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Review

Different Age Term Women in Sport: Anthropological Differences by Sex

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Abstract: In informal circles there can still be found division of sport according to criterion of sex, therefore we have so called "male" and "female" sports. Reasons for this division can be found in different places but it seems that gender (in) equality, which was particularly pronounced in the past, is the foundation of this understanding of sports. Tradition observes sport as "male" activity in which certain anthropological dimensions, such as body constitution or muscle strength determine success, dominantly, where participation of women in such activities becomes pointless, unnecessary and irrelevant, because they have "weaker body constitution". This approach and understanding of sport lead to the opinion that historically speaking, women in all aspect of social development didn't have equal rights in doing physical activities and sport, in general, although their needs for movement were and still are on the same level as men's. The goal was to use a descriptive method to analyze and define certain gender differences in the area of anthropological dimensions (morphology, cardiovascular system, functional abilities, body composition, somatic changes during life, ...) on the basis of which certain recommendations were given for physical activity and the training process of women. Playing sports and physical exercise are important for women's health, physical fitness and physical appearance and improve their quality of life. It can be concluded that physical activity has an extremely good and positive effect on the psychophysical state of the female organism and numerous health benefits compared to women who lead a sedentary lifestyle

Keywords: anthropological dimensions; women; sport activity; sex differences

1. Introduction

Sport as a human activity can be understood in many different ways but it grew, undoubtedly, from human's need for physical activity, play, competition, socializing and self-actualization, through achievement of results and goals In theory of sport, according to different criteria there are different divisions of sport activities, which are accepted and exist in public. Fortunately, modern time, in culturally developed countries, brings a trend, where women participate in physical exercising and sport almost equally as men. Still that percentage on the highest level (Olympic Games) is not equal, but an increase of a number of female athletes is recorded. Organized participation of women in sport is connected to appearance of modern Olympic Games, where sport is one of the rare human activities, which records participation of women since the beginning [1]. Since most of the sports today are equally available to both sexes, sport results are commonly surprising, in the context of small differences between men and women. Differences in means of world records in male and female disciplines are not that drastic and they are within 15% [2]. Differences in results and participation in sport and body exercising in the past were significantly bigger in favor of men, because it was believed that physical activity is not

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necessary nor recommended for women. However, historical medical document Surgeon General's Report on Physical Activity and Health gave firm scientific proofs that regular physical activity is very important for health, in both men and women, with recommendation of active participation of women in all aspects of physical activity and sport [3] . This document can be considered as a base, in terms of confirmation of hypothesis that women of all age categories should practice all sorts of exercising and sports. However, it is necessary to know that more mature women have certain physiological, anatomic, socio-cultural features of woman's (body) sex, which demand special considerations in all aspects of their sport activities [4].

1.1. Anthropological Differences between Men and Women

Women, in general, have genetic anatomic and physiological differences, which are reflected in body composition, aerobic capacity and muscle strength, due to hormonal differences between men and women. That hormonal difference is most evident in appearance menstruation cycle (period). Menstruation cycle is monthly bleeding, which appears due to the influence of glands with internal secretion. Menstrual bleeding is the last stage of menstrual cycle, which duration lasts 28 days, in average, and the first day of the cycle is counted from the beginning of the bleeding. Since this is perfectly normal physiological process, menstruation cycle is natural process and not ill state (Wikipedia) but it has to be considered, due to changes that come with its appearance.

Looking from morphological aspect, woman's physique is different form man's physique. In relation to dominant morphological measures, it can be said that women are 13 cm shorter and 14-18 kg lighter than men. Also, women have bigger ratio of torso and legs, shoulders are narrower and weaker in terms of musculature, while hips are wider than men's [5]. The most evident anatomic difference between men and women is dimension of pelvis, which is wider in women, due to anatomic predisposition for the pregnancy and birth process. Wider pelvis lowers the angle between neck and body of femur, which changes ratio between lever and transfer of muscles in the pelvis and leg area. Consequently, anatomic position is changed and manner of movement of lower extremities [6]**,** which probably gives predisposition for instability, knee pain and more common injuries of front crossed ligament- ACL [7]. The fact is that non-contact injuries of ACL are 2-10 times more frequent in women than in men [8].

From anatomy-physiological aspect there are some significant differences in the physique and function of female body, especially in the context of high training loading. Women have smaller heart than men, which causes differences in functions of cardiovascular system between men and women, for example: the average means of frequency of heart in women is 77 heartbeats in a minute, while in men is 68 heartbeats in a minute. Women have smaller beating volume and minute volume as well. Smaller volume of blood, hematocrit and hemoglobin contribute smaller aerobic capacity in average 5-15% in relation to men and means of maximal receipt of oxygen are 8-12% less in women. Therefore during physical exercising there is smaller possibility of bringing enough amount of oxygen to tissues i. e. capacity of oxygen in blood is smaller. Due to her morphological-functional features, female athlete spends more energy in performing the physical exercises than male athlete (on the same exercise) [9]. Differences in structure of tissues are reflected in 6-10% bigger relative percentage of body fat, which is dominantly distributed in the chest and gluteus area and smaller relative percentage of muscle tissue (around 28% in women in relation to 40% of men) lead to functional differences, which are expressed in the field of motor skills, especially in absolute production of muscle force. One of the key of motor differences between men and women is the ability to express strength. Women's muscles are less developed than men's, especially in upper part of the body. Aside from these differences, it is shown that women are more flexible than men [10] which is commonly connected to anatomic body build (especially pelvis), structure and elasticity of muscle tissue and hormonal status, as well. It appears that woman's body is more flexible in all stages of life. In that sense (Drinkwater, 2000) suggests that girls after puberty have bigger potential for flexibility, especially in the area of torso, due to lower position of center of gravity of the body and shorter legs in relation to the torso [11]. Studies have shown that even changes that happen during the pregnancy help women maintain or even increase level of flexibility. Due to all changes that happen in the body, during pregnancy, flexibility (Drinkwater, 2000) is increased, but instability of joints, especially ligaments of pelvis, occur [11]. Women who don't have problems with excessive body mass, in average 18% of their body weight is

consisted of fat, and they have bigger relative percentage of body fat (6-10% in relation to men) in overall body mass. This kind of distribution of body fat makes women to have bigger amount of fat between fasciculus. This difference comes due to action of estrogen, in women, which causes increase of mass component of overall body mass. It stimulates disposal of fat in subcutaneous tissue, breast tissue and gluteus and thigh tissue. High activity of lipoprotein lipase during puberty causes depositing of fat in all areas and its difficulty with losing [2]. The amount of body fat in average woman, who doesn't practice sport, is around 27% of overall body mass, while man, who practices sport is around 15%. This, surely, shows the lack of sport discipline, which requires speed and strength or they are based on ratio of muscle mass (strength) and overall body mass [12]. Today, in many sport disciplines, results of male and female athletes is coming closer, especially in disciplines which require skills, that were developed in pre-adolescent and adolescent period and were limited by social and cultural limitations, that affected girls. Sex dimorphism is not evident before puberty for the most of morphological and anthropometrical features, size, build and composition of the body. Along with hormonal changes, which are conditioned by puberty, differences start to develop with all other features and skills, which are defined by text later on.

1.1.1. Sex Dimorphism in the Area of Morphological Features and Body Composition

During the whole process of growth, with the exception of the period of earlier adolescent period of girls between 11 and 13 age of life, when the outgrow boys, girls are shorter than boys, in average. Along with pre-adolescent growth and adolescent growth in boys, the differences in maturing become bigger. Women are 7% (8 to 12cm) shorter and around 18% (10-15kg) lighter than men. Proportions of body in adults are different by sex. Women have longer torso in relation to body height and shorter legs in relation to body height. Biacromial range is absolutely and relatively smaller than in men, while width of pelvis (bycristalline range) and hips width (bitrochanteric range) is relatively bigger in women. Woman's pelvis, with its width and structure is appropriate to reproductive function of women. Also a reduced angle, which includes neck and body of femur, is typical for women. This contributes phenomenon of physiological X-legs (genu valgum), which changes relation between bar and transfer of strength of muscles in the area of pelvis and legs. Center of gravity in women is positioned lower than in men. Woman's spine has more evident lumbar lordosis and thoracic part of the spine in women is shorter. Diameters of chest are smaller in women. Arms are shorter and narrower and supination becomes visible in girls, as they get older, individually more or less, radial open angle-cubitus valgus. Skeleton of a woman is lighter, absolute bone mass is smaller. Transversal dimensions of the skeleton are smaller. In menopause, reduce of bone density begins in women, as oppose to men, who maintain bone density in involution (more details in the chapter about aging). Girls, as they get older, start to differentiate, significantly, from boys in body composition. During the early adolescent period, non-mass body mass is increased faster in boys. Girls deposit more subcutaneous fat than boys, especially in the area of hips and lower part of the body. In the beginning of third decade of life (non-trained) women have 6 to 10% of relative body fat in relation to men. It needs to be pointed out that body fat, in trained women, is evidently reduced (under average means of untrained men), especially in certain sports, such as running or gymnastics. This is discussed in chapter of body composition, in detail. As people get older, the accumulation of body fat gets bigger and its relative participation in overall body mass grows with simultaneous reduction of non-fat body mass. This happens partly due to consequences of reduced physical activity, as person gets older, with maintaining calorie intake.

Skeletal musculature includes 40-45% of body mass in women and 42-54% of overall body mass in men. While maximum of increase of muscle cells is recorded in puberty in girls, boys increase size of their muscle cells till the first half of third decade. Women have smaller surface of cross section of muscle fibers than men. Biopsies of muscles in male and female athletes of the same sports/disciplines showed that ratio of slow and fast muscle fibers do not show gender specific differences. Number of mitochondria in cells of men is bigger than in women. Women, however, have bigger amount of fat in cells, which can be additional source of energy in long-term work.

According to Wilmore and Costill [13], given the smaller overall mass of skeleton of muscles, women have around 40-60% smaller absolute strength of upper part of the body and lower part of the body is 25-30%, in

average, weaker than in men. Most part of the overall skeleton musculature women have in their lower part of the body. However, in relative display- on the same amount of muscle mass, differences in strength by genders are disappearing. Gender specific differences reflect in everything mentioned and in body constitution. Girls and women have, in somatotype, more pronounced endorphin component and less pronounced mesomorph component than men of the same age. The same direction of gender differences is notices in male and female athletes of the same sports/disciplines. Female athletes are more endomorphic and less mesomorphic in relation to the male athletes of the same sports/disciplines.

1.1.2. Sex Dimorphism in the Area of Cardio-respiratory Abilities

Sex dimorphism in functional-physical abilities becomes evident with maturation process, when under the hormone influence, significant differences in size and composition of the body appear – with bigger proportion of fat in girls, stronger development of musculature in boys- and in particular links of transport system of oxygen, as well. Also some biological differences in average population "enhanced" by social and cultural influences, which, through history, required lower level of activity and sport activities of girls, especially in maturation period. Comparisons of top-trained male and female athletes reduce sex specific differences obtained by comparisons of average, non-trained population of different sexes of the same age.

Size of the heart in women is smaller than in men partly as a consequence of smaller size of women's body. Women have smaller dimensions of left ventricle of heart in relation to men.

Volume of heart of average non-trained young adult woman is 578 mL and in average man 769 mL [14]. The average heart mass of a woman is around 25% smaller than men's. Relative volume of heart (kilogram of body mass is displayed) is not different in men and women.

Sports of endurance influence on increase of the size and volume of the heart, respectively, in both men and women, although results of different authors do not match in size of possible adaptation of volume of heart on training of endurance in different sports. In our region the biggest heart, in relative voluminous female athletes; top-level swimmers, was described by Medved, Mišigoj-Duraković (1993) volume of heart was 1150 cm^3 [15]. Accordingly to differences in the size of the body, women have smaller amount of blood: overall amount of blood in women is around 1/15 and in men it is 1/3 of overall body mass. As a result of smaller dimension of left ventricles of the heart and smaller volume of blood, beating volume of heart in women is smaller. Means of frequency of the heart, during growth, is similar in girls and boys till the age of 13 after that boys have lower heart frequency. During each submaximal task frequency of heart (HF) is bigger in women than in men. Bigger frequency of the heart compensates smaller beat volume in women. This reduces sex specific differences in minute volume of the heart. A faster recovery (according to heart frequency) after loading is noticed in boys. Sex dimorphism of respiratory indicators is a reflection of differences in size of the body, as well. Vital capacity is bigger in men. Frequency of breathing in stillness and during the action of the same relative strength doesn't usually show bigger differences by sex. However, for the same absolute loading, women show bigger frequency of breathing. Respiratory volume and minute volume of breathing is smaller in women, with the same loading and the same direction of differences exist with maximal loading. Ventilation equivalent, ventilation in ratio to 1 liter of consumed oxygen, indicator of economic breathing- has bigger means in girls. In resting and during submaximal action, there is no indication of sex dimorphism. But during the maximal loading its means show less economic breathing of women in relation to men.

1.1.3. Somatic and Functional Changes during Lifetime

Women show less increase of arterial-vein differences of oxygen, during work, which are probably a result of smaller amount of hemoglobin, responsible for oxygen delivery to active musculature and less oxidative abilities of muscles. This will reflect on aerobic abilities, which are almost commonly evaluated by determining maximal oxygen delivery (VO_2max). The biggest means of maximal oxygen intake of average, non-trained girl are achieved at the age between 12 and 15. Boys, however, continue with increase of aerobic abilities until the end of growth (image 106). After puberty aerobic abilities in girls is around 70-75% of abilities of boys of the same age. Those gender conditioned specific differences of aerobic abilities, which occur during maturing process of the average population, are attributed to different influences of male and female hormones on

development of muscle tissue and significantly bigger level of activity in boys. Body activity of utilization of muscles causes increase of mitochondria enzymes. Both mechanisms require greater amount of muscle mass in boys. Comparison of aerobic abilities in well trained top-level male and female athletes of the same sport disciplines showed that those differences in VO_2max are reduced in 8-12%, in favor of men. The largest described means of relative maximal oxygen uptake (O_2max), in sport-medicine literature, are the ones of the Russian female ski runner- 77 mL/kg min, while the largest maximal relative oxygen uptake described is in Norwegian male ski runner – 94 mL/kg in a minute [16-17]. Following means of relative maximal oxygen delivery during growth gives better insight to what extant is aerobic capacity sex differentiated. Since body mass, up until puberty (which divides absolute means of maximal oxygen uptake, in this derived variable), does not differ significantly, the difference in children of younger age, in this derived variable is identical to the one with oxygen intake. During and especially at the end of maturing process, mass of the boys is increasing, significantly, in relation to girls. But from 14 years of age, some statistically significant differences in means of relative maximal oxygen intake, start to appear in favor of boys.

Aerobic-anaerobic threshold does not point to most of the differences if it's expressed relatively and as % Vo_2max, respectively- under the influence of specific training processes, adaptation changes, that require improvement of functional-physiological and motor skills, occur. Size of changes of aerobic abilities under the influence of trainings of endurance does not record greater differences by sex. Also, under the influence of training of strength, a similar increase of strength by sex, with different final status of monitored indicator considering differences in initial state with expected diversities of individual reactions to the training (see the latter in the following), will be recorded. Increase of strength, in women, does not follow the increase of muscles so much as it is the case with men. Changes in strength are attributed to neuro factors [18].

Table 1. Display of some morphological and functional abilities of women in relation to men

Physiological metabolic features	Impact on Work Capacity or Training
Lower maximal beating volume	Smaller capacity of blood flow, less work capacity
Smaller capacity of increase of arterio-vain differences of oxygen	Smaller VO_2max
Smaller blood volume	Smaller transport capacity O_2
Lower concentration of hemoglobin	Smaller transport capacity of blood for oxygen
Lower VO_2 max	Less work capacity
Smaller non-fat body mass	40-60% smaller force of upper part of the body 25% smaller force of lower part of the body
Greater percentage of body fat	More ballast mass

1.1.4. Changes in body Composition during Growth and Development

Body composition changes significantly, during growth and development. Relative proportion of water in overall body mass during growth is reduced and proportion of proteins, minerals and fat is increased. Relative contribution of proteins and minerals in non-fat body mass is increased and relative contribution of water is reduced (Table 2).

Sex differences in relative composition of non-fat body mass are negligible up to third year of life. Afterwards, in boys, non-fat body mass contains smaller proportion of water and bigger proportion of proteins than in girls. Non-fat mass, in boys, includes more potassium and greater density than in girls. This is a reflection of sex diversity in muscle and bone mass. Overall amount of body water during growth follows general curve of growth, with relatively fast growth during the first years, more slowly until puberty, when intense increase occurs. Sex differences are minimal in childhood, with slightly bigger amount of body water in boys. In girls, overall body water reaches plateau at 15 years of age. In growth momentum boys exceed girls in overall amount of body water, which is increased up to first years of the third decade.

Density of the body is reduced at the age 8 -10, in boys, and 11 in girls. It increases gradually, later on. Girls reach plateau at 14 years of age and it increases linearly up to 17 years of age, in boys. Density of the body reduces a bit in late adolescent period. Sex differences in density of the body exist during growth and mature

process, with higher means in men. Non-fat mass during the growth follows the general curve of growth. Girls reach plateau means at 15 and 16, respectively, while non-fat mass of boys is increased at 20. Sex differences are identified during maturation process with greater amount of non-fat mass in boys. In young adults non-fat mass in women is around 70% of non-fat mass than in men. The difference is the result of gender differences in size and mass of skeleton and increase of muscle mass during maturation process.

Table 2. Mass and density of body, relative composition of body of male newborn baby and young male adult [19]

	Newborn	**Young adult**
Body mass (kg)	3.5	65.3
Density of body (g/cm^3)	1.024	1.064
Components of body composition in %		
Body mass:		
Water	75.1	62.4
Proteins	11.4	16.4
Fat	11.0	15.3
Minerals	2.5	5.9
Non-fat mass	89.0	84.7
Components in % of non-fat mass		
Water	84.4	73.8
Protein	12.8	19.4
Minerals	2.8	6.8

Overall amount of body fat is increased during first years of life. The next following years, those changes are minimal. Afterwards it is increased more in girls than in boys. The amount of body fat is increased in girls, during the adolescence period. Boys reach plateau, during puberty growth momentum. The percentage of body fat increases intensely, during the first years of life. Afterwards, during the childhood, it decreases gradually. Sex differences in percentage of body mass are spotted in early years of age. Girls have permanently bigger percentage proportion of fat in overall body mass, and the percentage of fat is increased during the adolescent period. Proportion of fat in boys increases until 12 years of age and afterwards (as oppose to overall amount of fat) it is decreased until the age of 17, when it increases again. Results of the analysis of body composition of girls aged between 8 and 18 are conducted on sample of longitudinal study [20]. They showed that there is a significant reduction of the percentage of fat in girls at the age 12 and 13 [21] This can be contributed to mobilization of energy supplies necessary for covering energy needs in puberty growth momentum [22, 23]. During the adolescent period, girls exceed boys twice in increase of fat mass. Boys, however, exceed girls twice in increase of non-fat mass [24, 25].

Table 3. Average means of percentage of body fat at the age 6-22 [26]

Age	**Male**	**Female**
6-8	13-15%	16-18%
14-16	10-12%	21 - 23%
18-22	15-18%	22 - 26%

1.1.5. Changes in Body Composition during the Adult Period

The biggest ratio of non-fat part to fat part of body composition is reached at the age of 20 and the ratio get smaller in physically inactive individuals.

After 20 years of age normal increase of body fat is usually 1% per decade up to 60 years of life, which makes overall increase of 4%, while after the age of 60 the amount of subcutaneous fat is usually reduced. Normal means at the adult age are considered means of body fat to 25% in men and to 30% in women. More means indicate that it is the case of obese individuals. As it is important to mark top limits of percentage of body

fat, it is also important to define a minimal percentage of body fat, compatible with the term of health. That percentage is between 5 and 10%, for men and 15 and 18%, for women (Table 5) [27]. Excessive shortage of fat tissue in women causes a lot of unwanted health consequences. That is noticed in training volumes and competitions of burdened female athletes with highly reduced percentage of fat in sports such as gymnastics or athletics disciplines of running of mid or long distances. Unwanted consequences include primary amenorrhea (postponed appearance of menarche after 15 years of life) or secondary amenorrhea (absence of menstrual cycle for two or three months) loss of bone tissue, stress-fractures of bones of lower extremities. Composition of the body and part of fat and non-fat components can be influenced by modification of diet habits and exercising and sport activity, respectively, in order to maintain the ratio of components within limits optimal for health and physical fitness.

Table 4 Average means of proportion of fat in body composition [19]

	Men (TM = 70 kg)		**Women (TM = 58 kg)**	
	amount kg	**%**	**amount kg**	**%**
Non-essential fat	12.0	17	15	25.9
Essential fat	1.5	2	1	1.7
Total amount	13.5	19	16	27.6

Table 5. Standard means of percentage of body fat in men and women [27]

	Men	**Women**
Essential fat	0-5	0-8
Minimal	5	15
Most athletes	5-13	12-22
Optimal health	10-25	18 – 30
Optimal physical fitness	12-18	16-25
Adiposity	> 25	>30

1.2. Body Composition and Sports

Improvement of functional abilities in athlete's body is a result of application of knowledge of scientific disciplines. Matching amount of muscle mass is necessary for optimal ability of physical activity. Fat supplies excite special interest in sport. Since the excessive amount of fat tissue, as ballast mass, affects body ability, negatively (decreases speed of running, efficiency of jump, endurance and agility in athletes), determination of body composition an important method for formulation of suitable, optimal body mass in adults and athletes, especially ratio of fat and non-fat components in overall body mass. Table 6 shows range of optimal means of percentage of body mass in athletes of certain sports obtained in one of the many study analysis of body composition in athletes [28].

It is evident that athletes, regardless of discipline, have less body fat than non-active population, with differences in sex. Many studies of body composition of top-level athletes show that obtained percentages of body mass are indicators to professor physical education and sports, for modification of training program and nutrition, in order to bring body composition of an athlete to optimal, referred to certain sport and discipline, respectively. Subtraction of means of body mass out of overall body mass we get means of non-fat body mass, which is skeleton musculature, mostly and mass of other tissues and organs. Muscle mass is around 40-50% of non-fat body mass. In average young male population of student age non-fat body mass, including is around 85% of overall body mass, while in female population non-fat mass is around 75% of overall body mass. Study of build and composition of the body of University of Zagreb (Faculty of Kinesiology, today) is significantly different than other studies of the University. Future professor physical education and sport are selected population group, with significantly smaller amount of fat in body composition in relation to students of other faculties, which have similar mass. Non-fat body mass is usually connected, positively, to sport abilities, since

non-fat mass means bigger muscle mass and therefore bigger strength potential. Bigger muscle mass is important in athletics disciplines of throwing, for example.

Table 6 Range of optimal percentage of body mass in athletes of certain sports [28]

SPORT	% Body Fat	
	Men	Women
Alpine skiing	7-15	10-18
Athletics running disciplines	5-12	8-15
Athletics throwing disciplines	8-18	12-20
Cycling	5-11	8-15
Gymnastics	5-12	8-16
Ice hockey	8-16	12-18
Wrestling	5-16	-
Ice skating	5-12	8-16
Basketball	6-12	10-16
Football	6-14	10-18
Volleyball	7-15	10-18
Swimming	6-12	10-18
Tennis	6-14	10-20
Bodybuilding	5-8	6-12
Triathlon	5-12	8-15
Canoe/Kayak	6-12	10-16
Rowing	6-14	8-16
Fencing	8-12	10-16
Golf	10-16	12-20
Horse-riding	6-12	10-16
Badminton	6-14	10-18
Rugby	6-16	-
Ski jumps	7-15	10-18
Synchronized swimming	-	10-18
Weightlifting	5-12	10-18

In certain sport activities, great non-fat mass can have negative effect on skills. For example, running on long distance (during which great absolute mass and mass component contribute to bigger body weight), wrestling and gymnastics, in which athletes have slightly smaller absolute component of non-fat body mass. However, those athletes have bigger relative non-fat mass, which means that they have very small amount of body fat. Female athletes have much less non-fat mass in relation to male athletes of the same discipline. For example female gymnasts have an average 44 kg of non-fat mass, while male gymnasts have around 63kg. It needs to be noted that body composition in male athletes can be significantly changed during competing season.

Vercruyssen and Shelton (1988) describe significant reduce of percentage of fat tissue in female gymnasts of USA with 21%, in pre-season, to only 13% at the end of competing season, while non-fat body mass was increased for only 0.2 kg for the same time period [29]. Very illustrative example of change of body composition was in composition of female students of Faculty of Physical Culture (Faculty of Kinesiology today), who produced significant changes in body composition with evident reduction of mass component: from initial 22.64% of body mass to final 11.22%, by three-month intense and extensive training and body aerobics [30].

2. Recommendations for Activity and Training of Women

In previous part of this chapter it is stated that practicing sports and physical exercising, in general are important for health, physical fitness and physical appearance in women and other positive qualities of life. However, the general opinion on training of women has many misapprehensions prejudices, which are present

even in training practice. For that reason it is necessary to note and clear out that the most common uncertainties occur in training of female athletes and women population, in general. According to Zaciorski (2009) [31] and taken to Ebben and Jensen (1998) [32] it is considered that men and women do not need to use the same training principles in training of strength, because women mustn't apply "great" loadings, that women have different mechanisms of adaptations and that trainings of strength will improve increase of muscle mass and overall body weight, finally, which women, in most cases, want to avoid. However scientific studies state that men and women have similar effects on applying the same training means and methods, therefore men and women don't have significant differences in training adaptation. As mentioned before, the biggest discussions are led about trainings of strength and most of the researchers of this field state significantly positive effects of training of strength on woman's body in relation to possible risks [33]. state that training of strength in women: strengthens the bone and reduces the risk of osteoporosis, strengthens connective tissues and increases stability of joints and improves movement in everyday activities, increases non-fat body mass and reduces non-functional fat deposits, which accelerates metabolism, because it increases muscle and reduces fat mass of the body and affects self-confidence. It can be concluded that physical activity has extremely good and positive effect on psycho-physical state of woman's body. Šebić, Podrug-Arapović (2012) [34, 35] state that review study documented women, who are moderately physically active have numerous of health benefits than the women who are sitting all the time and those are:

Table 7. Classification of body mass based on thickness of skin folds in male and female athletes [19]

Male Athletes					
	Thickness of Skin Folder (mm)				
Classification	Upper arm	back	stomach	sum	Body fat (%)
Thin	< 7	< 8	< 10	<25	< 7
Acceptable	7-13	8-15	10-20	25-48	7-15
Excessive body fat	> 13	> 15	> 20	>48	> 15
FEMALE ATHLETES					
Thickness of Skin Folder (mm)					
Classification	Upper arm	back	stomach	sum	Body fat (%)
Thin	< 9	< 7	< 7	<23	< 12
Acceptable	9-17	7- 14	7-15	23-46	12 – 15
Excessive body fat	> 17	> 14	> 15	>46	> 15

· Lower percentage of cancer and better immune system (more leucocytes and increased concentration of immunoglobulin)

· Lower risk of breast cancer (women who practice at least 4 times a week have significantly lower risk of breast cancer)

· Life expectancy is 7 years longer [36]

· Less depression and anxiety and better mental skills and speed some studies show higher coefficient of intelligence in women who exercise [37]

· More relaxation, more confidence, more spontaneous and enthusiasm, better relation with oneself and better acceptance of oneself [38]

· Stronger bones, increased bone density, increased bone mass and increased ability of bones to endure mechanic stresses and breaks [39]

· More rest sleep [40]

· Bigger self-respect [41]

· Exercising decreases symptoms of PMS [42]

· Pregnant women who exercise regularly suffer less from constipation, hemorrhoids, varicose veins and morning sickness [43]

Apart from positive effects of physical exercising to women's health, Ostojić (2007) states that there is a certain "health phenomenon" that is typical for female population, who practices physical activities [8]. This

applies especially to so called women's sport triad (eating disorder, amenorrhea and osteoporosis). This phenomenon is mentioned for the first time in 1990s when connection between eating disorder, disruption of menstrual cycle and disturbance of metabolism (mineralization) of bones, started to be evident. Yeager et al (1993) integrated them into syndrome known as Female Athlete Triad. Although appearance of triad is relatively high, in certain sports, health benefits of physical exercising and practicing sports overcome health risks to the great amount [44]. The most important thing is that physically active women need to be educated in the field of proper nutrition, optimal training methods and factor risks and prevention of health complications, which can be linked to increased physical activity.

Measures conducted on women show that same physiological principles apply to them as on men with differences in quantity means, which are the consequence of differences in size and body composition and presence or absence of male hormone- testosterone. Most of the quantity means in women, such as muscle strength, lung ventilation and minute heart volume are variables, which are connected to muscle mass and they are 2/3 and 3/4 of means measured in men. On the other hand when it comes to measurement of force of loading by cm2 of surface of cross section, woman's muscle can achieve almost the same maximal strength of contraction as man i.e. between 3 and 4 kg/cm^2. The biggest difference in overall muscle features is shown in additional, extra-percentages of muscles of male body caused by endocrine differences. A good sign of relative functional abilities of women in relation to men is the time necessary for running marathon. Time of top-level male runner is around 11% better time than the time of top-level female runner. On the other hand some cases of endurance (competitions of duration) show women are better than men. Testosterone has strong anabolic effect, which means that it causes depositing proteins all over the body, especially muscles. Even in men, who don't practice sports and who have normal level of testosterone, muscles have around 40% of bigger muscle mass than comparable women without testosterones. Women's sex hormones, estrogens contribute to differences between men and women in sport abilities but not as much as the testosterone does. It is known that estrogens increase depositing of fat in women, especially in certain tissues (breasts, thighs and subconscious fat tissue). Partially because the amount of fat tissue in average woman, who practices sport is around 27% of overall body mass, while in man, who doesn't practice sport that percentage is around 15%. This shows lack of sport discipline for which strength and speed are necessary or are based on ratio of muscle mass (strength) to overall body mass [12].

3. Conclusion

Gender and age differences are evident between men and women, from an older age. However, with an adequate training process, adapted to age, needs and activities (sport), these differences can be reduced to significantly smaller differences. Today, more than before, women in top sports have all the prerequisites to be approximately at the same level as men, especially in sports where results are not evaluated by time units, but are evaluated descriptively through scoring. Also, the respiratory and cardiovascular system as well as the musculature of women recorded significant progress in aerobic and anaerobic activities, strength, speed, endurance, coordination, flexibility, balance, precision. Playing sports and physical exercise are important for women's health, physical fitness and physical appearance and improve their quality of life. The general opinion about women's training has many wrong prejudices, which are present even in training practice. Men and women should not use the same training principles in strength training, because women should not apply "heavy" loads. Men and women have similar effects using the same tools and training methods, therefore men and women do not have significant differences in training adaptation. It can be concluded that physical activity has an extremely good and positive effect on the psychophysical state of the female organism and numerous health benefits compared to women who lead a sedentary lifestyle.

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