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Research Article

The Dynamics of the Values of Some Biomotrical Parameters Relevant in The Training of Competitive Athletes Who Practice Bodybuilding and Fitness

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Abstract

Physical assessment of athletes who practice bodybuilding and fitness at different time intervals is necessary in physical preparation for the development of the training program, thus, the internal feedback of the evaluated bio-motor parameters can be confirmed by the physical appearance, being essential in order to improve performances sports through the use of psycho-physical strategies and techniques that lead to the development of specific skills. In order to identify the dynamics of the values of some relevant biomotor parameters in the training of competitive athletes who practice bodybuilding and fitness, we performed non-invasive measurements, using accessible medical equipment and allowing athletes to self-assess, performed on a group of 70 competitive athletes, of which 17 athletes and 53 athletes) practicing bodybuilding and fitness for at least 1 year, we evaluated the percentage body fat, visceral fat level, BMI value and arm strength value.

We concluded that most athletes are strong, evaluated by the level of arm strength, have a level of body fat percentage located at a normal to low level, the BMI value being at a normal level towards the upper limit, against the background of an optimal state of health, having in mind see the normal mean value of visceral fat index, pulse values and oxygen saturation, values that fall within physiological limits. The average value of the measured parameters registers a sinusoidal curve in the direction of increase for athletes preparing to compete in the senior categories and decreases for athletes participating in the masters. Knowing the relevant biomotor parameters of the athletes' training makes the training process more efficient by adapting the training needs in order to obtain the sports form.

Keywords: Bodybuilding and fitness, Strength, Body Fat, Visceral fat

Practicing bodybuilding and fitness requires organizing your life by adopting a healthy lifestyle due to training routines, nutrition (hyperprotein to promote muscle mass growth, hypoglycemic to reduce fat gain) and rest, the state of physical fatigue and mental stress negatively affecting effort parameters and muscle strength level.

By increasing the number of people who adhere to the concept of sport for all, choosing a form of exercise as a way of spending their free time, in this case "going to the gym", the triad of the need for exercise-healthy nutrition-rest is outlined for the good felt at the physical level by increasing muscle tone and a body weight index in optimal parameters and on a psychological level by reducing the level of stress, neuroticism/aggressiveness by focusing and discharging negative energies with lifting/pushing weights, followed by mental relaxation [1].

Bodybuilding or physical culture is a sport that, through training with weights, overloads (resistance training) and a specific diet, has as its final objective the change of body composition with the increase of muscle mass and the reduction of body fat, where the goals are aesthetic but also competitive. Bodybuilding competitions are becoming more and more popular, and competitors are judged on their aesthetic appearance and typically display a high level of muscularity and symmetry and a low level of body fat. A structured

and scientifically supported nutrition strategy can be implemented to improve parameters relevant to bodybuilding competition and especially the health of competitors [2].

Muscle hypertrophy or increasing muscle size is the main goal of bodybuilding by making large changes in muscle chemistry, thus muscle mass develops more as a result of the contraction of muscle fiber elements (myosin filaments) than an increased flow of fluid and plasma, as usually happens [3]. This explains why the strength of bodybuilders is not always proportional to their body size. In bodybuilding, typically sub-maximal loads are used, athletes contracting the muscles to the point of refusal and the contraction of the muscle fibers varies as follows: when some get tired others come into action. It is very important to perform the maximum number of repetitions in a series, usually between 6-12, if the weight is too light the load is increased and vice versa so that the stimulation of the muscle creates sufficient tension during the executions.

In bodybuilding competitions, the participants evoke their muscular development through their own forms of presentation and specific body display positions during the competition. They are judged based on musculature, physical condition and symmetry. To look better during competitions, bodybuilders prepare through a combination of fat loss, dehydration, tanning and the use of special creams. During periods of physical development, bodybuilders follow heavy training, specific nutrition programs and follow a schedule of at least 6-8 hours of rest for faster recovery of trained muscle groups. Bodybuilding is one of the sports activities that identifies with masculinity and includes several characteristics such as being muscular, having an imposing physical appearance, being strong and competent. An interesting study involving 63 bodybuilders and 65 sedentary men [4] indicates that as bodybuilders' desire to become more muscular and strong increases, the degree of positive body perception decreases and there is a relationship between bodybuilders' physical dissatisfaction and their physical appearance. Following the results, it can be said that as the desire to become more muscular and stronger increases, the degree of positive body perception decreases and there is a relationship between the physical dissatisfaction of bodybuilders and their physical appearance. As a result of this finding, it can be said that individuals who become bodybuilders turn to bodybuilding as a result of this dissatisfaction and that they turn to bodybuilding to have the body they want.

The authors of the study Pursuit of the muscular ideal: Physical and psychological consequences and putative risk factors [5] consider that the development of a muscular figure for sports purposes and/or appearance has become a central issue for men. Concern has been raised because the desire to develop such a body build can lead to the adoption of numerous behaviors which endanger health. In this sense, they performed measurements of some physiological parameters such as visceral fat, pulse and oxygen saturation. Bodybuilding was seen as a subcultural lifestyle of peripheral youth [6] in a qualitative study of a group of young Polish bodybuilders conducted in 2014 in a small town in North-Eastern Poland that still faces the consequences of the collapse of communism. The author found that bodybuilding activities provided instant gratification. Such activities allowed individuals to see the immediate effect of training. The purpose of the confirmatory study on the dynamics of the values of some relevant biomotor parameters in the training of competitive athletes who practice bodybuilding and fitness was to know and realize the dynamics of the relevant biomotor performance indicators in bodybuilding and fitness.

Objectives

a. Knowing the BMI value and certain percentages of the body composition is measured by means of the body analyzer.

b. Knowing the level of arm strength by measuring it with the hand dynamometer.

c. Knowing the values of the relevant physiological indicators of the athletes' state of health.

Tasks

a) Measurement of anthropometric indicators, respectively, height and weight, values based on which the body analyzer calculated BMI

b) Determination of certain percentages of body composition, namely subcutaneous fat, visceral fat.

c) Measuring the level of muscle strength in the arms and some indicators that reflect body harmony and general health.

Hypothesis

Competitive athletes who practice bodybuilding and fitness are strong and harmoniously developed, having a good state of health, aspects reflected in the average values of the evaluated biomotor indicators that fall within the normal physiological limits, gender and age ratios.

Methods

The research methods applied in the study on the dynamics of the values of some relevant biomotor parameters in the training of competitive athletes were the method of observation, conversation, measurement, statistics.

Organization and conduct of the ascertainment study on the dynamics of the values of some relevant biomotor parameters in the training of competitive athletes who practice bodybuilding and fitness The study was carried out between September 2021 and September 2022 both during the weekly training program at the gym and during the National Bodybuilding and Fitness Championships

organized between 09-11.09.2021 and 31.08-04.09.2022 in Sibiu. The athletes participating in the study are competitive athletes in different stages of preparation, namely the period of strength, muscle hypertrophy or pre-competitive definition, aged between 15 and 72, of which 53 are male and 17 female.

Most of the athletes who participated in the study have notable performances both nationally and internationally. I observed aspects related to the equipment of the bodybuilding and fitness rooms, the training routine of the athletes, their personality and their behavior in the gym, and last but not least, I visually evaluated their physical appearance.

In order to capture as many aspects as possible of the effects of bodybuilding training, namely the harmony of body development, health status and segmental strength, we performed anthropometric measurements (height, weight, indirect BMI), biological measurements (pulse, oxygen saturation 2), determinations of body composition expressed as percentages (body and visceral fat) and motor measurements (arm strength). Biometric measurements were performed using the apparatus briefly described below, with measurement standards presented in the instructions for use or user manual of each apparatus.

Brief Presentation of The Apparatus and Devices Used to Perform Bio-Motor Measurements

a. Ultrasonic height meter used to measure body height, model U-grow UHM-001, by ultrasonic technology with LCD display, unit of measurement Anglo-Saxon (ft) / Metric (cm).

b. The body composition measuring monitor Monitor BF-508 from OMRON used for determining body composition and BMI which is a clinically validated device for determining body composition, which provides an analysis of the whole body, a complete picture of body composition, including of the percentage of adipose tissue, visceral adipose tissue and body mass index (BMI). It provides high accuracy so that daily progress can be monitored. It can be used for people aged between 10-80 years, maximum weight capacity (kg): 150.00 Scales and values of measured parameters according to the user manual of the presented device (Tables 1-3).

Table 1: Interpretation of body fat percentage.

Gender	Age	-Low	0 - Normal	1+ High	2++ Very High
Female	20 - 39	< 21.0%	21.0 – 32.9%	33.0 – 38.9%	≥ 39,0%
	40 - 59	< 23.0%	23.0 – 33.9%	34.0 – 39.9%	≥ 40,0%
	60 - 79	< 24.0%	24.0 – 35.9%	36.0 – 41.9%	≥ 42,0%
Male	20 - 39	< 8.0%	8.0 – 19.9%	20.0 – 24.9%	≥ 25,0%
	40 - 59	< 11.0%	11.0 – 21.9%	22.0 – 27.9%	≥ 28,0%
	60 - 79	< 13.0%	13.0 – 24.9%	25.0 – 29.9%	≥ 30,0%

Note*: Body fat percentage (%) = [Body fat mass (kg) / Body wight (kg)] x 100

Subcutaneous fat = fat below the skin, is included in the body fat percentage

Table 2: Interpretation of visceral fat levels.

Visceral Fat Level	Level Classififcation
01-Sep	0 normal
Oct-14	1 + high (mare)
15-30	2++ very high (foarte mare)

Note*: Visceral fat = fat surrounding internal organs

Table 3: Interpretation of BMI scores.

BMI	BMI (by the WHO)	BMI Classification bar	BMI rating
		- 0 + ++	
BMI < 18.5	-underweight (scăzut)	_	7.0-10.7
		_ _	10.8-14.5
		_ _ _	14.6-18.4

18.5 ≤BMI < 25	0 normal	____	18.5-20.5
		_____	20.6-22.7
		______	22.8-24.9
25 ≤ BMI < 30	+overweight (mare)	_______	25.0-26.5
		________	26.6-28.2
		_________	28.3-29.9
30 ≤ BMI	++ obese (obez)	__________	30.0-34.9
		__________	35.0-39.9
		___________	40.0-90.0

Note*: BMI, BODY MASS INDEX; BMI=GREUTATEA (KG)/ÎNĂLȚIMEA (M), by WHO–WORLD HEALTH ORGANIZATION.

c. The Puloximeter measuring device for measuring pulse values and oxygen saturation. The digital pulse oximeter features high accuracy and repeatability and is easy to use. Basically, a finger is inserted into the photoelectric sensor to establish the diagnosis, and the oxygen saturation is shown on the screen.

Technical specifications: SP02 measurement 35%-100% and pulse measurement: 30bpm – 250 bmp;

d. To measure the muscle strength at the level of the arm/hand (handgrip strength) I used the electronic hand dynamometer EH101, which is a high-precision medical device, which ensures the digital reading of the grip strength, the display of the maximum self-capturing value of the grip strength gripping, storing and retrieving results for different users, adjustable handle, valid for all users of different ages, equipped with high-precision grip force sensor, which allows the evaluation of results by age and gender groups. kg/lb, maximum capacity: 90kg/ 198 lb. The use of this simple and easy-to-use device has aroused great interest among athletes who were eager to know the value of their arm strength. Scales and values of measured parameters according to the user manual of the presented device (Tables 4-7).

Table 4: Pulling Strength Ratings for Men (in kg).

Age	Weak	Normal	Strong
10-Nov	< 12,6	12,6-22,4	> 22.4
Dec-13	< 19,4	19.4-31.2	> 31.2
14-15	< 28,5	28,5-44,3	> 44,3
16-17	< 32,6	32,6-52,4	> 52,4
18-19	< 35,7	35,7-55,5	> 55,5
20-24	< 36,8	36,8-56,6	> 56,6
25-29	< 37,7	37,7-57,5	> 57,5
30-34	< 36,0	36,0-55,8	> 55,8
35-39	< 35,8	35,8-55,6	> 55,6
40-44	< 35,5	35,5-55,3	> 55,3
45-49	< 34,7	34,7-54,5	> 54,5
50-54	< 32,9	32,9-50,7	> 50,7
55-59	< 30,7	30,7-48,5	> 48,5
60-64	< 30,2	30,2-48,0	> 48,0
65-69	< 28,2	28,2-44,0	> 44,0
70-99	< 21,3	21,3-35,1	> 35.1

Table 5: Pull force ratings for women (in kg).

Age	Weak	Normal	Strong
10-Nov	< 11,8	11,8-21,6	> 21.6
Dec-13	< 14,6	14,6-24,4	> 24.4
14-15	< 15,5	15,5-27,3	> 27.3
16-17	< 17,2	17,2-29,0	> 29,0
18-19	< 19,2	19,2-31,0	> 31,0

20-24	< 21,5	21,5-35,3	> 35.3
25-29	< 25,6	25,6-41,4	> 41,4
30-34	< 21,5	21,5-35,3	> 35.3
35-39	< 20,3	20,3-34,1	> 34.1
40-44	< 18,9	18,9-32,7	> 32,7
45-49	< 18,6	18,6-32,4	> 32.4
50-54	< 18,1	18.1-31.9	> 31.9
55-59	< 17,7	17,7-31,5	> 31,5
60-64	< 17,2	17,2-31,0	> 31,0
65-69	< 15,4	15,4-27,2	> 27.2
70-99	< 14,7	14,7-24,5	> 24,5

Table 6: Results biomotrice measurements for 70 sportsmen, 53 men and 17 women.

No. crt.	Initial	SexF/M	Age (years)	Waist (H)	Gr. (kg)	Sat. O2	Pulse b/ min.	Body fat (FAT)	Fat level	Visceral fat (Vfat)	Level Vfat	Body Mass Index (BMI)	BMI Level	Dynamo. Right (kg.)	Level Force right	Dynamo Left (Kg)	Dynamo Left (Kg) Left force Level left force
1	B.A.	M	15	162	66	99	105	18,7	normal	0	0	25,1	big1	36	n	36,8	n
2	E.D.	M	16	162	71,3	98	101	21,2	big	0	0	27,2	big2	58,1	p	62,8	p
3	A.E.	M	16	168	58,7	99	78	14,3	normal	0	0	22,3	normal3	48,8	n	49,9	n
4	N.B.	M	17	178	77,6	99	88	17	normal	0	0	24,5	normal3	63,6	p	60,2	p
5	D.S.	M	18	161	72,7	98	117	22	big	1	n	28	big3	41,7	n	43,2	n
6	D.A.	M	18	163	56,2	99	84	9,1	Normal	0	0	21,2	normal2	42,7	n	44,2	n
7	B.A.	M	19	156	51,3	99	104	14,6	normal	4	n	21,1	normal2	40,9	n	39,8	n
8	D.S.	M	19	182	93,5	98	100	29,8	very big	10	n	28,2	big3	55,4	n	53,6	n
9	G.A.	M	19	185	75	99	90	16,1	normal	4	n	21,9	normal2	55,8	p	50,8	n
10	R.N.	M	19	178	80,5	97	88	9,6	normal	6	n	25,4	big1	66,8	p	60,2	p
11	T.M.	M	19	169,5	82,2	98	99	21,9	big	9	n	28,6	big3	58,6	p	63,6	p
12	B.V.	M	20	173,5	66,3	99	114	24,4	big	6	n	22,4	normal2	48,1	n	49,2	n
13	M.M.	F	20	170	88,2	99	120	34,1	big	5	n	30,5	Veri big1	40,1	p	42,1	p
14	R.R.	M	20	179	79	98	81	12	normal	7	n	22	normal2	62,5	p	59,8	p
15	L.A.	M	20	180	79,9	99	59	12,7	normal	6	n	24,7	normal3	61,7	p	56,7	p
16	C.A.	M	21	180	73,5	97	80	14,8	normal	5	n	22,9	normal3	70,9	p	65,4	p
17	T.G.	M	21	170	70	97	77	19,8	normal	7	n	24,5	normal3	55,8	n	59,6	p
18	P.R.	M	22	170	78,1	96	154	10,7	normal	8	n	27	big2	72,5	p	76	p
19	A.C.	M	23	180,5	78,6	98	79	19,3	normal	6	n	24,1	normal3	52,5	n	55,5	n
20	I.V.	M	23	177	70,1	98	107	13,8	normal	5	n	22,4	normal2	63,4	p	56,6	p
21	N.G.	F	23	160	51,5	99	88	30,2	normal	3	n	20,1	normal1	27,4	n	26,6	n
Total	Junior Average	2f/ 19m	19,43	171,64	72,39	98,24	95,85	18,39	normal	4,38	n	24,48	normal3	53,49	n	52,98	n
22	A.A.	M	24	192	105,7	94	122	13	normal	9	n	28,7	big3	60	p	61,2	p
23	B.D.	M	24	165	64,3	95	72	9,9	normal	5	n	23,3	normal3	52,2	n	50,8	n
24	O.C.	M	24	182	72,9	97	73	19,7	normal	4	n	22	normal2	48,9	n	47,9	n
25	A.R.	M	25	186	74,1	99	73	10	normal	3	n	21,4	normal3	50,6	n	48,4	n
26	C.C.	M	25	179	89	99	97	14	normal	8	n	24	normal3	63,2	p	55,5	n
27	I.F.	M	25	175	67,7	97	121	12	normal	6	n	21	normal2	75,9	p	69,3	p
28	M.T.	M	25	175	85,7	96	103	32,5	very big	11	m	28	big2	59	p	62,2	p
29	S.C.	M	25	186	83,5	97	79	15,1	normal	6	n	24,1	normal3	44,8	n	43,5	n
30	P.A.M	F	25	168	52,3	97	58	18,4	low	1	n	18,53	normal1	29,2	n	25,9	n

31	A.P.	M	26	185	96,7	97	103	21,1	big	15	m	31,6	Very big1	58,2	p	75,6	p
32	N.T.	M	26	170	82,1	96	101	24,3	big	10	m	28,4	big3	42,2	n	41,8	n
33	N.N.	M	26	184	67,1	99	73	5,9	low	2	n	19,8	normal1	42,9	n	42,1	n
34	T.M.	F	26	167,5	53,4	99	109	22,3	low	2	n	19	normal1	33,5	n	29,8	n
35	F.R.	M	27	178	85	96	87	20,9	big	5	n	26,6	big2	72	p	63	p
36	D.A.	M	28	175	84,4	98	89	16,5	normal	8	n	26,6	big2	58,5	p	63,1	p
37	R.S.	M	29	175	79,7	98	105	7	low	8	n	25,3	big1	55	n	56	n
38	S.G.	M	29	175	84,6	98	115	14,4	normal	8	n	27	big2	70,9	p	75,2	p
39	M.A.	M	30	188	87,4	99	74	10,9	normal	6	n	24,7	normal3	69,4	p	66,7	p
40	M.D.	F	31	165	55,7	95	78	27,8	normal	3	n	20,5	normal3	28,8	n	27,5	n
41	C.V.	M	31	180	88,4	99	71	14,6	normal	9	n	27,3	big2	68,3	p	69,4	p
42	I.J.S	M	31	174	83,6	99	61	14,73	normal	9	n	27,6	big2	76,7	p	67,9	p
43	S.O.	M	32	186	105,9	97	79	27,6	very big	7	n	30,6	verybig1	67,1	p	65,8	p
44	L.S.	F	33	164	58	99	85	21,1	normal	3	n	21,6	big2	34	n	30,5	n
45	P.S.	M	33	183,5	93,9	96	100	21	big	10	m	27,9	big2	59,9	p	54,5	n
46	R.P.	M	33	177	81,1	98	79	20,1	low	8	n	25,9	big1	57,8	p	61,1	p
47	S.C.	M	33	166	80	97	104	15	normal	6	n	25	big1	69,8	p	59,4	p
48	B.N.	M	34	180,5	79,2	97	83	15,5	normal	7	n	24,3	normal3	61,7	p	58,7	p
49	D.M.	M	34	164	67,6	97	72	17,2	normal	8	n	25,1	big1	66,1	p	60	p
Total	Middle-seniors	4f/24m	28,55	176,67	79,30	97,27	87,72	17,49	normal	6,83	n	24,98	big1	55,89	n	54,04	n
50	G.A.G.	F	38	162	61,3	95	69	31,2	normal	5	n	23,4	normal3	32,6	n	32,7	n
51	D.M.	F	38	174	59,9	99	77	22,9	normal	3	n	19,8	normal1	35,6	p	33,7	n
52	S.C.	F	40	170	60,4	99	102	24,6	normal	6	n	23,3	normal3	47	p	42	p
53	K.P.	F	42	160	52	99	75	11,5	low	3	n	20,6	normal2	36,2	p	38,2	p
54	I.D.	M	43	180	84,4	95	81	16,8	normal	9	n	26	big1	51,1	n	50,5	n
55	M.E.	F	44	163	54	97	79	15,3	low	3	n	20,4	normal1	37,8	p	40,4	p
56	R.C.	F	44	158	49,3	99	64	23,9	normal	3	n	19,7	normal1	22,8	n	23,5	n
57	C.I.	F	44	166	66,2	98	118	29	normal	5	n	24	normal3	40,3	p	34,3	p
58	A.M.	M	45	190	102,9	95	83	13,8	normal	12	m	30,4	Very big1	70,7	p	68,2	p
59	C.E.	F	45	160	46,8	99	99	7,3	low	2	n	18,4	low3	36,7	p	36,8	p
60	N.A.	M	45	178	99,9	98	80	18,2	normal	14	m	31,5	Very big1	84,6	p	78,1	p
61	P.C.	M	46	178	90,6	98	81	23,4	big	6	n	25	big1	68,6	p	64,7	p
62	R.A.	F	46	165	55,6	99	88	14,7	low	2	n	20,4	normal2	27,6	n	27,2	n
63	Z.A.M.	F	46	169	64,1	99	100	15,9	low	6	n	23	normal3	33,3	p	30	n
64	S.M	M	48	178	77,7	99	109	8,9	low	7	n	24,5	normal3	56,2	p	54,3	n
65	Ș.M.	M	48	177	81,3	97	122	14,9	normal	9	n	26	big1	52,3	n	45,7	n
66	N.D.	F	50	172	68,3	99	95	30,1	normal	6	n	23,1	normal3	38,2	p	32	p
67	B.C.	M	53	188	109,9	98	97	29,1	big	18	f.m.	33,9	very big2	63,7	p	63,2	p
68	C.S.	M	54	175	88,2	99	74	12,3	normal	13	mare	28,8	big3	59,1	p	61,7	p
69	D.G	M	62	162	67	92	99	17,8	normal	11	m	26	big1	51,5	p	46,6	n
70	S.V.	M	72	172	83	97	75	19,6	normal	15	fmare	28,4	big3	55,7	p	49,8	p
Total	Media Masters	11f /10m	47,29	171,29	72,51	97,62	89,94	19,10	s/f-n/b	7,52	n	24,6	normal3	47,70	n	45,41	n
Total	Media	17f /53m	31,36	173,53	75,03	97,69	90,66	18,14	normal/b	6,25	n	24,66	normal3	52,88	n	51,27	n

Table 7: Descriptive statistics 70 athletes.

Age	How. Age	Waist	The weight	Saturation O2	Pulse	Corporal fat	Visceral fat	BMI	Right force	Left force	
Mean	31,36	1,31	173,53	75,03	97,69	90,66	18,23	6,242,857	24,66	52,88	51,27
Standard Error	1,46	0,06	1,05	1,79	0,18	2,16	0,82	0,45974	0,42	1,70	1,69
Median	27,5	1	175	77,65	98	88	16,9	6	24,5	55,55	53,95

Mode	25	1	178	88,2	99	79	14,6	6	24,5	55,8	36,8
Standard Deviation	12,19	0,53	8,79	14,98	1,49	18,09	6,86	3,846,458	3,48	14,24	14,11
Sample Variance	148,52	0,28	77,25	224,33	2,22	327,12	47,06	1,479,524	12,12	202,91	199,19
Kurtosis	0,64	1,13	-0,88	-0,49	2,06	0,82	-0,10	0,55494	-0,38	-0,79	-0,91
Skewness	0,97	1,42	-0,01	0,13	-1,33	0,69	0,60	0,614547	0,31	-0,16	-0,20
Range	57	2	36	63,1	7	96	30,2	18	15,5	61,8	54,6
Minimum	15	1	156	46,8	92	58	5,9	0	18,4	22,8	23,5
Maximum	72	3	192	109,9	99	154	36,1	18	33,9	84,6	78,1
Sum	2195	92	12147	5252	6838	6346	1275,83	437	1726,53	3701,5	3589
Count	70	70	70	70	70	70	70	70	70	70	70
Largest(1)	72	3	192	109,9	99	154	36,1	18	33,9	84,6	78,1
Smallest(1)	15	1	156	46,8	92	58	5,9	0	18,4	22,8	23,5
Confidence Level(95,0%)	2,91	1,31	2,10	3,57	0,36	4,31	1,64	0,917156	0,83	3,40	3,37

As can be seen in the table above, the average age of the 70 athletes is 31 years, with an average height of 173.53, with an average body weight of 75.03, oxygen saturation 97.69, pulse 90.66, normal values. The average percentage of body fat is 18.14, an average which in females represents a low value, and in males normal, compared to the average age. The average index of visceral fat is 6.25, a value that falls within the limits of normal values, without pathological risk, and the average index of BMI is 24.6, located at the limit of the normal value, towards increased, which denotes a high percentage of the muscle mass, compared to the other values, also the value of the strength of the arms has an average value of 52.88 kg tightening force of the right arm and 51.33 of the left arm, a value located close to the transition to the strong category (Tables 8,9).

Table 8: Results of biomotor measurements for 53 athletes.

No. crt.	Initial	SexF/M	Age (ani)	Waist (H)	Gr. (kg)	Sat. O2	Pulse b/min.	Body fat (FAT)	Fat level	Visceral fat (Vfat)	Level Vfat	Body Mass Index (BMI)	BMI Level	Dynamo. Right kg.	Level Force right	Dynamo Left (Kg)	Level Force left
1	B.A.	M	15	162	66	99	105	18,7	normal	0	0	25,1	big1	36	n	36,8	n
2	E.D.	M	16	162	71,3	98	101	21,2	big	0	0	27,2	big2	58,1	p	62,8	p
3	A.E.	M	16	168	58,7	99	78	14,3	normal	0	0	22,3	normal3	48,8	n	49,9	n
4	N.B.	M	17	178	77,6	99	88	17	normal	0	0	24,5	normal3	63,6	p	60,2	p
5	D.S.	M	18	161	72,7	98	117	22	big	1	n	28	big3	41,7	n	43,2	n
6	D.A.	M	18	163	56,2	99	84	9,1	normal	0	0	21,2	normal2	42,7	n	44,2	n
7	B.A.	M	19	156	51,3	99	104	14,6	normal	4	n	21,1	normal2	40,9	n	39,8	n
8	D.S.	M	19	182	93,5	98	100	29,8	very big	10	n	28,2	big3	55,4	n	53,6	n
9	G.A.	M	19	185	75	99	90	16,1	normal	4	n	21,9	normal2	55,8	p	50,8	n
10	R.N.	M	19	178	80,5	97	88	9,6	normal	6	n	25,4	big1	66,8	p	60,2	p
11	T.M.	M	19	169,5	82,2	98	99	21,9	big	9	n	28,6	big3	58,6	p	63,6	p
12	B.V.	M	20	173,5	66,3	99	114	24,4	big	6	n	22,4	normal2	48,1	n	49,2	n
13	R.R.	M	20	179	79	98	81	12	normal	7	n	22	normal2	62,5	p	59,8	p
14	L.A.	M	20	180	79,9	99	59	12,7	normal	6	n	24,7	normal3	61,7	p	56,7	p
15	C.A.	M	21	180	73,5	97	80	14,8	normal	5	n	22,9	normal3	70,9	p	65,4	p
16	T.G.	M	21	170	70	97	77	19,8	normal	7	n	24,5	normal3	55,8	n	59,6	p
17	P.R.	M	22	170	78,1	96	154	10,7	normal	8	n	27	big2	72,5	p	76	p
18	A.C.	M	23	180,5	78,6	98	79	19,3	normal	6	n	24,1	normal3	52,5	n	55,5	n
19	I.V.	M	23	177	70,1	98	107	13,8	normal	5	n	22,4	normal2	63,4	p	56,6	p
Total	Junior average	19m	19,21	172,08	72,66	98,16	95	16,94	normal	4,42	n	24,39	normal 3	55,57	p	54,94	n
20	A.A.	M	24	192	105,7	94	122	13	normal	9	n	28,7	big3	60	p	61,2	p
21	B.D.	M	24	165	64,3	95	72	9,9	normal	5	n	23,3	normal3	52,2	n	50,8	n
22	O.C.	M	24	182	72,9	97	73	19,7	normal	4	n	22	normal2	48,9	n	47,9	n
23	A.R.	M	25	186	74,1	99	73	10	normal	3	n	21,4	normal3	50,6	n	48,4	n

24	C.C.	M	25	179	89	99	97	14	normal	8	n	24	normal3	63,2	p	55,5	n
25	I.F.	M	25	175	67,7	97	121	12	normal	6	n	21	normal2	75,9	p	69,3	p
26	M.T.	M	25	175	85,7	96	103	32,5	very big	11	m	28	big2	59	p	62,2	p
27	S.C.	M	25	186	83,5	97	79	15,1	normal	6	n	24,1	normal3	44,8	n	43,5	n
28	A.P.	M	26	185	96,7	97	103	21,1	big	15	m	31,6	very big1	58,2	p	75,6	p
29	N.T.	M	26	170	82,1	96	101	24,3	big	10	m	28,4	big3	42,2	n	41,8	n
30	N.N.	M	26	184	67,1	99	73	5,9	low	2	n	19,8	normal1	42,9	n	42,1	n
31	F.R.	M	27	178	85	96	87	20,9	big	5	n	26,6	big2	72	p	63	p
32	D.A.	M	28	175	84,4	98	89	16,5	normal	8	n	26,6	big2	58,5	p	63,1	p
33	R.S.	M	29	175	79,7	98	105	7	low	8	n	25,3	big1	55	n	56	n
34	S.G.	M	29	175	84,6	98	115	14,4	normal	8	n	27	big2	70,9	p	75,2	p
35	M.A.	M	30	188	87,4	99	74	10,9	normal	6	n	24,7	normal3	69,4	p	66,7	p
36	C.V.	M	31	180	88,4	99	71	14,6	normal	9	n	27,3	big2	68,3	p	69,4	p
37	I.J.S	M	31	174	83,6	99	61	14,73	normal	9	n	27,6	big2	76,7	p	67,9	p
38	S.O.	M	32	186	105,9	97	79	27,6	Very big	7	n	30,6	Very big1	67,1	p	65,8	p
39	P.S.	M	33	183,5	93,9	96	100	21	big	10	m	27,9	big2	59,9	p	54,5	n
40	R.P.	M	33	177	81,1	98	79	20,1	scăzut	8	n	25,9	big1	57,8	p	61,1	p
41	S.C.	M	33	166	80	97	104	15	normal	6	n	25	big1	69,8	p	59,4	p
42	B.N.	M	34	180,5	79,2	97	83	15,5	normal	7	n	24,3	normal3	61,7	p	58,7	p
43	D.M.	M	34	164	67,6	97	72	17,2	normal	8	n	25,1	big1	66,1	p	60	p
44	Senior average	24m	28,29	178,37	82,9	97,29	89	16,37	normal	7,42	n	25,67	big 1	60,46	p	58,71	p
45	I.D.	M	43	180	84,4	95	81	16,8	normal	9	n	26	big1	51,1	n	50,5	n
46	A.M.	M	45	190	102,9	95	83	13,8	normal	12	m	30,4	very big1	70,7	p	68,2	p
47	N.A.	M	45	178	99,9	98	80	18,2	normal	14	m	31,5	Very big1	84,6	p	78,1	p
474	P.C.	M	46	178	90,6	98	81	23,4	big	6	n	25	big1	68,6	p	64,7	p
48	S.M	M	48	178	77,7	99	109	8,9	low	7	n	24,5	normal3	56,2	p	54,3	n
49	Ș.M.	M	48	177	81,3	97	122	14,9	normal	9	n	26	big1	52,3	n	45,7	n
50	B.C.	M	53	188	109,9	98	97	29,1	big	18	f.m.	33,9	verybig2	63,7	p	63,2	p
51	C.S.	M	54	175	88,2	99	74	12,3	normal	13	mare	28,8	big3	59,1	p	61,7	p
52	D.G	M	62	162	67	92	99	17,8	normal	11	m	26	big1	51,5	p	46,6	n
53	S.V.	M	72	172	83	97	75	19,6	normal	15	fmare	28,4	big3	55,7	p	49,8	p
Total	Average	10m	51,6	177,8	88,49	96,8	90,1	17,48	normal	11,4	mare	28,05	big 3	61,35	p	58,28	p
Total		53m	29,23	176,07	80,19	97,52	91,38	16,78	normal	7,05	normal	25,64	big1	58,84	p	57,26	p

Note*: M, male; Gr., weight, Sat., Oxygen saturation; Pulse b/min., beats/minute; Dynam., Dynamometry, n, normal; p, strong

Table 9: The averages of biomotor measurements for 53 athletes, by contest, junior, senior and masters categories.

1	Junior average	19m	19,21	172,08	72,66	98,16	95	16,94	normal	4,42	normal	24,39	normal 3	55,57	p	54,94	n
2	Senior average	24m	28,29	178,37	82,9	97,29	89	16,37	normal	7,42	normal	25,67	big 1	60,46	p	58,71	p
3	Masters average	10m	51,6	177,8	88,49	96,8	90,1	17,48	normal	11,4	big	28,05	big 3	61,35	p	58,28	p
Total	Average	/53m	29,23	176,07	80,19	97,52	91,38	16,78	normal	7,05	normal	25,64	Big 1	58,84	p	57,26	p

As can be seen, the dynamics of the values obtained in junior, senior and masters athletes follows a sinusoidal, plateau, increasing or decreasing path for certain parameters as follows: in juniors, the BMI index is at a normal value close to the upper limit, respectively level normal 3, while for seniors and masters, the BMI value is exceeded at level 1, respectively level 3, i.e. they have more muscle mass than juniors. In terms of body composition, the subcutaneous fat layer in juniors has an average of 16.94%, slightly lower in seniors, respectively 16.37% and an increasing trend in masters athletes by almost one percent, respectively 17, 48%, all the average percentages falling on the female low level, and on the male level at the normal to low level.

The value of visceral fat, which also reflects the state of health, increases constantly from juniors to masters, respectively 4.42 for juniors, 7.42 for seniors, falling within the limits of normal values, while in masters it exceeds the normal value by 2.4 points 11.4 (9). In this sense, oxygen saturation and heart rate follow the same

sinusoidal path from juniors to masters. Arm strength is lower in juniors by about 5kg in both arms, while seniors and masters athletes have almost equal values located at the strong level. The highest arm strength value was measured in both arms in a 45-year-old masters athlete, 84.1kg pulling force for the right arm and 78.6kg pulling force for the left arm who also has an exceeded BMI value, the equivalent of a non-athlete being "obese 1", but with a body fat value of 18.2% located at a normal level, i.e. with very high muscle mass (Table 10).

Table 10: Descriptive statistics 53 athletes.

Age	How. Age Waist		Waist	The weight	Saturation O2	pulse	Corporal fat	Visceral fat	BMI	Right force		Left force
Mean	29,43	1,25	176,10	80,28	97,51		91,36	16,78	709,434	25,66	5,887,547	5,716,604
Standard Error	1,71	0,07	1,13	1,70	0,20449		2,50	0,79	0,546306	0,42	1,425,155	136,323
Median	25	1	178	80	98		88	15,5	7	25,3	58,6	59,4
Mode	19	1	178	84,4	99		79	14,6	6	24,5	55,8	60,2
Standard Deviation	12,45	0,52	8,25	12,37	1,49		18,23	5,78	3,98	3,05	10,38	9,92
Sample Variance	155,06	0,27	68,01	153,04	2,22		332,23	33,37	15,82	9,28	107,65	98,49
Kurtosis	2,04	3,56	-0,31	0,28	2,53		1,22	0,32	0,46	-0,05	-0,25	-0,60
Skewness	1,48	2,05	-0,42	0,21	-1,35		0,85	0,61	0,26	0,36	-0,01168	-0,17
Range	57	2	36	58,6	7		95	26,6	18	14,1	48,6	39,2
Minimum	15	1	156	51,3	92		59	5,9	0	19,8	36	36,8
Maximum	72	3	192	109,9	99		154	32,5	18	33,9	84,6	76
Sum	1560	66	9333,5	4255	5168		4842	889,53	376	1360,2	3120,4	3029,8
Count	53	53	53	53	53		53	53	53	53	53	53
Largest(1)	72	3	192	109,9	99		154	32,5	18	33,9	84,6	76
Smallest(1)	15	1	156	51,3	92		59	5,9	0	19,8	36	36,8
Confidence Level(95,0%)	3,43	0,14	2,27	3,41	0,41		5,02	1,59	1,10	0,84	2,86	2,74

The youngest 15-year-old athlete, 162 cm tall and 66 kg, BMI high 1, had a body fat percentage of 18.7%, arm strength rated at normal, and pole opposite, the oldest athlete, at no less than 72 years old, a percentage of body fat of 19.6%, waist of 172cm, weighing 83kg, with 10kg of muscle mass above normal weight, the pulling force in both hands located at the strong level, in relation to his age. The highest power pulls were achieved by athletes with a BMI at or above the upper limit and a low percentage of body fat (Tables 11, 12).

Table 11: Results of biomotor measurements for 17 female athletes.

No. crt.	Initial	Sex F/M	Age (ani)	Waist (H)	Gr. (kg)	Sat. O2	Pulseb/ min.	Body fat (FAT)	Fat level	Visceral fat (Vfat)	Level Vfat	Body Mass Index (BMI)	BMI Level	Dynamo. Right (kg.)	Level Force right	Dynamo Left (Kg)	Level Force left
1	M.M.	F	20	170	88,2	99	120	34,1	big	5	n	30,5	Very big1	40,1	p	42,1	p
2	N.G.	F	23	160	51,5	99	88	30,2	normal	3	n	20,1	normal1	27,4	n	26,6	n
	Junior average	2f	21,5	165	69,85	99	104	32,15	normal	4	n	25,3	big1	33,75		34,35	
3	P.A.M	F	25	168	52,3	97	58	18,4	low	1	n	18,53	normal1	29,2	n	25,9	n
4	T.M.	F	26	167,5	53,4	99	109	22,3	low	2	n	19	normal1	33,5	n	29,8	n
5	M.D.	F	31	165	55,7	95	78	27,8	normal	3	n	20,5	normal3	28,8	n	27,5	n
6	L.S.	F	33	164	58	99	85	21,1	normal	3	n	21,6	big2	34	n	30,5	n
	Senior average	4f	28,75	166,125	54,85	97,5	82,5	22,4	low	2,25	n	19,91	normal2	31,37		28,42	
7	G.A.G.	F	38	162	61,3	95	69	31,2	normal	5	n	23,4	normal3	32,6	n	32,7	n
8	D.M.	F	38	174	59,9	99	77	22,9	normal	3	n	19,8	normal1	35,6	p	33,7	p
9	S.C.	F	40	170	60,4	99	102	24,6	normal	6	n	23,3	normal3	47	p	42	p
10	K.P.	F	42	160	52	99	75	11,5	low	3	n	20,6	normal2	36,2	p	38,2	p
11	M.E.	F	44	163	54	97	79	15,3	low	3	n	20,4	normal1	37,8	p	40,4	p
12	R.C.	F	44	158	49,3	99	64	23,9	normal	3	n	19,7	normal1	22,8	n	23,5	n
13	C.I.	F	44	166	66,2	98	118	29	normal	5	n	24	normal3	40,3	p	34,3	p

14	C.E.	F	45	160	46,8	99	99	7,3	low	2	n	18,4	low3	36,7	p	36,8	p
15	R.A.	F	46	165	55,6	99	88	14,7	low	2	n	20,4	normal2	27,6	n	27,2	n
16	Z.A.M.	F	46	169	64,1	99	100	15,9	low	6	n	23	normal3	33,3	p	30	p
17	N.D.	F	50	172	68,3	99	95	30,1	big	6	n	23,1	normal3	38,2	p	32	p
	Masters average	11f	43,36	165,36	57,99	98,36	87,82	20,58	low	3,8	n	21,46	normal2	35,28	p	33,88	p
Total	Total F	17f	36,07	165,51	59,04	98,24	88,97	22,89	low	3,54		21,66	Normal 2	34,01	p	32,42	p

Note*: F, female, M, male; Gr., weight, Sat., Oxygen saturation; Pulse b/min., beats/minute; Dynam., Dynamometry, n, normal; p, strong

Table 12: Averages of biomotor measurements for 17 sportswomen, by contest categories, Juniors, seniors and masters.

Junior average	21,5	165	69,85	99	104	32,15	normal	4	n	25,3	mare1	33,75	n	34,35	n
Senior average	28,75	166,125	54,85	97,5	82,5	22,4	low	2,25	n	19,91	normal2	31,37	n	28,42	n
Masters average	43,36	165,36	57,99	98,36	87,82	20,58	low	3,8	n	21,46	normal2	35,28	p	33,88	p

As can be seen, the dynamics of the values obtained in junior, senior and masters sportswomen follow a sinusoidal, plateau, increasing or decreasing path for certain parameters as follows: in juniors, the BMI index is slightly exceeded, i.e. high level 1, while for seniors and masters, the BMI value is at normal level 2. Regarding body composition, the subcutaneous fat layer in juniors has an average of 32.15%, located at the upper limit of normal, low in seniors, respectively 22.4% and a downward trend in masters athletes by almost two percent, respectively 20.58%. The value of visceral fat, which also reflects the state of health, is 4 points for juniors, decreases for seniors and increases slightly for masters, respectively 2.25 for seniors, 3.8 for masters, falling within the limits of normal values in all categories of age, the normal value being between 1-9.

In this sense, the oxygen saturation follows a decreasing path, from juniors to masters, while the pulse has a sinusoidal path, being higher in juniors, 104, decreasing in seniors, 82.5 and increasing in masters, 87, 82. Average arm strength is higher in the juniors, who have a higher pull force on the left side, slightly lower in the seniors, who have a higher pull force on the right side, and higher in the masters with 2kg of force on both arms, respectively of 35, 28 in the right arm and 33.88 in the left arm, which fall into the strong level. The highest value of arm strength was measured in the right arm of a 40-year-old female masters athlete with a pulling force of 47kg, who has a normal BMI of 3, while in the arm on the left, the highest pulling force was obtained by a 20-year-old junior athlete, respectively 40.1kg, who also has a high BMI value of 1, the equivalent of a non-athlete who would fall into the obese category 1 (Table 13).

Table 13: Descriptive statistics for 17 female athletes.

Age	**How. Age Waist**		**The weight**	**The weigh**	**Saturation O2 Pulse**	**Corporal fat Visceral fat**	**Right force**	**Right force**		**Left force**	**Age**
Mean	37,35	1,53	165,5	58,65	98,24	88,47	22,37	3,59	21,55	34,18	32,54
Median	40	2	165	55,7	99	88	22,9	3	20,5	34	32
Standard Deviation	9,28	0,51	4,65	9,67	1,39	18,01	7,63	1,58	2,91	5,89	5,76
Sample Variance	86,12	0,26	21,625	93,49	1,94	324,26	58,19	2,51	8,49	34,68	33,17
Kurtosis	-0,94	-2,27	-0,90	4,79	1,85	-0,69	-0,73	-1,08	4,86	0,31	-0,93
Skewness	-0,63	-0,13	0,11	1,85	-1,73	0,18	-0,34	0,35	1,88	0,12	0,33
Range	30	1	16	41,4	4	62	26,8	5	12,1	24,2	18,6
Minimum	20	1	158	46,8	95	58	7,3	1	18,4	22,8	23,5
Maximum	50	2	174	88,2	99	120	34,1	6	30,5	47	42,1
Sum	635	26	2813,5	997	1670	1504	380,3	61	366,33	581,1	553,2
Count	17	17	17	17	17	17	17	17	17	17	17
Largest(1)	50	2	174	88,2	99	120	34,1	6	30,5	47	42,1

Smallest(1)	20	1	158	46,8	95	58	7,3	1	18,4	22,8	23,5
Confidence Level(95,0%)	4,77	0,26	2,39	4,97	0,72	9,26	3,92	0,811	1,50	3,03	2,96

The youngest 20-year-old female athlete, 170 cm tall and 88.2 kg, BMI high 1, had a body fat percentage of 34.1%, arm strength rated strong, and at the opposite pole, the oldest athlete, 50 years old, a similar percentage of body fat of 30.1%, waist of 172cm, weighing 68.3kg, , pulling force in both hands evaluated at the strong level, in relation to his age. The athletes with the lowest percentage of body fat were the masters athletes, and the seniors had the lowest percentage of visceral fat.

Conclusions

We could conclude that the direct factors involved in the effectiveness of bodybuilding training (muscle mass, body fat, body harmony) tend to increase (muscle mass, BMI) and decrease (body fat) as the number of athletes increases. The average value of the age of the 70 athletes is 31 years, with an average height of 173.53, an average body weight of 75.03, oxygen saturation 97.69, pulse 90.66, values considered physiological. The average percentage of body fat is 18.14, an average which in females represents a low value, and in males normal, compared to the average age. The average index of visceral fat is 6.25, a value that falls within the limits of normal values, without pathological risk, and the average index of BMI is 24.6, located at the limit of the normal value, towards increased, which denotes a high percentage of the muscle mass, compared to the other values, also the value of the strength of the arms has an average value of 52.88 kg tightening force of the right arm and 51.33 of the left arm, a value located close to the transition to the strong category.

The dynamics of the values obtained in junior, senior and masters athletes follows a sinusoidal, plateau, increasing or decreasing path for certain parameters as follows: in juniors, the BMI index is at a normal value close to the upper limit, i.e. normal level 3, while in seniors and masters, the BMI value is exceeded at level 1, respectively level 3, i.e. they have more muscle mass than juniors. In terms of body composition, the subcutaneous fat layer in juniors has an average of 16.94%, slightly lower in seniors, respectively 16.37% and an increasing trend in masters athletes by almost one percent, respectively 17, 48%, all the average percentages falling on the female low level, and on the male level at the normal to low level. The value of visceral fat, which also reflects the state of health, increases constantly from juniors to masters, respectively 4.42 for juniors, 7.42 for seniors, falling within the limits of normal values, while in masters it exceeds the normal value by 2.4 points 11.4 (9). In this sense, oxygen saturation and heart rate follow the same sinusoidal path from juniors to masters.

Arm strength is lower in juniors by about 5kg in both arms, while seniors and masters athletes have almost equal values located at the strong level.

The highest arm strength value was measured in both arms in a 45-year-old masters athlete, 84.1 kg pulling force for the right arm and 78.6 kg pulling force for the left arm who also has an exceeded BMI value, the equivalent of a non-athlete being "obese 1", but with a body fat value of 18.2% located at a normal level, i.e. with very high muscle mass. The youngest 15-year-old athlete, 162cm tall and 66 kg, BMI high 1, had a body fat percentage of 18.7%, arm strength rated at normal, and pole opposite, the oldest athlete, at no less than 72 years old, a percentage of body fat of 19.6%, waist of 172cm, weighing 83kg, with 10kg of muscle mass above normal weight, the pulling force in both hands located at the strong level, in relation to his age. The highest power pulls were achieved by athletes with a BMI at or above the upper limit and a low percentage of body fat.

The dynamics of the values obtained in junior, senior and masters athletes follows a sinusoidal, plateau, increasing or decreasing path for certain parameters as follows: in juniors, the BMI index is at a slightly exceeded value, i.e. high level 1, while in seniors and masters, the BMI value is at normal level 2. Regarding body composition, the subcutaneous fat layer in juniors has an average of 32.15%, located at the upper limit of normal, low in seniors, respectively 22.4% and a downward trend in masters athletes by almost two percent, respectively 20.58%. The value of visceral fat, which also reflects the state of health, is 4 points for juniors, decreases for seniors and increases slightly for masters, respectively 2.25 for seniors, 3.8 for masters, falling within the limits of normal values in all categories of age, the normal value being between 1-9. In this sense, oxygen saturation follows a decreasing path, from juniors to masters, while the pulse has a sinusoidal path, being higher in juniors, 104, decreasing in seniors, 82.5 and increasing in masters, 87, 82.

Average arm strength is higher in the juniors, who have a higher pull force on the left side, slightly lower in the seniors, who have a higher pull force on the right side, and higher in the masters with 2kg of force on both arms, respectively of 35, 28 in the right arm and 33.88 in the left arm, which fall into the strong level. The highest value of arm strength was measured in the right arm of a 40-year-old female masters athlete with a pulling force of 47kg, who has a normal BMI of 3, while in the arm on the left, the highest pulling force was obtained by a 20-year-old junior athlete, respectively 40.1kg, who also has a high BMI value of 1, the equivalent of a non-athlete who would fall into the obese category 1.

Discussions

In bodybuilding competitions, participants evoke their

muscular development through their own forms of presentation and through specific positions required within the contests. They are judged based on musculature, physical condition and symmetry. To look better during competitions, bodybuilders prepare through a combination of fat loss, dehydration, tanning and the use of special creams. During periods of physical development, bodybuilders follow heavy training, specific nutrition programs and follow a schedule of at least 6-8 hours of rest for faster recovery of trained muscle groups. Self-esteem is not the first reason men become competitive amateur bodybuilders, emulation was the largest category stated for starting bodybuilding (n = 118), followed by previous participation in sports (n = 107), self-esteem (n = 107). = 50), health (n = 36) and other (n=28), concluded (*Parish, et al*. 2010) studying the reasons why men become competitive amateur bodybuilders.

The results of the study Personality Factors in Exercise Addiction: A Pilot Study Exploring the Role of Narcissism, Extraversion, and Agreeableness [7] indicate a low incidence of people who were classified as being at risk of exercise addiction (7%), but a high incidence of symptomatic individuals (75%). The results suggested that extraversion and narcissism may be underlying factors in exercise addiction with no effect on agreeableness. Exercise engagement and intensity were also related to exercise addiction. Further research examining the relationship between personality types and exercise addiction may be helpful in identifying individuals at risk for developing exercise addiction. In the study exploring issues of identity construction in mature bodybuilders [8] which seeks to contribute empirically, theoretically and methodologically to the literature on aging bodies and identity construction by analyzing self-photographic data from a project exploring the embodied identities of mature bodybuilders, the analysis identified three important identities that participants constructed through the self-photograph task. These identities were; a healthy body-self, a performance body-self, and a relational body-self In combination, these three identities provide insight into what mature bodybuilders themselves consider important in their lives and social worlds.

Research themes such as self-enhancement, attention and self-control, knowledge and experience development, well-being and life have been integrated into the concept of "extraordinary self" based on the fact in the studies "Self-enhancement: Bodybuilders make sense of the experiences with which they improve themselves". appearance and performance [9], participants realized a potential "exit point" that undermined the use of appearance and performance-enhancing drugs (APEDs) emerged from a tension between such "extraordinary selves" and "ordinary selves" whereby they perceived APEDs as preventing them from living a normal, balanced life outside of the context of bodybuilding.

The attitude of a winner, combativeness, overcoming one's own limits through self-determination, combined with compliance with the training program, the diet, the controlled administration of nutritional supplements and sufficient rest are extremely important aspects of the preparation of bodybuilders in order to participate in competitions. In this sense, the "Experiences of competitive male bodybuilders from a non-pathologizing perspective" [10] were analyzed using a meaning condensation procedure that resulted in five themes: being proud of the ability to discipline, seeing an attitude perfectionist as a necessary evil, experiencing recognition within the bodybuilding community, being stigmatized outside the bodybuilding community, and taking the stage to demonstrate a capacity for will and discipline. We suggest that bodybuilders can be stigmatized for violating social norms: through their distinctive appearance, through the way they deal with suspected drug use, and through challenging gender norms.

Men over 40 are doing more exercise in the gym to improve their body image as a way to boost their personal self-esteem and sex appeal. Cases where self-image becomes an obsession can lead to a body dysmorphic disorder called "muscle dysmorphia" (MD). The combination of psychological, environmental and biological factors determines the appearance and development of this disorder. The results of the study "Modeling the spread of male muscle dysmorphia in adults in Spain: economic, emotional and social factors" [11] predict an increase in non-competitive Spanish bodybuilders suffering from MD from 1% in 2011 to approximately 11% in 2015 (From the Picture, 2015).

The essential characteristic of man is to present himself as an individual, a unique result of the convergence of a multitude of biological, psychological, social and cultural factors that give him uniqueness in both the mental and behavioral spheres. That is why a holistic approach at national level is needed to capture and identify all the physical, mental and social aspects of the routine of bodybuilders and fitness practitioners. Bodybuilding and fitness is a long-lived sport, special performances achieved by athletes of the master categories. Men over 40 are doing more exercise in the gym to improve their body image as a way to boost their personal self-esteem and sex appeal. Cases where self-image becomes an obsession can lead to a body dysmorphic disorder called "muscle dysmorphia" (MD). The combination of psychological, environmental and biological factors determines the appearance and development of this disorder. The results of the study "Modeling the spread of adult male muscle dysmorphia in Spain: economic, emotional and social factors" [12] predict an increase in non-competitive Spanish bodybuilders suffering from MD from 1% in 2011 to approximately 11% in 2015. Contemporary life has turned the body into an object of increasing interest. The real emphasis of our culture is not on the body as the "material substrate" of the person, but on the body as the ideal appearance and the very repository of social rules and norms.

Starting from the importance of the principles and means of bodybuilding aimed at the somatic-functional and psychological

development of practitioners, a sociological study [13], of survey type, was carried out on first- and second-year students of the Faculty of Movement, Sport and Sciences of Health in Bacău, within Sport and the Top Motor Performance program. The results of the survey led to the respondents' conviction that the practice of fitness-improving sports and in this case bodybuilding (even as a professional sport) have extensive beneficial effects for their general physical and mental development such as: improvement of health status, beneficial influence on behavior, improving motor skills. , ensures a good level of fitness, mental-emotional balance, develops communication skills (especially non-verbal communication) and also develops aesthetic sense.

With the rapid development of society and economy, people's living standards are improving day by day, and more and more attention is paid to physical health, which has triggered an increase in fitness. The impact of bodybuilding exercises on physical fitness based on deep learning algorithm was analyzed in a paper [14] as a reference for fitness enthusiasts to choose scientific and directed exercise methods, which provides a theoretical basis for promoting bodybuilding and fitness. The results of the data showed that under the scientific and reasonable conditions, bodybuilding and fitness exercises have a corresponding positive effect on the subjects' body shape and posture. It is more practical to choose a combination of aerobic and anaerobic exercises.

Inactivity leads to morbidity and mortality, while new and exciting approaches to fitness improve health outcomes. Through the study "Health and fitness benefits using a heart rate intensity-based group fitness exercise regimen" the authors [15] evaluated the influence of an 8-week commercial group exercise regimen for interval training high intensity exercise (HIIT) to examine comprehensive health and fitness metrics. Aerobic fitness, body composition, resting metabolic rate, blood cholesterol, and glucose, in addition to resting blood pressure, were quantified in a laboratory setting independent of training facilities. Training used multimodal HIIT-based exercises, and work intensity was measured by real-time heart rate feedback. All participants completed the required two sessions per week. This study quantified improvements in aerobic fitness, body composition, resting metabolic rate, resting blood pressure, and triacylglycerol following an 8-week HIIT regimen. Implications of heart rate (HR) monitoring in franchised group exercise with wearable technology serve as an unexplored scientific approach to understanding novel exercise prescriptions on health-fitness outcomes. The hand grip strength test (HGS) is commonly used as an indicator of general muscle strength in medical and sports practices [16].

Given its predictive validity and simplicity, dynamometric ally measured grip strength should be considered a useful vital sign for screening middle-aged and older adults [17]. Similar to our research, the authors of the study "The Effect of Hand Dimensions, Hand Shape and Some Anthropometric Characteristics on Handgrip Strength in Male Grip Athletes and Non-Athletes", investigated the effect of hand dimensions, hand shape and some anthropometric characteristics on grip strength in male athletes and non-athletes. Grip strength was measured in the dominant and non-dominant hand using a standard dynamometer. The results showed that grip strength and some of the hand dimensions may be different in athletes who use objects or opponents compared to non-athletes.

Although hand grip strength is essential for daily life in humans and our arboreal great ape relatives, the human hand has changed in form and function throughout our evolution due to terrestrial bipedalism, tool use, and directional asymmetry (DA), such as the hand. Using the dynamometer the authors of a complex study [18] measured grip strength in a heterogeneous cross-sectional sample of human participants (n = 662, aged 17–83 years) to test for potential effects of age, sex, asymmetry (hand dominance and hand attitude), hand shape, occupation and playing sports and musical instruments involving the hands. The tests revealed a significant effect of gender and hand dominance on grip strength, but not of hand, while hand shape and age had a greater influence on women's grip strength. Women were significantly weaker with age, but grip strength in women with large hands was less affected than those with long hands. Frequent engagement in hand sports significantly increased grip strength in the non-dominant hand in both sexes, whereas only men showed a significant effect of occupation, indicating different patterns of asymmetries in hand dominance and hand function. The authors believe that the results of the study improve our understanding of the link between form and function for both hands and provide insight into the evolution of laterality and human dexterity.

Sensation seeking denotes the tendency to seek new, varied, complex, and intense sensations and experiences and describes the willingness to take risks for the sake of such experiences. Hand grip strength (as a measure of overall muscle strength) is also known to show associations with measures of circulating testosterone and certain physical and behavioral characteristics, particularly in men. The "Hand-grip strength and sensation seeking" study examines the possible relationship between hand grip strength and sensation seeking, as assessed by the Sensation Seeking Scale Form V (SSS-V) in 117 men aged 18-30. A positive and significant correlation was found between hand grip strength and SSS-V total score and thrill-seeking and adventure-seeking (SAS) after controlling for weight, height, and involvement in sports activities.

Reliable and valid assessment of hand strength is important to determine the effectiveness of various sports activities when the hands produce the appropriate muscle grip force, which is manifested as hand grip strength (HGS). The purpose of the study [19] was to determine maximal isometric handgrip muscle strength

as a function of body height (BH), body weight (BW), and body mass index (BMI). The results confirmed a statistically significant influence of body height on HGS and body weight.

In the "Asymmetry of Musculature and Hand Grip Strength in Bodybuilders and Martial Artists" study, left and right hand grip strength measurements were performed, and body structure assessment was performed by segmental bioelectrical impedance analysis. The authors [20] after analyzing the results, concluded that in judo, the uneven physical effort of the right and left side of the body further increases both directional and absolute asymmetry. Bilateral muscle asymmetry occurs to a lesser extent in jiu-jitsu competitors and bodybuilders. To avoid the risk of injury to athletes, it is important to constantly monitor and correct their body structure, which also includes the symmetrical participation of active muscle mass in certain segments.

The idealization of a "perfect body" has led people to increasingly seek ways to achieve it. Exercising combined with a proper diet is very effective in achieving this goal. In this context, in the study "Nutritional profile of exercise practitioners aiming at hypertrophy and weight loss" the authors [21] set out to evaluate the body composition and food intake of bodybuilders aiming at hypertrophy and weight loss. At the end of the study, the hypertrophy group had an average fat percentage that was classified as excellent, with mostly eutrophic BMI and insufficient energy intake.

Similar to our research, other authors [22] determined anthropometric and body composition changes in female bodybuilders during competition training. The results of the study revealed a loss of 5.80 kg of body mass by the bodybuilders while preparing for competition which was mainly due to a reduction in fat mass (FM; -4.42 kg; 76.2%). unlike fat-free mass (FFM; -1.38kg; 23.8%). Although the bodybuilders presented with low %BF at the start of the experiment, they significantly decreased their body mass during the 12 weeks of competition training, and most of this loss was due to a reduction in FM as opposed to FFM.

Other authors also used a body analyzer that measured body fat percentage (BF) by the electrical bioimpedance method [23] In this sense, they compared the percentage of BF obtained by the bioelectrical impedance method with the percentage of BF obtained by two other methods, {Skin-fold Thickness Measurements (STM) and Body Mass Index (IMC)}, in healthy subjects. According to the study results, the authors concluded that the bioelectrical impedance analyzer underestimated the percentage of BF compared to two other methods (skinfold thickness measurements and BMI), although there was a positive correlation between BF measurements by BIA and two other methods.

To measure body weight and body composition, respectively body and visceral fat, the authors [24] used the Bioelectrical Impedance Analysis (BIA) monitor (OMRON (R) Karada Scan Body Composition Monitor HBF -358-BW), body analyzer also used in our study to determine body fat and BMI. Based on the results, the authors concluded that adults, especially women, need to pay attention to their body fat to reduce the risk of high blood pressure. Bodybuilding is an individual, one-on-one sport, the psyche through autonomy, determination, willpower, motivation, discipline and the physical through changing body composition and lifestyle. Contemporary life has turned the body into an object of increasing interest. The real emphasis of our culture is not on the body as the "material substrate" of the person, but on the body as the ideal appearance and the very repository of social rules and norms.

Pluses

a) The use of machines and devices accessible to athletes in order to monitor some parameters of the effectiveness of bodybuilding and fitness training, in order to obtain the sports form but also the effects of the training on the state of health.

b) Knowing the relevant personality factors of athletes who practice bodybuilding and the relationship with their biomotor data can contribute decisively to the improvement of athletes' performances. The results of the research can be extrapolated and applied for the knowledge and development of the personality of athletes in any sports branch, individual or team sports.

Minuses

Pulse and oxygen saturation should have been measured before performing the dynamometric test, and the pulling force could have been evaluated using other sockets. Participating athletes were at different stages of preparation, which is why those going through the strength period had higher values for BMI and body fat than those in the pre-competition definition period, with weight loss and training adapted to the preparation period.

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