Sports-Medical Problems of Wrestling

P. Slanchev, I. Iliev, R. Kossev*)

SUMMARY

A physiological characteristics of wrestling is presented. The physical qualities required of the modern wrestler are estimated according to the new regulations of FILA.

The morphologic characteristics of the wrestler is described on the basis of data from anthropometric studies on 591 competitors in three World and one European championships (1963, 1971, 1975, 1978). This morphologic characteristics and the investigations carried out on children and adolescents from Bulgarian sports schools, training wrestling (2130 persons aged 9 - 19 years), allow some recommendations concerning the selection of young sportsmen and the forming of the wrestlers' team to be given. The results from the complex functional investigation and the longitudinal functional control over the best Bulgarian wrestlers (about 2000 examinations on 250 wrestlers from both styles) in the period between four Olympic games (1964-1980) permit not only the formulation of a functional characteristics of modern wrestler, but also of a rational model for complex functional investigation which can be used for guidance of the training process.

The longterm medical observations on Bulgarian wrestlers and the discussion of data published in the literature allow injuries and morbidity in top class wrestlers to be characterized. Some prophylactic and therapeutic measures are considered too.

The specific nutrional regimen of wrestlers, the methods for weight regulation and some hygienic and health problems are also discussed.

In conclusion the authors are proposing a model for complex sports - medical control in wrestling.

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The new competitive rules of the FILA imposing a time shortening of competitive engagement and encouraging intensive fight, exerted a considerable influence on the technical and tactical methods of preparation, on the physiological characteristics and the requirements for the morphologic constitution of wrestlers. In present-day competitions the match between equal adversaries run on submaximal or maximal capacity level. A common occurence is a heart rate of 170-190 b/min and a lactate concentration at the end of the match of 16-18 mM/l, rsp. a BE lower than -25 mEq/l. Intensive fight has become common also for wrestlers of the heavyweights even for the weight-class "over 100 kg".

*) Higher Institute of Physical Culture, Sofia

There is a general tendency of emphasizing the importance of functional qualities and of athletic type constitution for the practice of wrestling and the achievement of high performances in competions. The global functional capacity of elite Bulgarian wrestlers, European, World and Olympic champions, in the period between 1964-1968, is significantly lower than the capacity of present - day elite Bulgarian wrestlers.

Modern wrestlers possess a high anaerobic capacity, good aerobic possibilities and an effective adaptation capacity of hemodynamics. The aerobic capacity of Bulgarian wrestlers, compared to other sportsmen, takes the third place, immediately after competitors in the specifically aerobic kinds of sport like rowing, cycling, cross-country skiing, middle and long distance running. Their anaerobic capacity is near to the capacity of competitors in 400 m 800 m running. An equalization of the functional capacity of wrestlers is found in both styles.

The international competitive programme has become more strenuous. Elite wrestlers take part yearly in numerous national and international competitions, in regional, continental and world championships, and every four years in Olympic games. A complicated cyclic rhythm of their training has been created in order to achive several 'functional pics' in one year and a 'absolute pic' during the Olympic games. It was necessary to find out and to apply effective methods for building up good functional qualities, for keeping the attained high level of functional capacity and for its adaptation synchronously to the cyclic rhythm of preparation.

In the preparatory cycles wrestlers have a lower general and special working capacity, limited possibilities for aerobic supply and an uneconomical adaptation of hemodynamics to loads of submaximal and maximal watt-power. In the basic cycles wrestlers attain an increased working capacity, greater oxygen consumption economy, stabilization of hemodynamic adaptation to loading, but a tendency for delayed recovery is often found. In the precompetitive cycles wrestlers reach a "pic level" of working capacity, high oxygen consumption economy, abruptly raised anaerobic production, stabilized hemodynamics during efforts and recovery. This characteristics has been confirmed by numerous mathematical studies, inclusively factor analysis of the internal structure of functional capacity in different cycles of the preparation.

The official admittance of competitions for adolescents (national and international championships for juniors) posed special requirements to the morphologic characteristics and the somatotype of the adolescent wrestlers at the stage of selection, and led to an intensifying of preparation of young wrestlers as well. The functional capacity of wrestlers from rather different age groups became nearly equal. Now it is generally usual to find in 15 - 18 years-aged competitors functional parameters not lower than the standard values for elite wrestlers over 22 years. Elevated functional parameters are recorded also in wrestlers under 15 years. Typical for them is however an uneconomic aerobic metabolism and a hyperreactivity of hemodynamics.

The functional preparation of wrestlers deserves a special attention, and therefore it is necessary to create a system for functional diagnostics. Such a system exists in our country since 1964 for elite wrestlers-

juniors and men. We apply a complex diagnostic programme comprising: a spiroergometric study with gradually increasing loading untill exaustion and continuous recording of lung ventilation, oxygen consumption and carbon dioxide production, ECG recording, recording of hemodynamic indices at rest, during effort and in the recovery period, determination of lactate concentration or acid-base status of blood prior to and after loading, stimulation EMG recording before and after effort, establishing of the hypoxic resistance.

This programme provides information about; ergometric working capacity, maximal aerobic power, anaerobic capacity, anaerobic threshold, zones of metabolic adaptation, activation readiness of the different types of muscle fibres, adaptive capacity of the myocard and the hemodynamics, resistance conditions and to products of the anaerobic metabolism.

The applied method of direct measuring of the ergometric working capacity and the acrobic power allows following up not only the global physiologic indices (W max and VO_2 max), but also the behaviour of the organism at different grades of loading which is very important for better understanding of the internal structure of functional capacity. The fluctuations in functional capacity of wrestlers having attained a high degree of functional preparation affects mainly the behaviour of the functions at the different stages of loading-economy of oxygen consumption, range of metabolite zones, anaerobic threshold, the energy cost of respiration and oxygen transport, heart rate corresponding to the different metabolite zones etc., and to a smaller degree the values of W max and VO_2 max. This information is of practical interest for regulation of the training process. It offers basic data for programing and controlling of training loads.

We dispose actually of data from more than 3000 investigations according to this programme. Our experience proved that complex functional investigations should be planned 3-4 times yearly, according to the cyclic character of the preparation.

The integration of the results obtained from the complex studies as a global estimation of the functional capacity would be of great interest. It is a still unsolved problem of functional diagnostics in sport. A mathematical model for integral estimation of the functional capacity of wrestlers was developed on the basis of the multiple correlation and regression. In the regression equation each parameter is represented by a coefficient corresponding to the partial importance of the parameter for W max. For more than 10 years we use this valuation and our experience has proved that it offered good possibilities for quantifying the functional capacity of wrestlers. There is a close relation between the functional capacity of wrestlers and their specific working capacity. This correlation becomes quite evident if the specific working capacity is presented in terms of its energetic equivalent and it was verified by means of a mathematical analysis of the performances in the basic motor tests used for evaluation of the specific working capacity of wrestlers.

A special problem arises when the information from functional investigations is ploted against the body weight. It is well known that maximal strenght, maximal ergometric capacity, maximal aerobic and anaerobic power and performances in some specific motor tests depend on body weight and are not linear. They can be

very good approximated with exponential or parabolic curves. Difficulties arise however when functional and motor performances of subjects with a different body weight have to be coumpared and in wrestling weights range from 48 kg to 130 kg and over. These difficulties are present as well when we interpret other indices depending indirectly on body weight, for example oxygen pulse. The use of relative values - performance per kg body weight - does not eliminate the inconvenience. The dependences: body weight _ relative values are also unlinear and represent practically a mirror-image of the dependences: body weight - absolute values.

We tried different ways to eliminate the limitations which these dependences impose on the interpretation of data. The most convenient method proven was to find the arithmetical means from the special estimates of absolute and relative performances.

A special attention in functional diagnostic is payed to the deviations from the normal ECG - such as troubles in automatism, excitability, conductance, repolarization or combined disturbances.

Data from the electrocardiographic studies (Georgiev) on 330 elite Bulgarian wrestlers, carried out in the course of 17 years, indicate that in 17.3 % of the subjects there exist different deviations from normal ECG. The most common deviations are related to disturbed repolarization - 42.1 % (mainly changes in the "T" wave). The disturbances in excitability take the second place - 26.3 % (atrionodal and ventricular extrasystoles). On the third place come the troubles in the automatism - 19.3 % (sinus bradycardia and migrative rhythm), followed by troubles in the conduction - 8.8 % (atrioventricular block) and the combined ECG deviations - 3.5 % (low-voltage ECG records).

ECG deviations are most frequently met in the basic cycles of the preparation. They are rarely accompanied by other signs of functional insufficiency. Generally they disappear after a reduction of the training programme.

A number of these deviations can be interpreted also as a manifestation of the myocard adaptation to high training loadings. We still have not enough evidence for their harmless character. Therefore, independently of the discrepancy between electrocardiographic diagnosis and status of the basic functions, we approach these cases with the necessary attention. Two illustrations of these eventualities:

Two wrestlers, European and World medalists, demonstrated in the course of several years electrocardiographic deviations at the end of the basic annual cycle of preparation, without these deviations being supported by data for lower functional capacity and disturbancies in hemodynamics. Clinical cardiological examinations did not establish structural changes of the myocardium. One of the persons presented clinical data for a light inborn shunt.

Serious troubles of the rhythm were found in an other competitor at current medical examinations, accompanied by indications for a lowered functional capacity and unefficiency of the hemodynamics. After an interruption of training for a certain period these troubles disappeared. The competitor attained again a good functional capacity and a year later became olympic champion.

In our sports-medical practice only one case of acute cardiac incident during

wrestling training is noted. It had a lethal issue, and the pathologic-anatomical findings pointed to an acute toxical myocarditis. A fortnight before the incident, the competitor was in good functional state and had a completely normal ECG. The incident coincided with a grippe epidemic.

For characterization of traumatism in wrestling we used the data (Dagorov) about the registered injuries of a specialized sports-medical service in Sofia, collected in the course of one year, in total 341 injuries. Mild injuries (lost of working capacity up to 5 days) and the very grave ones (lost of training ability for more than one year) are not included.

Traumatism in wrestling is on the third place in the structure of sports traumatism in Bulgaria, after football and track and field injuries - 11.5 %. As to chronic microtraumatism wrestling takes the same position (9.7 %). The frequency of injuries (coefficient of traumatism) in wrestling is high - 1.48, followed by weight lifting track and field and judo.

In the general characteristics of traumatism acute macrotraumas prevail over chronic micro injuries (80.6 % versus 19.4 %). The increase in volume and intensity of training and competition loadings leads also to a raise of the relative rate of the chronic microinjuries. In the contingent of club wrestlers chronic microinjuries represent only 14.5 % of the total traumatism while in national competitors they grow up to 35.5 %.

The kinds of injuries in wrestling are as follow: contusions - 25.5 % (31.6 % from the acute traumatism), followed by distorsions - 24.3 % (30.2 % from the acute traumatism), and injuries of the meniscus - 11.1 % (13.8 % of the acute traumatism). Arthroses can be ranged on the fourth place in the structure of traumatism - 9.4 %, but they are on the first place in the ranking of the chronic traumatism.

The most common localization of injuries in wrestling is the knee joint (34.6 %), followed by injuries of the trunk - 20.8 %, injuries of the trunk muscles - 13.2 %, injuries of the spinal column - 7.6 %, of the elbow - 7.9 and shoulder joints - 6.2 %.

Contusions are very common in the region of the trunk muscles and the knee joint. Distorsions occur most often to the knee joints. Arthrosis affects mainly the knee and the elbow joints. Chondrosis (of the disks) is located in the cervical and the lumbo-sacral regions of the column.

In the latter years as a result of the intensification of fight cases of commotio cerebri became more common.

The mean yearly lost of training days after an injury in wrestling is 23.4, after acute injuries being 24, and after chronic ones - 20.7 days. For national competitors it is lesser - 21.4 days as a result of the effective medical cares, versus 23.7 days for club wrestlers.

A differentiation in severity of injuries can be made too. Club wrestlers get a greater percentage of middle severe injuries (15-45 training days lost) and severe injuries (more than 45 training days lost), rsp. 45.4 % and 9.5 %. In national competitors more common are mild injuries (5-15 training days lost) - 54.4 %, compared to 45 % in club wrestlers.

Traumatism in wrestling, considered in age aspect, displays data for a little number of injuries in the earlier (11-16 years) and in the later age periods (after 27 years), the maximum being attained

in the most active training and competitive age (17-27 years).

The analysis of the most common causes for sports injuries in wrestling points to errors in the methods of training as the main reason (26.7 %), application of illicid locks by the competitors - 18.3 %, not enough mastered techniques - 10.6 %, poor ground conditions - 6.7 % etc.. Injuries of unknown origine or those preceded by micro-injuries attain the greatest percentage (30 %).

The investigations on physical development of the participants in three World and one European championships (1963, 1971, 1975 and 1978), and of 2130 Bulgarian wrestlers (over 9 years) permit some conclusions and recommendations for the use of the morphological characteristics for orientation and selection to be made.

In the Bulgarian population the main features of the specific constitution of wrestlers are formed in the age period of 14-15 years, and in the age of 16-17 years this specific constitution is definitively built up. This fact allows to consider the age period of 14-15 years as the most favorable for the definitive selection and the prognosis of the physical development of the young talents in wrestling.

There is a tendency in wrestling to select for all weight classes competitors with a greater height, longer upper extremities, a more athletic constitution and a mesomorph characteristics of the somatotype. As basic somatometric parameters for selection and prognosis in wrestling it is advisable to use first of all the height, the absolute and relative dimensions of the upper extremities.The analysis of the physical development of the "perfect wrestler" let us to conclude that wrestlers have a specific constitution described by an emphasized development of neck muscles, chest, shoulder girthe and upper extremities. The thunk is comparativly longer and the lower extremities are shorter. The upper extremities are relatively longer. fat tissue content is not high. In the different weight classes wrestlers possess a specific physical development, and the differences in the most anthropometric parameters between wrestlers from different weight classes are significant. More stable are the differences between the weight classes in respect to the parameters characterizing height, length of the upper extremities, span, chest circumference and pelvic diameters.

A very important sports-medical problem is the nutrition of wrestlers. On our opinion rational nutrition has to combine a balanced ration with a so called "relative physiologic energetic deficit" (Slanchev, Afar), i.e. a 5-10 % lower caloric supply than the actually expended calories. In our view such a nutritional ration stimulates biologically the metabolic processes and increases the efficiency of the consumed food. On the other hand it helps to the more effective and physiologically purposfull regulation of the body weight.

Energy balance in the nutrition of wrestlers can be most effectively secured by 50-80 calories/kg body weight daily, 2.5-2.8 g/kg b.w. proteins, 1.5-1.6 g/kg fats and 8-10 g/kg b.w. carbohydrates.

Of course there are a number of other important sports - medical problems of wrestling which we omited to consider, for example the use of sauna and other thermal procedures, water - salt and vitamin regimen, personal hygiene, doping and anabolic control etc. The limited time we dispose does not permit to exhaust them.

EKG Findings in Long Distance Runners

Prof. Dr. Fikret DURUSOY*

SUMMARY

Long distance runners have increased physical working capacities by stenuous and long lasting training of several years influencing their heart. The Ecg findings of this group athletes show some special features and in order to evaluate these, not only static but also dynamic ECG investigations must be performed. In a group of 20 long distance, Marathon runners the following findings are discussed. The heart beats in an extreme bradycardia at rest, heart rate increases normally with effort and after effort in returns to normal very rapidly. PR prolongation and atrio-ventricular block of II. degree and Wenckebach periods observed in 2 cases and further conduction abnormalities caused by bradycardia may be seen not rarely; but these findings return to normal with effort or running. Incomplete right bundle branch block observed in two runners was not considered pathological and may be explained as an adaptation to high intensity, long lasting physical activities. The increased QRS amplitudes are in favour of left ventricular hypertrophy which may be accepted as physiological. ST-T disturbances of repolarisation are not seen in general. Unimportant minimal elevations and depressions in rest due to vagal tonus are normalized with effort or running and no findings were seen after effort. Only one antero-septal ischemic finding was recorded in a good Marathon runner, which disappeared completely with running and it was evident, it did not mean a coronary circulatory disturbance. The similar findings in literature are discussed.

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In sports cardiology EKG investigations are followed not only for diagnostic purposes, but also to document the integrity of the heart and its capabilities of adaptation to stress of an extended and intensive physical activity. In order to determine the limits of normal EKG tracings, several hundred tousent EKG s of healthy people without any cardiovascular disturbances were investigated and the results published (8 and several others) These broad investigations have shown that, in normal healthy people EKG abnormalities as bundle branch blocks, nonspecific repolarisation changes, rhythm disturbances disturbances may occur (4,5).

The athletes with healthy cardiovascular system and high performance capacities may present some EKG changes of pace making and its propagation very slow bradycardia, repolarisation disturbances (9,14). But in general, athletes EKG findings appear to be in normal limits, ac-

*) Ege University Faculty of Medicine, Institute of Sports Medicine

cording tc Plas (10). Recently Venerando (15) presented the results of 12000 tracings recorded among athletes' periodical controls. In most instances the EKG s were normal but in 12 % of cases there were characteristic abnormalities of rhythm, conduction and in the repolarisation and even more rarely abnormalities like paroxsysmal tachycardia, ventricular preexitations, coronary sinus rhythm, right bundle branch block, premature beats.. Particularly the athletes may show EKG differances according, to the load intensity played by the sports they participate. Endurance athletes and among them long distance and Marathon runners are subject to intensive physiological stress, and it is well known that their heart size is the most enlarged among the athletes.

In this study, the EKG findings of 20 long distance, Marathon runners will be discussed, who were competitors for several years. Their age averaged 24 years. EKG s were recorded first in resting 15 minutes in supine position and just after running 20 - 30 km distance. In order to place the electrodes in the same place on chest their place were marked before with color marker.

In resting EKG s their heart rate averaged 55/min.; in 15 athletes heart rate was below 60, among them in 5 it was below 50 per minute and two of them had 45 per minute. Two cases presented second degree heart block with Wenckebach periods (Fig. 1), one case showed temporary atrio-ventricular dissociation, one case with short PR syndrome. 2 cases of incomplete right bundle branch block, were the other rhythm abnormalities. With the exception of short PR and incomplete right bundle branch block, the above findings were normalized after running. One case with resting heart rate of 45 per minute and temporary atrio-ventricular dissociation had remarkable respiratory arrhythmia after running.

One case showed anteroseptal ischemic changes in rest, with inverted T wa-

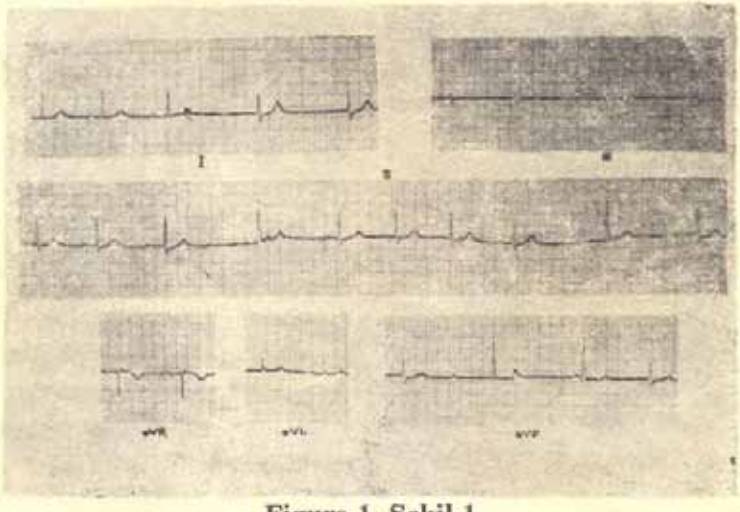

Figure-1, Şekil-1