormone (9%), other: EPO, clenbuterol, sitosterol (5%). 35% of the respondents were unable to give any names of prohibited supplementation means.

As effects inducing athletes to reach for pharmacological substances, the subjects mentioned the following: increasing muscle mass (50%) and muscle power (43%), improving sports results (36%), improving endurance (22%), achieving nice appearance (9%), shortening the waiting time for training effects (2%). In 7 cases no answer was given.

Among possible negative effects of using pharmacological supplementation 79% of the respondents ranked different health consequences: acne (19%), liver damage (18%), worsening the health condition (17%), going bald (14%), damaging kidneys (11%), infertility (11%), increasing the risk of heart attack (10%), skin changes (8%), potency problems (8%), excessive body hair (7%), aggression and hyperactivity (5%), damaging internal organs (5%), gynecomastia (5%), testicular atrophy (4%), rise in arterial pressure (4%), increased risk of diseases of the prostate gland (4%). However, 21% admitted that no incidental effects of administering pharmacological substances were well-known to them.

45% of the respondents defined their attitude to illegal pharmacological supplementation as negative, 27% as neutral, and 8% as positive. Only 12% recognised that using illegal pharmacological supplementation should be outlawed, 4% claimed that it should be subject to a penalty, 2% that it was incompatible with the "fair play" principle, and 2% that it was an individual's business only.

Only 58% found conducting compulsory anti-doping tests appropriate, 17% stated that they should be conducted more often, while 4% that they should be more thorough. An indifferent attitude to compulsory anti-doping tests was demonstrated by 9% of the respondents, and 2% answered that they were unnecessary and should be conducted voluntarily.

The question "would you be prone to take illegal performance-enhancing drugs if they affected achieving better sports results?" was answered "yes" by 21%, but two of them indicated that on condition of a high amount of prize money for the victory in a contest. Among the respondents, one would accept doping only under a doctor's supervision and expressed the readiness to take drugs in small amounts. Only two "rather not" replies were obtained, and 11% of the replies were: "I don't know". 58% of the subjects answered in the negative, but not categorically "definitely not".

In answer to the question "in what form did you (or persons well-known to you) take prohibited pharmacological means?", 41% indicated oral substances, 38% intramuscular means, and 8% intravenous ones. The majority of the subjects (52%) answered in the negative. Also 52% of the respondents claimed that one could become addicted to prohibited pharmacological substances; 40% claimed that these substances could not be addictive, and 8% admitted that they did not know.

Those using illegal pharmacological means indicated friends from the gym (30%), illegal sources (25%), and pharmacy (6%) as the place of obtaining them. As reasons for reaching for prohibited supplementation means, they enumerated willingness to increase muscular power and mass in a short time (34%), lack of visible effects of the training (17%) and persuasion of friends (14%).

Discussion

Dietary supplementation

Despite an optimistic self-assessment of the state of knowledge concerning dietary supplementation (78%), an analysis of the poll results leads to a conclusion little less favourable to respondents. The majority of the respondents are well informed as to substances which need to be paid special attention; however, this knowledge is imprecise. They mention protein as a substance with the greatest meaning. Although it constitutes the basic building element for muscles, still carbohydrates should be the main means of dietary supplementation for persons practising recreational bodybuilding. The energy demand for those practising bodybuilding should be satisfied primarily by carbohydrates, and the proportions of basic nutrients are most frequently defined as about 60-70% carbohydrates, 20-30% proteins, 10-15% fats [7, 11, 12, 16, 19]. In this context recommendations of the ketogenic diet, which assumes the elimination of carbohydrates and acquiring the energy from proteins and fats, are omitted as a way of nutrition not used by respondents of the present study. After a short period of fascination with this kind of diet, it is also less frequently used by bodybuilding competitors, due to possible adverse health consequences, bad mood, lack of appetite after longer use, and a possibility of increased accretion of cholesterol as a result of the greater accumulation of apolipoprotein E4 [24]. A small percentage of respondents (3%) demonstrate total ignorance and regard substances known only to them and different from the ones mentioned

above as the most important means of dietary supplementation, which also poorly corresponds with the optimistic self-assessment of the subjects' knowledge (Tab. 1).

Over half of the exercising persons (57%) disregard their eating manner and do not care for planning the diet, which may be contributed not only to their comfort-loving nature, but also to a low level of knowledge of dietary supplementation. It may be surprising perhaps that in the era of the Internet, where completely irresponsible advice is published, after all magazines and, what is important and appropriate, using specialists' (coaches and dieticians) knowledge turned out to be a basic source of information.

Physiological supplementation

Answers to questions concerning physiological supplementation seem to show that the majority of subjects have a sufficient level of knowledge of these substances to be able to use them correctly, although their regular use is declared by scarcely 38% of the respondents. The percentage of persons demonstrating total ignorance in the knowledge about taking particular groups of supplements falls within the limits of from a few up to several per cent and is similar to the one demonstrated in the case of dietary supplementation. It seems that both regular and occasional use of physiological supplementation (25%) is connected with having sound knowledge of the meaning and the influence of these substances on improving and increasing the pace of physiological processes of the organism or generating physical strength [5, 7, 11, 20] (Tab. 3).

Respondents are well familiar with the usefulness of the most important allowed means of physiological supplementation and most often mention creatine, protein supplements and branched-chain amino acids (BCAA), which is accurate, as the effectiveness of these agents in professional sport has found extensive confirmation [4, 6, 10, 11, 13, 16, 21]. The knowledge about permitted means of physiological supplementation seems very specialist and, unlike in the case of dietary supplementation, comes mainly not from magazines, but from coaches and acquaintances (79%). Specialist shops are mainly the places of acquiring these substances (one should appreciate here the power of advertising of ergogenic agents), which confirms a special character and significance of physiological supplementation to all persons who work out.

One should, however, remember, that taken slavishly in large doses, they do not give the anticipated effects; in some cases they can upset the physiological balance in the body and trigger adverse incidental effects, and some of them (e.g. iron) should be taken only after consultation with a doctor [7, 12, 20].

Pharmacological supplementation

Negative associations (91%) connected with anabolic steroids most often used in strength sports (68%) probably affect the state of the knowledge concerning pharmacological supplementation among persons practising recreational bodybuilding. Puzzling is a considerable percentage of persons (27%) who are not able or do not want to take a stance towards forbidden pharmacological supplementation. It is hard to settle whether this results from a lack of knowledge or whether this is an effect of unwillingness to express one's opinion in this respect. Possible are also anxieties of alleged sanctions, which are universally known to be applied, although not everyone knows that they concern only professional sports.

Only an analysis of further statements allows specifying better the actual state of the respondents' knowledge of pharmacological supplementation. Respondents demonstrated a good knowledge of groups of substances and even names of pharmacological agents forbidden in sport, listed in the "Results" section. Testosterone (51%) and methanabol (44%) were the most often mentioned, which corresponds with the frequency of detecting these means by laboratories accredited by IOC, in which (since 2001) out of 914 cases of using anabolic substances, three – testosterone, nandrolone and stanazolol – constituted 80% [14].

Although the state of the respondents' knowledge concerning health hazards connected with taking prohibited means of pharmacological supplementation should be regarded as high (79%), only 45% of them definitely reject a possibility of using them, and they point to friends from the gym and other illegal distribution (55%) as sources of obtaining them. In view of such attitudes, incon-

sistent are 58% of replies acknowledging the rightness to conduct anti-doping tests and simultaneously 21% of declarations of using doping in order to improve sport results, even in intramuscular (32%) and intravenous (8%) forms, which after all pose additional threats. This confirms worrying observations of the US sports administration and epidemiological services, which conclude with regards to taking anabolic steroids in American sport: 90% of men practising weightlifting, bodybuilding and powerlifting use anabolic steroids, 70-80 % of throwers, 40-50 % of sprinters and decathletes,10% of athletes specializing in endurance sports [15, 22, 23].

Because findings of our study concern persons practising recreational bodybuilding, a view universal in 2003 propagating that "the accurate scale of using pharmacological agents in order to increase results in sport is unknown" [17] should be extended also to recreation. It is highly alarming, because it violates the sense of taking up and practising recreation, which after all is oriented towards health, well-being, self-realization but simultaneously burdened with a high risk of health complications. However, ethical issues of using pharmacological supplementation seem to be pushed into the background also among persons exercising recreationally, because a willingness to increase power and muscle mass in a short time, though lower than among athletes, is still highly significant for them (34%), regardless of a dilemma of becoming addicted to them (52% – yes; up to 40% – not). In combination with an intensive protein diet and weight effort, there can be indeed a considerable increase in the muscle mass with a simultaneous limiting of the fatty tissue content, which is also an attractive prospect for persons exercising recreationally [3, 11].

However, one should remember that even with so enticing prospects, pharmacological supplementation creates a number of other hazards and restrictions. Those exercising who already have well-developed musculature should expect that taking anabolic steroids will precipitate a processes of deadaptation of their muscles, compared to persons with smaller musculature [5, 12]. After discontinuing exercises or a marked decrease in their intensity, a fast return of muscles to the state from before the pharmacologically assisted training cycle will take place. Starting a new cycle by such persons will be connected with the need to increase doses of pharmacological substances and to take an increasingly greater risk of health consequences, whose constant escalation proved fatal to many "experimenters".

Conclusions

1. It is recommended to conduct a widespread informative action among persons practising recreational bodybuilding to make them aware of dietary supplementation, as it is used incorrectly by this group and is not-included in planning the diet.
2. The majority of respondents have a sufficient level of knowledge of means of physiological supplementation, and preferences of using them seem correct.
3. Even though the state of knowledge concerning health complications hazards when taking prohibited pharmacological supplementation should be regarded as high, still the majority of the subjects (58%) do not reject the possibility of using it.
4. Inconsistencies of attitudes among persons practising bodybuilding recreationally manifest themselves through simultaneous support for anti-doping tests and the desire to take advantage of unlawful pharmacological supplementation.

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