



Science, Movement and Health, Vol. XIII, ISSUE 2 supplement, 2013
September 2013, 13 (2), 362-368

DEVELOPMENT OF MUSCLE STRENGTH BY USING BASIC AND COMPLEMENTARY EXERCISES IN BODYBUILDING FOR MASSES

TIMNEA OLIVIA CARMEN¹, POTOP VLADIMIR¹, CHERAN COSMINA¹

Abstract

Purpose. Highlighting the contents of bodybuilding workouts by using basic and complementary exercises in bodybuilding for masses.

Methods and procedures. This scientific approach led to a study of case conducted within the Sports Club named „Tonik Fitness Club” of Bucharest, with two athletes aged 24 and 33 respectively, with 4 and 6 years experience in the field. The study was carried out during a period of 4 months (February - May 2012). Tests and control trials have been applied for assessing the development of muscle groups strength, in terms of anthropometric data and tests for pectoral strength, back and lower limbs strength. Two categories of exercises were used during workouts: basic and secondary (complementary).

Results. The results of the research highlight changes of the anthropometric measurements: increase of the perimeter of chest, arms, thighs and calves consistent with weight increase and last, but not least, increase of muscle mass. This shows the effectiveness of using basic and complementary exercises for the development of main muscle groups in the training; this fact is proven by the results of control trials for pectoral muscles, back muscles and legs muscles.

Discussion and conclusions. In the end of the paper we can draw the conclusion that the review of the theoretical materials and practical activities emphasize the fact that the use of both basic and complementary exercises contribute to a more efficient development of main muscle groups during workouts.

Key words: bodybuilding, exercises, muscle groups, strength.

Introduction

Bodybuilding is considered a sport because it includes all elements of the sport – proper and specific training, with its own means and methods, a competitive circuit including organizers, coaches, judges and an impressive number of practitioners. There are many decisive factors on the road towards success of a bodybuilder. It takes an iron will and an incredibly strong motivation to succeed in this sport. As a science, it assumes that everyone who wants to reach the pinnacle of sport mastery of this discipline must have significant notions on anatomy, physiology, biomechanics, nutrition, recovery after effort, etc. As an art, it requires a special artistic sense to create a high aesthetic level program of muscle presentation. A great harmony between movements and musical background is needed (***, 2011).

The difference between bodybuilding and fitness can be seen if we monitor the components on which the workouts focus and if we analyze their ultimate goal. In length of time, bodybuilding involves a training strategy clearly aimed at developing a muscle mass represented as well as possible, obviously without neglecting muscle definition, the symmetrical, balanced and harmonious development. In fitness, muscle mass is placed on the same level as the cardio-respiratory condition and flexibility (Damian, 2006, 68; Chirazi, Ciorbă, 2006).

The muscle has an extraordinary structure, able to

convert the chemical energy derived from food into physical (mechanical) energy, thus becoming the element that performs the movement. The musculoskeletal system consists of a number of rigid elements, the bones, which are attached to each other by means of joint structures. Muscles are the dynamic elements that generate the force necessary for moving the bones to one another. The approximately 500 muscles of the human body have different sizes, shapes and actions. They do not act independently but in coordinated manner; they have, depending on the action to perform, leading roles or secondary roles (agonists and antagonist muscles). There are several types of muscular contractions: *isotonic contraction* is the most usual muscle contraction that occurs with changing muscle length and determines joint movement, so it is considered a dynamic contraction; *isometric contraction* – muscle tension increases, but the muscle fibers length does not change, that is why they are also called static; *isokinetic contraction* – is a type of dynamic contraction in which the muscles contract at their maximum capacity on the entire range of motion (Damian, 2006).

It is particularly known that in order to give muscle volume and thickness to the back, this one must be "attacked" from several angles, each exercise is complementary to other. In this context all exercises work together to achieve the desideratum consisting of setting up a harmonious back, full of power and

¹Ecological University of Bucharest, Faculty of Physical Education and Sport, ROMANIA
Email: vladimir_potop@yahoo.com



flexibility. As it is very well known by now, the workouts with free weights are the determining factor in building a solid muscle mass, lacking of depositions of fat and moreover, they are the strongest alternative because they do not require special facilities (**2006).

Regarding the physiological and biomechanical substratum of power, we can divide the factors into two groups, for teaching purposes (Bota, Prodescu, 1997): central factors and peripheral factors. Central factors refer to the activity of the nervous elements generally involved in the elaboration of the voluntary or involuntary orders. The group of central factors includes also: the ability to coordinate the muscles (intramuscular and intermuscular coordination); regulation of muscle tone. The peripheral factors, like the nervous ones, influence the maximal power mainly, but also the other forms of power at a different share. These are: muscle diameter, muscular hypertrophy produced by workouts, muscle volume, muscle structure, energetic reserves, length of muscle fibers and action angle. Other factors that influence the power are: motivation, age, sex and circadian rhythm.

By muscle strength we understand the ability of muscles to contract for moving the body segments against a load (weight). General strength is the foundation of the entire training program and the maximum strength refers to the largest load that the athlete can handle at one time, also noted as "1RM" (one maximum repetition) (Damian, 2006).

Before we talk about training, we need to understand the systems that provide the energy needed for muscles to contract. There are many forms of energy: *chemical, electrical, electromagnetic, thermal, mechanical, and nuclear*. People get energy from food in the form of carbohydrates, proteins and lipids in different percentages, transformed into heat; the amount of energy released in biochemical reactions is calculated based on the produced heat and is measured in kilocalories. The energy is used for cellular growth and repair, for the active transport of substances (such as calcium and glucose through the cell membrane) but also to produce movement (power is generated at muscular level by the sliding of actin and myosin filaments). That is why the myosin must have ATP as an energy source. The other sources of energy can not be directly used because of the slow action of the cardio-respiratory system, which needs a while to adapt. The ATP can be generated in three ways: ATP-CP system, glycolytic system and oxidative system (Damian, 2006).

The principles of training are pedagogical, philosophical, psychological ideas that underpin the training process. Most of the principles have derived from the principles of sports training. But the bodybuilding has also its own principles, like any distinct sports field (Damian, 2006): principle of interdependence of training, nutrition and recovery;

principle of continuity (in training); principle of accessibility; principle of individualization; principle of load progressive increase; principle of periodization; principle of muscular confusion; principle of holistic training; principle of eclectic training; principle of instinctive (intuitive) training; principle of division of the muscle groups per days; principle of muscle groups employment during workouts.

Weider system of training includes all the principles; Joe Weider's merit is that he described these principles and organized them in a unitary system. Many of the principles, very important for the training, have been tested in the course of time at maximum level; the number and the name of these principles changed in proportion as the methodical-biological observations and researches provided the new data absolutely necessary. The combination of the kind of exercises with the working mode per training session and per days in a complex form led to the emergence of these principles divided into three groups, depending on the nature of the workout used and on the execution of the exercises (Sakizlian, 2012).

A. *Principles that help to streamline the training session per cycles*: principle of training cyclization; principle of the training separated per week; principle of double or triple separation of the training; principle of muscular confusion; principle of permanent heating; principle of variation; principle of eclectic training; principle of instinctive training.

B. *Principles that help to improve the organization of training sessions*: principle of sets system; principle of supersets; principle of compound sets; principle of tri-sets; principle of giant sets; principle of intercalated sets; principle of pause-rest; principle of muscle priority; principle of pre-exhaustion; principle of the pyramid; principle of descending sets and principle of instinctive training.

C. *Principles that explain the execution of each exercise*: principle of isolation; principle of cheating; principle of continuous tension; principle of qualitative training; principle of forced reps; principle of irrigation (muscle pumping); principle of arcs; principle of partial reps; principle of negative reps; principle of peak contraction; principle of speed and principle of is-tension.

The principles are designed to provide permanent incentives and methods to increase the intensity of the workouts gradually. Another classification performed by Prof. Dr. Alexandru Virgil Voicu in his course on bodybuilding, divides Weider principles in three groups also, but depending on the training level (Sazlian, 2012):

1. Weider principles for beginners
2. Weider principles for athletes with intermediate stage of development
3. Weider principles for athletes with advanced stage of development



Regarding the influence of training sessions and dietary supplements on the adaptive process of the skeletal muscles, or what to do to become massive, one highlights the importance of food for conditioning the muscles throughout the complex process of physical training, by (**2006): composition of muscle protein, body reaction to workouts, decrease of glycemic index, negative net protein balance, increased level of assimilation process, increased concentration of cortisol, etc.

It is interesting to notice that generations of researchers that were against the introduction of alcohol in the programs of weight control might have been wrong. It is obvious that a regular and excessive consumption of alcohol could lead to fattening (Wannamethee, Shaper, 2003). Another element of weight loss affected by alcohol, explained and demonstrated by Dr. Michael Zemel and his team is that dietary calcium intake may prevent fattening (Zemel, 2004). One factor that affect body weight and is influenced by alcohol is angiogenesis. Angiogenesis refers to the development of new blood vessels necessary for growth or active tissue. Pharmaceutical companies prepare anti-angiogenic compounds to fight obesity (Brakenheim, Cao, et al., 2004).

The difference between basic exercises and the isolation ones is given by the number of muscles involved in movement. The name of basic exercises is explained by the fact that these exercises are the basis of muscle mass development. They involve several muscle groups and joints. For example: squats, straight legged dead lifts, bar rows, barbell chest press. The name of isolation exercises is given by the ability of these exercises to isolate a specific muscle from contraction point of view. For example, if we make the flexion of the forearm on the arm with the barbell from seated position, besides the brachial biceps there will be contracted the brachial and brachio-radial muscles too, plus other muscles that act to stabilize the body and to allow a coordinated movement. However, if we make this exercise from seated position on "Scott" bench, most of the muscles that do not affect directly the movement will be relaxed, so we shall succeed to isolate the arm anterior muscles group (Damian, 2006).

Regarding nutrition during the intense workouts, many bodybuilders tend to lose muscle mass as they prepare for competition, probably due to protein diet. It takes an extra amount of protein to repair damaged muscle fibers after intense training. Among the

potential mediators of recovery with additional intake of protein there is the diminution of muscle destruction markers and the facilitation of accelerated rate of glycogen replacement after exercise (Flakoll, et.al, 2004).

There is evidence that increased protein intake stimulates fat oxidation to a greater extent than other nutrients and that the metabolism and fat oxidation are accelerated after consumption of high amounts of protein during slimming diets with energy restriction (Labayen, Diez, Parra et al., 2004; Labayen, Diez, Gonzalez et al. 2003; Labayen, Diez, Parra et al. 2004). Moreover, the oxidation of fats induced by workouts is higher if protein intake is high (Soenen, Plasqui, Smeets, et al. 2010). Thus, the oxidation of fats increases the intake of protein, per se, and protein synthesis is supported by the extra energy. Also, a larger amount of energy will be required because the muscle mass is maintained along such a diet. A recent study has shown that diets with a high amount of proteins have the ability to maintain muscle mass during severe energy restriction for two weeks in the case of weightlifters (Mettler, Mitchell, Tipton, 2010).

For some persons, bodybuilding is just about lifting weights, for others it means using steroids, for others - a waste of time, for others it is a fad and the examples can continue. But for the serious athletes, committed body and soul to this sport, bodybuilding is hard work, done in a scientific manner, in other words, a pleasant lifestyle and beneficial for the body, after which you get a healthy and beautiful body. It is highly unlikely, if not impossible (normally if there are not other disorders) to exceed your genetic limitations and to grow 20-30cm in height or to reach 60cm of the arms if your parents are people of small stature and with thin bones. (** 2011).

Methods

This scientific approach led to a study of case conducted within the Sports Club named „Tonik Fitness Club” of Bucharest, with two athletes aged 24 and 33 respectively, with 4 and 6 years experience in the field. The study was carried out during a period of 4 months (February - May 2012). Tests and control trials have been applied for assessing the development of muscle groups strength, in terms of anthropometric data and tests for pectoral strength, back and lower limbs strength. Two categories of exercises were used during workouts: basic and secondary (complementary).



Fig. 1. Exercises for pectoral muscles



Fig. 2. Exercises for back muscles

Control tests and trials have been applied during the research:

1) *Anthropometric measurements*: Height, cm; Weight, kg; Thoracic perimeter, cm: expiration, inspiration and amplitude; Waist, cm: inspiration and expiration; Perimeter of arms, cm: right and left; Perimeter of thighs, cm: right and left; Perimeter of calves, cm: right and left.

2) *Control tests*:

- Pectoral strength, barbell horizontal bench press, assessed by a maximum rep (figure no. 1);
- Back strength, cable machine chest pull-downs with large grip, with 88kg, assessed by number of reps (figure no. 2);

- Lower limbs strength, back barbell squats with 100kg, assessed by maximum number of reps.

Workouts have been divided into two categories:

- *workouts with basic exercises* – the exercises that involve in their execution several muscle groups and that allow to use higher weights, specific to performance bodybuilding;

- *workouts with auxiliary exercises*, also called complementary ones – those exercises that do not allow the use of very large weights because of the isolation and that do not involve several muscle groups. The exercises isolate the muscle group with which we work and they are specific to fitness bodybuilding.

Results

Table no. 1. Results of anthropometric measurements

Table No. 1: Results of anthropometric measurements							
Full name	Weight, (kg)		Height, (cm)	Waist, cm			
	Initial	Final		Inspiration		Expiration	
				Initial	Final	Initial	Final
P.M.	72	74	166	78	76	85	84
F.C.	71.5	73	172	77	75	82	80
Statistical indicators							
X	71.75	73.5	169.0	77.5	75.5	83.5	82.0
Am	0.25	0.5	3.0	0.5	0.5	1.5	2.0
SD	0.25	0.5	3.0	0.5	0.5	1.5	2.0
Cv%	0.35	0.68	1.78	0.65	0.66	1.80	2.44

Note: X – mean, Am – average deviation; SD – Standard deviation; Cv- coefficient of variability

In table no. 1 are listed the results of anthropometric measurements in terms of weight, height and waist of the subjects of the study.

Table no. 2. Results of anthropometric measurements

Full name	Thoracic perimeter (cm)						Arms perimeter (cm)			
	Inspiration		Expiration		Amplitude		Right		Left	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
1 P.M.	111	113	106	107	5	6	40	41.5	41.5	43
2 F.C.	107	108	102	103.5	6	5	40.5	41.5	40	41
Statistical indicators										
X	109	110.5	104	105.2	5.5	5.5	40.25	41.25	40.5	42.0
Am	2.0	2.5	2.0	1.75	0.5	0.5	0.25	0.25	0.5	1.0
SD	2.0	2.5	2.0	1.75	0.5	0.5	0.25	0.25	0.5	1.0
Cv%	1.83	2.26	1.92	1.66	9.09	9.09	0.62	0.61	1.23	2.38

Table no. 2 shows the thoracic perimeter in terms of inspiration, expiration and amplitude and the perimeter of left and right arms during initial and final tests.

Table no. 3. Results of anthropometric measurements - continuation



No.	Full name	Perimeter of thighs (cm)				Perimeter of calves (cm)			
		Right Initial	Right Final	Left Initial	Left Final	Right Initial	Right Final	Left Initial	Left Final
1	P.M.	55	56	55	56	36	37	35.5	36.5
2	F.C.	53	54	53	54	34	35	34	35
Statistical indicators									
X		54.25	55.0	54.0	55.0	35.0	36.0	34.75	35.75
Am		0.75	1.0	1.0	1.0	1.0	1.0	0.75	0.75
SD		0.75	1.0	1.0	1.0	1.0	1.0	0.75	0.75
Cv%		1.38	1.82	1.85	1.82	2.86	2.78	2.16	2.10

Table no. 3 shows 3 the perimeter of thighs and the perimeter of calves at initial and final testing.

Table no. 4. Results of control tests

No.	Full name	Barbell horizontal bench press, max.1 rep.		Cable machine chest pull-downs, 88kg, reps no.		Barbell squats, 100kg, reps no.	
		Initial	Final	Initial	Final	Initial	Final
1	P.M.	115	120	8	12	8	12
2	F.C.	95	100	6	8	5	8
Statistical indicators							
X		105.2	110	7.0	10.0	6.5	10.0
Am		9.75	10.0	1.0	2.0	1.5	2.0
SD		9.75	10.0	1.0	2.0	1.5	2.0
Cv%		9.26	9.09	14.29	20.0	23.08	20.0

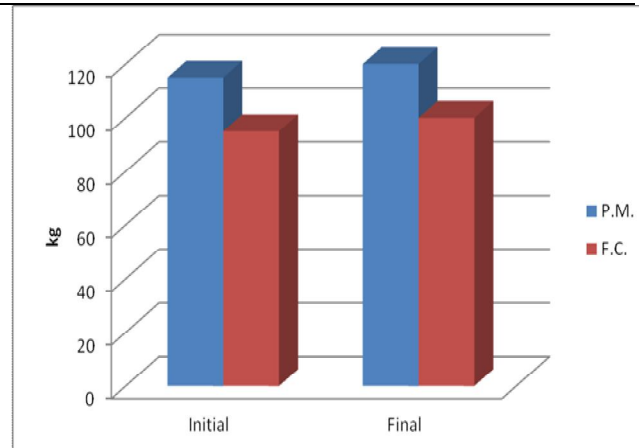


Fig. no. 1. Barbell horizontal bench press

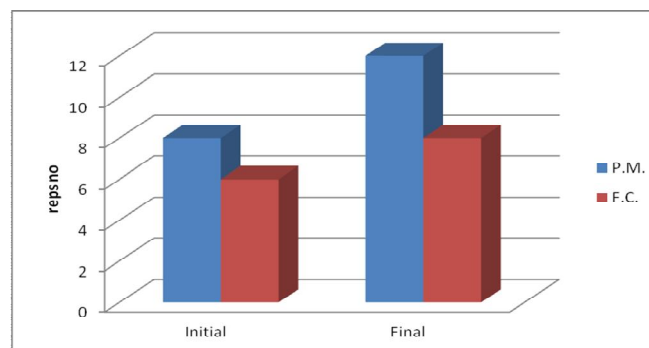


Fig. no.2. Cable machine chest pull-downs, weight 88kg

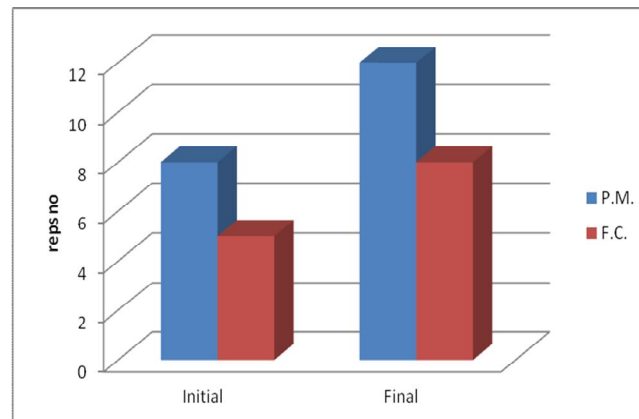


Fig. no. 3. Back barbell squats, weight 100kg

Table no. 4 highlights the results of control trials regarding the pectoral strength assessed by barbell horizontal bench press (fig. no.1), maximum 1 rep; strength of the back assessed by cable machine chest pull-downs with 88kg (fig.2) and strength of lower limbs assessed by squats with 100kg – maximum number of reps (fig.3).

Discussions

In the present study this is confirmed by a significant positive relationship between development in all strength parameters and serum testosterone concentration. This relationship is dependent on anatomic dimensions and skinfold thickness, indicating that these factors also play a role in the development of strength (Klausen, K, 1990).

Muscular strength increases more or less linearly with age from early childhood in boys. Strength is known to be related to the physiological cross-sectional area of the muscle and hence, according to a dimensional analysis, related to the second power of body height. During growth the cross-sectional area would then be expected to increase, with the square of the increase in the linear dimension (Hansen, L., J. Bangsbo, J. Twisk, and K. Klausen, 2013).

Regarding the results of anthropometric measurements, we notice a mean of 71.75kg at initial testing and an increase by 1.79kg at final testing; the height has a mean of 169 cm while the waist has a mean of 77.5cm at initial testing and a decrease by 2.2cm at final testing at inspiration and a mean of 83.5cm at initial testing and a decrease by 1.5cm at final testing at expiration (table no. 1).

In terms of thoracic perimeter, one can observe that the inspiration has a mean of 109 cm at initial testing and an increase by 1.5cm at final testing; at expiration, the mean is 104cm at initial testing and an increase by 1.2cm at final testing; the thoracic amplitude has a mean of 5.5cm at initial and final testing. As for the arms perimeter, we notice that in the case of right arm the mean is 40.25cm at initial testing with an increase

of 1.0cm at final testing; for the left arm, the mean is 40.5cm at initial testing with an increase of 0.5cm at final testing (table no. 2).

Regarding the results of thighs perimeter, we notice a mean of 54.25cm at initial testing with an increase of 0.75cm at final testing in the case of the right thigh and a mean of 54 cm at initial testing with an increase of 1.0cm at final testing in the case of the left thigh; as for the perimeter of calves, it has a mean of 35cm at initial testing and an increase of 1.0 cm at final testing for the right calf and a mean of 34.75cm at initial testing and an increase of 1.0cm at final testing for the left calf (table no. 3).

In terms of results of the control tests, in the case of pectoral muscles strength it is highlighted a mean of 105.2kg for performing 1 maximum repetition of barbell horizontal bench press and an increase of 4.8kg – at final testing; in the case of back muscles strength, we notice a mean of 7 reps for cable machine chest pull-downs with a weight of 88kg and an increase by 3 reps in final testing executed with the same weight; regarding the lower limbs strength, there is a mean of 6.5 reps at initial testing with a weight of 100kg and an increase of 3.5 reps at final testing executed with the same weight (table no. 5).

Conclusions

Improving and streamlining of bodybuilding training is done by individualizing the workouts, by experimenting new exercises, new training methods and programs.

Bodybuilding aims at the maximum use of all possibilities of each individual's muscular development. These possibilities vary from practitioner to practitioner; the bodybuilding places at the disposal of the enthusiasts many types and variants of exercises and from their range can be selected the exercises that are considered more useful and necessary.

In bodybuilding, the results depend on the bone structure, on the metabolism, on the way the body



reacts to stress, on the recovery ability, so on the individual characteristics. Therefore in this discipline more than in any other sports discipline, the training "recipes" are unfounded and invalid. Subsequently, the individual creation of training program is the only correct way of elaboration and organization of training process.

Study results show the changes of anthropometric measurements, namely: an increase of thoracic perimeter, of arms perimeter, of thighs and calves perimeters according to the weight increase and last, but not least, to muscle mass increase. This demonstrates the effectiveness of using basic and complementary exercises for the development of main muscle groups during workouts, showing the results of the control trials regarding pectoral muscles, back muscles and lower limbs muscles.

In the end of the paper we can draw the conclusion that the review of the theoretical materials and practical activities emphasize the fact that the use of both basic and complementary exercises contribute to a more efficient development of main muscle groups during workouts.

References

- Bota, C., Prodescu, B., 1997, Physiology of Physical Education and Sport – Ergophysiology. "Antim Ivireanu" Publishing House, Râmnicu Vâlcea, pp.176-199.
- Brakenheilm, E., Cao, R., et al., 2004, Angiogenesis inhibitor. TNP-470, prevents diet-induced and genetic obesity in mice. *Circ Res*, 2004, Jun 25; 94 (12): 1579-88.
- Chirazi, M.; Ciorbă, P., 2006, Bodybuilding – Fitness and Competition, "Polirom" Publishing House, pp.24-88.
- Damian, Ș., 2006, Super FIT. Essential in Fitness and Bodybuilding. Bucharest: Runa, pp.12-26, 74, 94.
- Hansen, L., J. Bangsbo, J. Twisk, and K. Klausen, 2013, Development of muscle strength in relation to training level and testosterone in young male soccer players, *Journal of Applied Physiology*, pp. 1141-1147
- Flakoll, Pj., Judy, T., Flinn, K., Carr, C., Flinn, S., 2004, Post-exercise protein supplementation improves health and muscle soreness during basic military training in Marine recruits. *J.Appl Physiol*, 2004 Mar; 96 (3): 951-5.
- Klausen, K. Strength, and weight-training. In: *Physiology of Sports*, edited by T. Reilly. London: Spon, 1990, pp.41–67.
- Labayen, I., Diez, N., Parra, D Et Al., 2004, Basal and postprandial substrate oxidation rates in obese women receiving two test meals with different protein content. *Clin. Nutr.* pp.23, 571-578.
- Labayen, I., Diez, N., Gonzales, A., Et Al., 2003, Effects of protein vs. carbohydrate -rich diets on fuel utilization in obese women during weight loss. *Forum Nutr.*, pp.56, 168-170.
- Labayen, I., Diez, N., Parra, Md, Et Al., 2004, Time-course changes in macronutrient metabolism induced by a nutritionally balanced low-calorie diet in obese women. *Int J Food Sci Nutr*, pp.55, 27-35.
- Mettler, S., Mitchell, N. & Tipton, Kd, 2010, Increased protein intake reduces lean body mass loss during weight loss in athletes. *Med. sci. Sports Exerc.*, pp.42, 326-337.
- Sakizlian, R., (2012), Bodybuilding and Fitness – Theoretical Background. Course for Non-Specialized Higher Education. University Publishing House, Bucharest, pp.57-65.
- Soenen, S., Plasqui, G., Smeets, Aj, Et Al., 2010, Protein intake induced an increase in exercise stimulated fat oxidation during stabile body weight. *Physiol Behav*, 101, 770-774.
- Uceanu, F., 1994, Performance Bodybuilding, Redis Club Publishing House, Bucharest;
- Zemeil, Mb., Role of calcium and dairy products in energy partitioning and weight management. *Am J Clin Nutr.*, 2004 May; 79 (5): 907S-12S.
- Wannamenthee, Sg., Shape Ag., 2003, Alcohol, bodyweight and weight gain in middle-aged men. *Am J Clin Nutr*, 2003 May, 77(5): 1312-7.
- ***Muscular development, year 3, no.1 (12), January, 2006. www.muscular.ro
- ***Muscular development, year 8, no.4 (45), July-August, 2006. www.muscular.ro
- ***Muscular development, year 8, no.4 (45), July-August, 2011. www.muscular.ro
- *** Muscle, Bodybuilding, Fitness, Healthy life, no.34/2006. www.pronutrition.ro
- ***Muscle, Bodybuilding, Fitness, Healthy life, no.36/2006. www.pronutrition.ro
- ***Pro muscle, nr.39/2011. *Work and Science*. www.pronutrition.ro,