EEG broadcasted in two days time from Gemini 7, although prior to this attempt Maulsby,R.L., after a clinical traditional computation of the same recordings wasn't able to stress any alteration of the cortical biogenesis in conditions of weightlessness. There are also difficulties occurring in sportsmen who are in full swing, in the recording and computing of the broadcasted data, due to the artifacts which appear as a result of the slight contractions of the neck and headmuscle, and of the inevitable sweating as well. Such a trajectory is almost completely destitute of the alfa rhythm, because the subject keeps his eyes open, he is preoccupied, with one or more parts of the body inactivity. We have although succeeded to record the EEG of some sportsmen during some unspecific dynamic efforts (genuflexion), as well as immediately after isometric efforts. On the basis of these results we drew the conclusion that an uninterrupted dynamic effort lasting for two minutes affects to a lesser extent the cortical biogenesis than the 10-second isometric effort does.

We were also able to draw a conclusion having an essential practical bearing on the sports activity, namely that the effect of a 10 s.isometric functional contraction upon the cerebral bioelectrical activity is of 90s.permanence, which demands the lengthening of the break between the successive contractions to at least 90 s. Earlier empirical opinions which allowed the repeating of the contractions in an interval of 10-15 s.seem, according to our data, ungrounded scientifically and wrong.

We have also concluded that among teen-agers and women the effects of the isometric contractions upon the cortical bioelectric activity are much more stressed upon and detrimental: the stopping reaction of the alfa waves ("arousal") and the desynchronizationtion of the trajectories immediately after exertion are much broader and longer in duration, the alfa rhythm becomes more frequent, with 0.5-1.0 c/s, on the EEG appear slow isolated waves and even theta rhythm. All these EEG alterations reveal important modifications of the cerebral metabolism and oblige us to contraindicate the usage of the functional isometric contractions in young high-level sportsmen and young girls. Our findings confirm an old observation of Vorobiev,A.V. and Dzidzisvili,N.N., who in 1943 noticed that the rise of the frequency and elfa rhythm amplitude during athletic exertion belong to the slow theta and delta waves in case of marked fatigue and exhaustion conditions. Meanwhile Ilina, L.I. and Kukolevskaia,E.V., noticed, after a 3 min. run an increasing amplitude of the alfa rhythm, lowering of the frequence in some of the subjects and a rise in others even with 2 c/s. Generally, the effort synchronizes the cortical bioelectric activity and causes the appearance of the elfa rhythm in subjects, or curves where it has not existed before.

By combining the EEG recordings with the inhalation of gaseous mixtures poor in O_2 it is possible to determine up to a certain extent the level of fitness in athletes exposed to endurance tasks. According to our data (Demeter,A.,Nestianu,V.1968), as well as to those of Baciu,I. and collab.(1965), it is evident that well trained athletes show an increased stability towards the perturbatory tendencies of the cortical homeostasis. Thus the well trained sportsmen present slow waves by a lower concentration of O_2 in the inhaled mixture according to their level of trainment.

It is not amazing that some specialists use the effort as therapeutical mean in a variety of pathological conditions.Goetze,E. and collab.(1965) reports the disappearance of the epileptic symptoms by reducing the convulsive irritability of the cortex in epileptics who perform before the hyperventilation 20-50 genuflexions; the biochemical and electrochemical alterations resulting from the physical effort have a salutary effect in such cases.

Among the findings obtained by broadcasted EEG in sportsmen it is worth mentioning those belonging to the Americans Hughes and Hendrix (1968) who show that the football players during the game have an EEG with a basical rhythm in continuous change and a rather high alfa frequency (13 c/s)in great stress moments of the game. During the head-kicking of the ball theta waves are to be seen, repeating for a few seconds, and disappearing afterwards, proving that cerebral injury was insignificant.

In sports pathology the aspects of the neurological pathology caused by a sustained athletic activity manifested by signs of cerebral disorders (slow general or local waves, discharging areas, spikes or acute waves, etc.) are to be found in cases of serious cranium injuries, or not so serious but repeated traumatism and in case of cerebral anemia due to the Valsalva effect. Cranium injuries may occur in any sports activity with a higher incidence than in everyday life. There are disciplines like cycling, motorcycling, riding, skiing, track and field athletics, wrestling, football, rugby where the cranium traumatism incidence is higher than in the other branches. Anyway, it is a matter of accidental traumatism. Boxing is the only sport where the practical and technical aim is to cause head and body kicks in order to knock the opponent out of the battle, the head blows being permitted as well as those in reflexogenic tones.

As regards short and repeated cerebral anemia it occurs in weight lifters and to a certain extent in wrestlers. The head blows cause mental shock, tiny hemorrhages and even injuries to the cerebral substance which can be immediately expressed by temporary amnesias and loss of orientation and repeatedly can lead to the "boxing dementia" expressed by aggresiveness, ataxy, coordination cloudings, tremor in speech and impossibility of memorizing new data, forgetting of the memorized data and other neuropsychic derangements. (Busse and Silverman 1952). The EEG control in boxers must be obligatorily done, immediately after brain attacks followed by temporary and recurrent amnesias, in order to discover the latent effects which are not always clinically manifested. They should be routinely done in all boxers, periodically, in order to find out the progressive deterioration of the cerebral function (by summing up all the microtraumatisms), which begins to settle in in some of them, and to stop its further progress towards serious clinical disorders in case the sports activity is continued.

From the extensive literature survey regarding encephalography in boxers, we give below the most representative data:

- 50% of the boxers (the length of boxing activity and the number of contests or knock-outs are not specified in standard EEG recordings between the games, show permanent desynchronization of the curves and slow waves of 3-6 c/s (Bornes, Vilevisensis,1959), while 5% have heavily alterated EEG curves;

- 36% from the boxers show alterated EEG after the game as compared to that before the game) with plain curves and slow waves, particularly those who sustained a knock-out, knock-down or head blows but it is difficult to explain why not all of the shocked boxers show these curves or vice-versa, why some boxers who did not suffer shock show similar changes. Maybe the different individual endurence towards mental shocks and great exertion is an explanation of these discordant results. (Larsson and collab. 1954, Beausoert, Mike, Boulegges and Glysen 1959, cited by Ilina and Kukolevskaia, 1962):

- a study on 116 international meets shows that while a sample group (non-athletes) does not present pathological EEG alterations, the boxers, before the game, had 29% EEG changes and 31.1% after one contest, 39.7% - after two, and 42% - after three contests;

- 85% from the young boxers who sustained two knock-outs show arhythmic and theta waves (Temmes and Huhmar, 1952);

- while amateur boxers after B contest present but 17.9% theta rhythm and 2.6% delta, the professionals having 45 played games show 21% theta rhythm and 5.5% delta and those who have more than 75 played games show 25% theta waves and 25% delta. (Sjaardema quoted by Brown, 1950).

The fusion threshold (the critical fusion frequency)

From the experimental physiological and psychological studies done by many authors on different categories of subjects it is obvious that the setting in of fatigue of the nervous system causes an evident lowering of the frequency at which the subject affirms that he percieves the intermittent stimuli in the form of an absolute continuous light.

After the setting in of fatigue, the frequency at which the subject succeeds to percieve the individual stimuli is lower than when he is rested. The two fusion frequencies and dissociation are slightly different as value, but thea raise and fall rather simultaneously. Although the fusion frequency is more constant and valuable for the determination of the brain function. A stroboscope should be used, with flash, and as far as possible the flash should be not accompanied by synchronic cracks with the flashes - hearing aid being more acute in perceiving and differenciation of frequencies than the visual system. The value of the critical fusion frequency is directly proportional to the logarithm of the light's intensity - that means that all the determinations should be done with constant intensities in order to have reproducible values.

The tests applied by Demeter (1967) on sportsmen show that from an average fusion frequency of 31/s at rest this value lowers to an average value of 23/s after anfunctional isometric effort, and to an average of 29/s after 60 genuflexions performed within 2 min.time. Notable alterations in the same way have been described by Demeter and Nestianu (1968) in sportsmen on high altitude, in pressure chambre, both before effort and after 8 functional isometric contractions.

In sport medicine the measurement of the fusion frequency may be successfully used for determination of the fatigue level in athletes after practice and competitions; it should be correlated with the data given by EEG, EMG, time of reaction, excitability etc.

Time of reaction

The time of reaction is the period of time elapsing from the moment of starting a medium intensity stimulus, usually an external one, to the moment of the adequate voluntary motor response.

There are usually used visual stimuli (flash, bubl switching etc.) or hearing ones (cracks, click, ring) and the voluntary motrical response is given by the subject in form of pressing as quick as possible a button with a key which stops the electric or electronic chronometer which has been started at the same time with the luminous or hearing stimulus.

The time of reaction includes the retinal - (auricle) cortical leading time, the intercerebral time towards the motor zone, including for the releasing of the volitional phenomenon (central leading time) and the necessary time for the reaching of the impact from the cortex to the muscle. There are also (1952) parallel experimental testings of the retinal-cortical and total time of reaction. (with the simultaneous recording of the starting moment of the stimulus of the ERG, of the EEG potential caused upon the occipital cortex by flash, of the EMG from the hand muscle which responds by pressing the button, of the mechanical movement of the hand and of the movement in which the button is pressed.)

The values of the time of reaction are quite different and depend on age, job, nature of the stimulus, athletic conditioning level etc., not to mention the neurologic and psychiatric pathology where one can find very long times of reaction. The time increases according to age, tiredness, overtraining. It is shorter for the hearing aid stimulus (80 ms) as compared to the visual one in the same subject (125 milliseconds - after Luschei and collab. 1967). The above values are given for the response of the EMG of the hand, which precedes with 10-20 milliseconds the proper mechanical movement of the hand. (Wargo and collab.,1967)

While some authors (Keresszty,1967) noticed very low values in sportsmen (even 65 milliseconds for response at hearing stimuli, by sprinters),Nemessuri (1967) finds much greater values, about 200 milliseconds, in weight-lifters, skaters, handball players, values which are in some cases falling, in other raising at the moment of apparition of the super-training. These date allow the author to conclude that there are two types of overtraining: with apathy and hyperexcitability.

Laufberger divided the time of reaction in constitutive units establishing also their average duration. Rotislav Rujbr on the basis of the data from the literature elaborated a chart regarding the influence of the different factors upon the duration T.R.

Study of the higher nervous activity

Not only for the initial selection of the athletes and their guiding towards the sports event most adequate for their higher nervous activity, but also for the amendment and improvement of their behaviour in order to reach higher sports performances, it is important to be aware of the type of their nervous system.

If for some disciplines and sports trials these data are not absolutely necessary, for others the level of the performance depends largely on the type of nervous system. Thus the weak type is completely excluded from the competition activity. Those of a strong type, bad-tempered (choleric) are very much to disadvantage both during the competition and mostly during the process of practice which requires a very great patience, perseverance, and precision. They also come frequently in conflict with the coach, teammates, referees etc., constituting "difficult" persons.

The strong type, even-tempered, inert, adapts himself rather easily to some sports events like weight-lifting, shooting, skittles, etc.

Although in the most sports one prefers the even-tempered, mobile types in order to get the best results. For sports events like fencing, running etc this nervous type system is particularly desired.

In order to fix the nervous system type, the Ivenov - Smolenski's classical method may be used where the latent times towards different commands from the first and second signalization, are fixed, and the corresponding responses as well. The study of the formation of the temporary links with the different external stimuli, and of the differentiation (and the other internal inhibitions), using simple methods and apparatus, considered already classical, may help a great deal in fixing the type of the nervous system. For the fixing of the nervous system type beside the above mentioned methods there may be others which may contribute: the measuring of the retinal - corcital time and those of reaction; the measuring of the fusion threshold towards the ILS, the EIM (for excitedness), a lot of psychotechnical tests and so on; nevertheless, the clinical, medical and pedagogical observation performed by a skilled person for a long period of time is the most reliable and simple way (from the apparatus point of view). The sports doctor should follow the strength of the basic nerve processes (excitation and inhibition), during practice camps and training in general, studying the athletes ability to respond adequately to the intensity of the stimulus (for a strong stimulus-strong response), and to recover quickly after an inhibition with a depth of an equal value as that of the previous excitation.

The equilibrum of the basic nerve processes is easily recognized by the very behaviour of the athlete under conditions of physical stress and social life. The functional mobility or lability of the cortex may be assayed by the speed with which he can change the excitation into inhibition, and viceversa.

CHANGES IN THE X-RAY IMAGE OF THE HEART IN RETAINING THE BREATHING AT VARYING INTRAPULMONARY PRESSURE (STRAINING TEST)

S.Zotov, N.Georgiev - Bulgaria

The heart size decrease during straining test is due to an increased intrathoracic pressure which is accompanied by an increase of the pressure in venae cavae inferior. This hinders the blood return from the abdominal regions and extremities, and at continuing activity of the heart, it results in a decrease of the heart dimensions.

The present investigations were carried out with a view to find an answer to the following questions:

1. At what intrapulmonary pressure with cessation of breathing the decrease in heart dimensions is manifested.

2. Is there any difference between the relatively bigger and smaller healthy hearts in this respect (the first task).

3. Does the roentgenological image of the heart continue to decrease upon further increase in intrapulmonary pressure? Is there a difference in this respect between bigger and smaller hearts?

4. Is there a difference in the decrease of the roentgenological dimensions between larger and smaller hearts in straining test (at different pressures), carried out at rest.

32 healthy students (men) in physical culture with a rather limited athletic experience were investigated. 4 frontal teleroentgenograms were taken of each person (at distance from the tube 1,5 m.). First, teleroentgenography was carried out at maximal inspiration. Then the hearts of the investigated persons were x-rayed at maximal inspiration once again at maximal continuous

straining by the students, amounting to 20 Hg mm.; the straining test was conducted in the same way at 40 Hg mm.; in the last experiment the straining test was carried out under pressure amounting to 60 Hg mm.

As an integral index of the X-ray heart image we used the cardiac surface, calculated according to the formula $A = \frac{\pi}{4} L.T.$ On the basis of the initial surface of the heart two grups were differentiated: the first one with a relatively bigger cardiac surface, amounting to 146,61 cm^2. on the average (12 persons), and the second - with a mean cardiac surface 120,95 cm^2 (20 persons).

A reliable change (decrease) in the cardiac surface was considered only that which is determined by a reliable, parallel change (decrease) in the longitudinal and transverse diameters of the heart - $P < 0,05$.

The results obtained reveal some essential characteristic features of the cardiac surface change at different intrapulmonary pressures and corresponding maximal arrest of breathing (the straining test). The cardiac surface in relatively bigger hearts decreases reliably at 40 Hg. mm. straining, while in relatively smaller hearts the cardiac surface is reliably reduced at 60 Hg.mm. straining. This indicates that straining of 20 Hg mm. is insufficient to cause a decrease in the cardiac surface both of the comparatively bigger and smaller hearts. It is obvious that the physiological mechanisms used (acceleration of heart contractions and utilization of rapid blood reserves) are sufficient to compensate for the modifidations which have taken place in the venous supply.

These data are extremely important. Even in mild difference between the initial cardiac surfaces of the hearts of either group (25,66% $cm.^2$), there are nevertheless important differences in their changes at arrested breathing at different intrapulmonary pressures. In relatively bigger hearts there is a greater amount of residual blood; its decrease is substantiated at a comparatively lower increase in intrapulmonary pressure (40 Hg mm.), and a corresponding decrease in venous heart supply which causes a corresponding reliable reduction of the heart image; in these cases the use of the greater possibilities of the rapid blood reserves (in the left half of the heart and in front of it) are sufficient to obviate a decrease in arterial blood pressure. For that reason a very high acceleration of the heart rhythm is not necessary. In other words, the decrease of the heart is situational, it depends on the existing conditions. It is a more favourable compensating mechanism than the considerably high acceleration of the heart contractions. This mechanism can be used because, as already mentioned, there is a greater amount of residual blood in the relatively bigger hearts.

For smaller hearts (at 40 Hg mm. pulmonary pressure), the relatively greater acceleration of the heart contractions is inevitably a more favourable compensatory reaction. That does not mean that smaller and bigger hearts can equally well tackle the aggravated conditions of the cardiac activity. The bigger hearts, by decreasing their volume, react more effectively under the conditions outlined above.

In relatively smaller hearts at 60 Hg mm. intrapulmonary pressure, the decrease in the venous supply of the heart is considerable as it has been explained before. Therefore the mechanism of the great acceleration of the heart contractions is not sufficient to compensate for the substantial blood flow reduction. Therefore they also decrease reliably under these conditions despite their small capacity in this respect owing to the insufficient amount of residual blood.

It is necessary to consider the differences between big and small hearts in relation to the magnitude of heart decrease during straining test. Since a reliable cardiac surface decrease in smaller hearts can be observed only at 60 Hg mm. pulmonary pressure, the comparison between the two groups was carried out on this basis. In bigger hearts the surface decrease amounts to 19,44 cm.^{2}, while this reduction in smaller hearts amounts to 11,9 cm^2. The difference in the decrease of hearts in both groups is reliable (P 0,05). The data obtained by H.Reindel and coauthors concerning the difference in the decrease of cardiac volume between untrained persons and sportsmen are based on Valsalva's test after physical effort. Our results show that there is a difference in this respect between smaller and bigger hearts at rest, also. Besides that the data obtained by us are quite indicative as the difference in the initial cardiac surface between the two groups is rather insignificant.

CONCLUSIONS:

1. In straining test at 20 Hg mm., the cardiac surface does not decrease reliably both in smaller and in bigger hearts.

2. In straining test at 40 Hg mm., the cardiac surface is reliably reduced only in bigger hearts.

3. A reliable reduction of the cardiac surface in straining test in smaller hearts is recorded at 60 Hg mm. only.

4. In straining at 60 Hg mm. the decrease of the cardiac surface in bigger hearts is not greater than in smaller hearts at 40 Hg mm.

5. For bigger hearts a reliably more considerable reduction of the cardiac surface as compared to that in smaller hearts during

straining test at rest is characteristic.

ANATOMO-PHYSIOLOGICAL PROBLEMS IN SELECTION AND EARLY SPECIALIZATION FOR WRESTLING AND WEIGHT LIFTING IN SPORTS SCHOOLS

V.Dushkov, E.Nedyalkova - Bulgaria

When and what to begin with, or more exactly when firmly and successfully to increase the training stress in early specialization of young athletes is one of the most actual problems nowadays.

There is a complete unanimity that the capacity to a given work load exposure is different in the consecutive stages of physical development. The cardio-vascular system and joint apparatus, for example, show a considerable functional fitness yet before puberty. Hence, a number of sports such as swimming and eurythmics may allow in early age not only technical elements to be adopted, but also a considerable intensive training work to be performed.

Many factors in the morphology of the puberty organism such as incomplete ossification, and prevailing skeletal development in relation to muscle mass interfere seriously with the early development of two basic physical qualities: strength and endurance. The lack of either of these qualities whose full development takes place from 15-18 years of age, render difficult the early training in wrestling and weight lifting.

On the other hand, the improvement of young athletes in this field is characterized by the fact, that their morphological and functional reorganization as a result of training is effected on the grounds of still incompleted processes of growth and development. Owing to this, "a considerable part of the total energy is mutually connected not only with sports activities, but also with the specific transformations characterizing the growing organism" /Volkov, 1974/. The deep reorganization of the endocrine apparatus, the growth in overall body sizes may produce changes in the biodynamic parameters' system. Intense training, especially at high performance level, combined with enormous emotional overloads and mental strain at a given moment may become a factor limiting the puberty development and in turn, the further development of such fundamental qualities as strength and endurance.

Therefore, with respect to wrestling and lifting events, the admittance and training work in sports schools pose a number of requirements of medical, biological and functional character. In this sense, the results of two year observations of some medical and functional parameters obtained from the classes for weight lifting and wrestling of the Secondary sports school in V.Turnovo, are of interest.

1. PHYSICAL DEVELOPMENT. Regularly both in wrestling and weight lifting classes, the height of the admitted schoolchildren is considerably below the height of the same age groups on a nation-wide scale, while the mean weight, vital capacity and dynamometry are close to the average ones.

The growth rate is close to this one of the country, the initial differences having been kept the same, the weight and physical parameters /vital capacity, dynamometry, litheness/ are considerably higher.

2. FLAT FOOT. Children with flat foot were not admitted to the classes for wrestling and weight lifting. It was established two years later that while in children with normal feet the Chigin index decreases, in the cases with fallen vault, the index increases to complete flat foot. At present, flat foot and its transitory

forms are 44,59%.

We have observed almost the same phenomena also in the specialized sports school for weight lifting where the percentage of the normal feet and transitory forms becomes lower within two years of training, and the incidence of manifested flat feet increases above 5 times.

3. LOCOMOTOR SYSTEM. In this case it becomes necessary to reconsider the problem of the presence of spina bifida occulta and M.O.Schlatteri among children admitted in the puberty period.

Taking into consideration that definite structural changes in the lumbosacral region of the vertebral column have not yet occurred at the age of 11 years, we admitted in 1972 16 schoolchildren with. The annual control roentgenograms showed some positive alterations /without definite character/ in 6 cases; the remainder were unchanged. The only case of M.O.Schlatteri underwent a very slow evolution, and within two years of admission it did not show any evidence of complete consolidation.

Out of the admitted 63 schoolchildren in the classes of wrestling and lifting weights, 4 new cases of M.O.Schlatteri were detected and confirmed radiologically at the end of the observation period. At the same time, because of clinical complaints, manifest osteoporosis of the bones forming the foot was established radiologically in 5 cases.

4. FUNCTIONAL DIAGNOSIS. No ECG variations were noted upon admission or after considerable in extent and intensity training stresses. Tests with dosed loads were conducted routinely during the two years, estimated on the ground of global pulse sum, as modified by Karaneshev, and according to qualitative analysis of the recovery. Along with improvement in the efficiency parameters, the assessments of the tests with dosed load also show a considerable

improvement.

5. MORBIDITY. Acute catarrhs of the upper airways were most common /38%/ - an index which is lower than that of the same age group in the district, but highest among the sports disciplines reviewed. Injuries to the musculo-skeletal system rank second (32%). According to severity of trauma, the wrestling classes rank first among the sports included in the survey.

The purpose of sports schools is to develop highly specialized athletes for the national sports. This task may be accomplished only through systematic hard training and early athletic specialization. "Similar demands are possible only in absolutely healthy children" /Dembeau,1973/. For this reason, with respect to the medical criteria for admission, it is necessary to consider, in the future too, the candidates with defects or anomalies of the locomotor system as contraindicated, since on the one hand, they are incompatible with the development of the qualities strength and endurance, and on the other, practically no positive alterations may be anticipated after the 11th year of life. This holds true to the same degree for flat foot and its transitory forms.

The problem of the technical qualities of the candidates is more complicated. While the coefficient candidates; available places for sports gymnastics, eurythmics and sports games at present is 5:1 / theoretically it should be 10:1/, it never exceeded 3:1 in the classes for wrestling. In the classes for lifting weights it is still lower - 1:1. Hence the small number of excellent technical evaluations in the preliminary selection is explained. A marked discrepancy between the technical evaluations and those of the cardiovascular tests, where the unsatisfactory and poor tests show a net prevalence is most impressive. Evident improvement of the functional capacities of the cardiovascular system as a result of planned and purposeful training have been noted during the two-year cycle of training.

With the existing tendency towards early specialization and strive for high performance, in the national weight-lifting championships the percentage of participants from the older age groups amounts to about 30%. Having in mind the aims of the sports schools, the inappropriate selection and the general tendency towards early participation in competitions, a real danger exists of forcing the training process of the teenagers. In this case "The specialization which does not correspond to the age, the underestimation of the means for general conditioning and exposure to loads which are not in conformity with the real possibilities of the organism, may lead to pathological changes in the children's health - to a deliterious effect on the growing organism" /Filin, 1974/.

Hence two questions arise:

- The problems of morphological, physiological and psychical nature related to the 10-11 years age group; is this age suitable for admission in sports schools for weight lifting and wrestling;

- is it advisable to direct children aged 10-11 years towards specific sports and more particularly those requiring strength development or it is preferable to wait the age of 13-14 years.

CONCLUSIONS

1. The admission in sports classes, connected with adoption of strength elements, at the age of 10-11 years is premature. The dynamics of the development of existing defects and variants im some regions of the locomotor system hardly lends itself to prognostication.

2. The actual admission is based on the results of the medic-

al examination, physical development data and reaching definite sports-technical standards. Priority is given to accelerated at the moment children without taking into consideration the growth rate and the technical parameters in the preceding years. Such an attitude does not guarantee preservation of the priority in the performances of accelerated children in the following years.

3. With a view to all problems of early sports specialization and early admission in sports schools posed so far, it is necessary to elaborate a unified system for the criteria of admission and control.

SPORTS AND WOMEN WITH A VIEW TO SOME SPECIFIC PECULIARITIES OF THE FEMALE ORGANISM

Ek.Saharieva - Bulgaria

Contemporary sports requires a great deal from female athletes. The amount and intensity of physical exercises often reach the limits of the functional capabilities of organism. This is especially true for highly qualified female athletes who use maximum efforts during their training for important competitions in order to reach the peak of their potential. In order to protect the health of women in sports it is necessary to control the physiological functions of the organism, especially those of them related to the biological destination of women.

In the medical-pedagogical control of women athletes it is most essential to follow up the character of the ovarian-menstrual cycle. Anomalies during this cycle might serve as a sign that the limits of optimal physical stress have been exceeded.

Our earlier investigations during athletic activities and in laboratory conditions, as well as those by a number of authors such as S.A.Jagunov, L.N.Startzeva, P.Quereux, V.N.Zheleznjakene, E.J.Klaus, H.Neack, J.Bausenwein and others have proved the necessity of controlling the changes referred to.

In the present report the character of menstrual cycle (M.C.), the menstrual phase (M.Ph.), and the general physical and mental condition during the above period are traced in female athletes with varying qualification levels.

METHODS

1,150 Bulgarian female athletes engaged in different sports were followed up. The data have been obtained through a detailed questionnaire study and personal conversation with each woman. This form of investigation is considered to be the most suitable in the case as it affords complete information covering a longer period of time and a greater number of female athletes.

The competitors were divided into three groups according to their athletic qualification. The first group included outstanding female athletes - honoured masters of sports (h.m.s.), masters of sports (m.s.) and candidate-masters of sports (c.m.s.) - totalling 168 women. The second group included first class athletes - 567, and group III included 415 competitors of second and third class.

In the report a comparative study is made of the data obtained from the different groups of female athletes with different qualification. Differences between the groups were considered which were with statistically proved reliability t 2,5 and $P_t > 0,95$.

Most of the female athletes under observation were young. During the questionnaire study 81,3% of them were under 20, 13,8 of them were between 21-25, and only 4,9% were above 25 years.

RESULTS AND DISCUSSION

We have come to the conclusion that the competitors from group I - honoured masters of sports, masters of sports and candidate-masters of sports are exposed to the most strenuous exercises and training efforts. Next rank first-class competitors. The second-class and third-class competitors included in group III are subject to the lowest in terms of amount and intensity physical stress.

No essential differences were found between the three groups of competitors as far as the rhythm and interval of the menstrual cycle were concerned. A rhythmical menstrual cycle was noted in 87,8% of the top level female athletes, 82,5% of the first-class athletes and 86,2% of the second- and third-class athletes. The interval between the menstrual cycles in the majority of female athletes from the three groups was 26-30 days. The short interval - below 25 days - was encountered more frequently than the longer one - above 30 days.

Essential differences among the groups were established in the nature of the menstrual phase itself, i.e. its duration, amount, painfulness as well as the presence of a pre-menstrual syndrome. These unfavourable aspects of the menstrual phase are encountered more frequently in top level and first-class female athletes than in those less qualified.

A strongly pronounced pre-menstrual syndrome is more frequently reported by high-level athletes as compared to the remainder (group I - 28,6 %; group II - 20,8 % and group III - II,7 %). Though in the majority of sportswomen from the three groups, the most frequent duration of the menstrual phase is between 3-5 days, a longer menstrual phase - exceeding 5 days - is more frequently recorded in qualified competitors (group I - 27,4%, group II - 29,3 %, group III - 20,8%). The menses is moderate in most of the competitors but the second-class and third-class female athletes have a higher percentage of moderate menses than the high-level sportswomen (group I - 66,8%, group II - 74,2 % and group III - 79 %). The abundant menses is more frequently encountered in high-level sportswomen. (group I - 14,1 %, group II - 9,7 % and group III - 6 %).

A difference was found as far as painfulness of the menstrual phase was concerned depending on the competitors' qualification. A mild or strong painfulness was more frequent in highly qualified athletes as compared to less qualified ones. (group I - 32,2%, group II - 35,0 % and group III - 27,6 %).

In sports-medical practice of considerable importance is not only the character of the menstrual-ovarian cycle in competitors but also the influence of the physical efforts and strain during training on the menstrual phase itself. As our observations show the participation of female athletes in practice sessions and contests during a menstrual phase is a frequent phenomenon. The higher the qualification of the comptetitors, the greater is the necessity of their participation in competitions during menses. This has been proved by the case material reported on. It shows, on the other hand, a certain adaptation of the female organisms to physical stress during that period.

Sports activities during the menstrual phase did not cause any changes in the rhythm and interval of the menstrual cycle in the three groups of competitors. Changes were observed only as far as the character of the menstrual phase itself was concerned. The unfavourable changes are virtually proportional to the qualification of the comptetitors. The highest incidence of disturbances in the course of the menstrual phase during training with menses is displayed by the top-list female athletes.

The general physical and mental condition during the menstrual phase is disturbed in nearly one half of the competitors. Most frequent are the complaints of nervousness and weakness. Inspite of that, adaptation of the competitors to efforts and strain during the menstrual phase was established. For example, 75,0% of the competitors are confident that during participation in competitions with menses, they can perform according to their actual training level regardless of their general physical and mental state.

In conclusion it is pointed out that no differences are found in the ovarian-menstrual cycle as far as rhythm and duration are concerned depending on the qualification of female athletes.

Changes were established in the character of the menstrual phase as result of the immediate influence of athletic efforts. Disturbances of the menstrual phase are more frequently encountered in high-level sportswomen, in comparison with less qualified ones. Unfavourable changes in the menstrual phase during training activities with menses are more frequent in masters of sports compared to second-class and third-class sportswomen. Moreover, the changes observed between high-level and first-class sportswomen are closer in nature than between the latter and the second- and third-class competitors.

Irrespective of the competitors' adaptation to athletic exertion during the menstrual phase, some unfavourable changes in its character are not rare. This requires more strict medicalpedagogical control and individual attitude in conducting the training and competitive activities in top-list female athletes.

NON-PATHOLOGICAL SYSTOLIC MURMURS IN CHILDREN ACTIVITY ENGAGED IN SPORTS

V.Velev, I.Iliev - Bulgaria

In every day practice the sports physician often faces non-pathological systolic murmurs, especially when mass examinations are carried out for selection of pupils for Sports Schools or for Secondary Sports Schools.

The literature data on non-pathological murmurs are quite different, and sometimes even contradictory. According to Kaluzhnaya, "there should be no murmurs in completely healthy children because even in the absence of organic lesions, they appear as the result of a disturbed physiological state of the myocardium itself, as well as of the mechanism regulating its function."

Other authors such as Glan, Groom, Sihvonen, Lewis, Holldack, Wolf, have discovered phonocardiographically systolic murmurs in 100 % of the healthy children.

According to Oskolkova, systolic murmurs in childhood have been found as follows: in children under school age - 36 %, in early school age - 56 %, and late school age - 58 %.

On the other hand, Dibner found systolic murmurs in athletes more frequently (92 %) than in untrained grown-ups. According to Z.B. Belotzerkovskii, in young athletes their incidence amounts to 65.7 %. Jahne-Liersch (1966) found less accidental systolic murmurs in children engaged in sports than in untrained ones, and came to the conclusion that there is a negative correlation between accidental murmurs and physical capacity of work. Neumann-Möller (1970) have found that among athletes with high physiological indices (maximum oxygen uptake, oxygen pulse) accidental systolic murmurs are more frequent and they consider them to be due to the increased capacity of work of the trained persons.

There is no agreement either insofar as terminology of systolic murmurs in healthy children is concerned. Denominations such as functional, accidental, non-pathological, innocent etc. have been suggested. We have accepted the classification given by Mavrodiev and Belov, according to which murmurs are divided up into pathological and non-pathological.

There are a lot of theories explaining the pathogenesis of non-pathological systolic murmurs. According to the latest researches, their occurrence is usually explained by the vertical blood movements when it is being pushed out of the cardiac ventricles. This is convincingly proved by the studies of Lewis et al. Using intracardial phonocardiography, they succeeded in detecting systolic murmur within the region of the pulmonary artery in healthy people. This so called pulmonic murmur of ejection can be heard on the anterior chest surface between the second and the third intercostal space along the left margin of the sternum but not infrequently it can be heard even nearby the cardiac apex.

Though more rarely we might come upon the so called "vibration systolic murmur", described by Still in 1909. It is typical with its musical character and is heard best within the region of the cardiac apex and along the left margin of the lower half of the sternum. It occurs intraventricularly with the participation of the chamber wall and the trubeculae.

The above data give us sufficient reason to carry out a phonocardiographic study on the pupils from the Secondary Sports School in Plovdiv.

MATERIAL AND METHODS

"3 analyzed the phonocardiograms of 275 children (135 boys and 140 girls) aged 11 to 14, engaged in sports as field-and-track events, sports gymnastics, canoe, wrestling, weight-lifting, volleyball and basketball.

Registration of the phonocardiograms was made in the morning after a five minute rest in a lying position. We used "Galileo" phonocardiograph, at frequency ranges 20-40, 40-80, 80-160 and 160-320 Hz. The registration was done in a position of moderate expiration, at tape speed 50 mm/sec., in the universally accepted auscultation points.

The spiroergometric investigation was carried out with a veloergometer "Zimmermann" and "Spirolyt II - Innkalor - German Democratic Republic. We applied maximum stress increasing the work load stepwise.

The cardiac output was determined roentgenocardiometrically according to the method of Roher and Kahlstorf, as modified by Musshoff-Reindell.

All children under study were clinically healthy.

RESULTS AND DISCUSSION

Of all the 275 children investigated, non-pathological systolic murmurs were discovered in 126 cases, i.e. 45%. Their incidence is practically the same in boys and girls. Most frequently, the form of the murmurs is spindle-like and rhomboid. They lend themselves to optimal registration in the mean frequencies M_2, usually occupying the first 1/3 or 1/2 of the systole. Within the region of the cardiac apex the spindlelike murmurs predominate while within the region of the pulmonary artery the spindle-like and the rhomboid murmurs are equally frequent. Punctum maximum is most frequently within the region of the pulmonary artery. In most instances the systolic murmur fails to coincide with the first heart sound.

A common feature of all systolic murmurs in the investigated children is their fluctuation as regards amplitude and duration. In standing position they usually disappear or else their amplitude shows an abrupt fall.

To compare the working capacity of children with and without non-pathological systolic murmurs, the data from the maximal aerobic capacity were made use of. On the basis of the mean values of the latter for the weight categories accepted (every other 10 kg), we divided the children into three groups. Both the girls and the boys with systolic murmurs display more frequently an aerobic capacity above the average level, and more rarely below it, than the boys and girls without such murmurs. This is in line with the researches of Neumann and Möller (1970). According to them all sportsmen with a high aerobic capacity have systolic murmurs.

A comparative study is made of the values of some spiroergometric indices and the data about the cardiac output in field-and-track athletes with and without systolic murmurs. Both in boys and girls with murmus,merely a tendency is observed towards higher values of some indices at statistically insignificant differences.

In children with non-pathological systolic murmurs the third heart sound is more frequent - 61.1 %. In cases without systolic murmur it is detected in 37.6 %.

CONCLUSIONS

1. Non-pathological systolic murmurs have been discovered in pupils from the Secondary Sports School in Plovdiv - in 48 %. The average percentage discovered does not differ much from that reported in the literature for children not engaged in sports.

2. Spindle-like (67.7 %) and rhomboid (31.4 %) murmurs predominate.

3. Most frequently punctum maximum is on the pulmonary artery

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CONSIDERATIONS ON THE
USED AS INDICATOR DUR
V.Dushkov, E.Nedyalko

Time is an important factor f
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of the higher nervous system, as w
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the past century. However, it is n
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standard variations in different a

*R.T. is the abbreviation used in
action time.

of the intensity and quality of stimulus to the response time of individual systems, as well as the nature of the dynamic changes under the effect of different in nature and volume loads have not been elucidated yet.

The motor reaction time (simple and complex) is a global magnitude - an extremely complex combination of numerous inhibitions appearing at various levels, and depends both on the method of measuring, and on a number of physiological and psychic factors. It is liable to modifications in one and the same subject as a function of the experimental conditions.

The measuring of the motor reaction time is to a great extent supplementary to psychological investigations, where priority is given to the complex motor response. Utilization of the simple (elementary) motor response as an index in training activity assessment has not been affirmed and elucidated as yet. Researches thus far made differ essentially in terms of the methods and apparatuses used which explains the great controversy of opinions concerning the importance of this indicator.

The present work deals with our researches, carried out on elementary motor response over a five-year period. 300000 samples taken under different conditions and with different methods have been investigated. The series comprises subjects from both sexes, with different ages, profession and level of athletic training. The volumetric and heterogeneous investigations were conducted with apparatus, designed and constructed in the District Medical Sports Dispensary for elementary motor response time measurements according to a three-level sound and light assignment, characterized by high precision and exacinesa of the task.

1. AGE AND SEX PECULIARITIES OF THE ELEMENTARY MOTOR REACTION TIME

Age is one of the factors affecting the values of RT (elementary motor response time). The investigations of Bellis (1933), Biren and Botvinik (1955) are similar in that the time of each response - elementary, complex or associative - decreases uniformly with the childhood variability relative to adults. The shortest response time is observed between 20 and 30 years. Solodnikova is in the opinion (1969) that at the age between 7 - 15 a gradual statistically reliable decrease of the mean group values of RT, at light assignment, occurs. In a number of reports (Jones, 1937; Sishor, 1941; 1953) it is emphasized that boys from all age groups react more quickly than girls, and men more quickly than women.

Our study includes the two sex groups at the age between 11 and 26. The results are in line with literary data in respect to the fact that the shortest time response is observed in the group between aged 15-28. Moreover, the maximum and minimum values are not influenced by age. They are strictly individual. We could not find any statistically reliable differences concerning the mean values of equal age groups from both sexes.

II. ELEMENTARY MOTOR REACTION TIME IN ATHLETES

It is accepted that this indicator in athletes is shorter than in persons not engaged in sports (Genova, 1953; Antipov, 1966; Parvanov, 1971).

In our observations we could not find a considerable and statistically reliable difference in RT between outstanding athletes and persons not engaged in sports from the same age and sex groups.

Some authors admit that there is a certain dependence between the elementary motor reaction time - practiced sport, and in some sense even as a function of the post assigned - forward or guard.

In specially selected groups of football, basketball and weight-lifting competitors aged 20 to 26 of first class, candidate mastership class and mastership class, the following values have been obtained:

Sport	Assignment - Second 1000 Hz		Assignment-Central Light	
	$\bar{X}$	b	$\bar{X}$	b
Football	158.63	23.04	212.15	29.47
Basketball	162.51	22.72	218.13	28.36
Weight-lifting	163.50	23.57	219.25	27.94

The greatest difference, obtained in sound assignment is of the order of 3,88 msec. with Tk 0,1896, and in light assignment 7,10 msec with Tk 0,3452.

We could not find considerable and progressive shortening of the mean group values in elementary time response under the influence of a many-year training. At the same time, the initial differences in RT value in the various competitors, with some exceptions, were maintained throughout the whole period of investigation, the recorded changes being mainly of momentary character.

III. ELEMENTARY MOTOR REACTION TIME IN SAMPLES WITH DOSED WORK LOADS

It is of interest to compare the elementary time response with the cardiovascular samples essay in dosed loading. In this case the widely used tests for functional capacity of athletes were adopted.

From 200 investigated competitors aged 15 to 18, 41 have an excellent and 55 - a poor mark of the sample. We have not found a correlation between the estimation of the cardiovascular sample, the initial sizes and the final values of RT. The dynamic changes in elementary motor response time after a sample with a dosed stress yield rather contradictory and statistically unreliable results, a fact which to a certain extent might be explained by the minimal changes occurring in the organism of outstanding athletes when samples with dosed work loads are applied.

IV. THE ELEMENTARY MOTOR REACTION TIME AS FUNCTION OF THE CHARACTER AND DURATION OF THE TRAINING STRESS

Puni and Vardimnadi (1959) are in the opinion that the indicators of the complex reaction are improved under the effect of athletic training much more than those of the elementary one, while Platonov and Schwartz, 1948) have noticed an improvement only in the complex motor response time. According to Graevskaya (1971), the elementary motor response time changes also during a practice session. For well trained athletes it is shortened by 10 to 50 msec., while during exhaustive training stresses, a lengthening of the mean values, and an increased variability are observed.

In our study, regardless of the character and duration of exertion, the RT changes are one-way. At the end of workouts, the mean RT values are shortened from 12.31 to 20.56 msec. for a sound assignment, and from 8.61 to 23.00 msec. for a light assignment. An exception are only the workouts with cyclic movements and low intensity where the changes are substantially smaller.

Warm up, carried out at a slow rate and low intensity, is accompanied by RT shortening, but at a high variability. The elementary motor reaction time shows a considerably greater shortening during warm-up and thus ensures the participation of all muscle groups in the high intensity exercises.

The increased training stress interval within the range of the experiments carried out, does not exert a negative effect on the reation time. After 112-minute work the competitors react with the shortest time to a light signal, and with an optimal one - to a sound stimulus at a comparatively high variability. Variability increases also during practice for mechanics and special preparation which is most probably due to the individual typological peculiarities of the competitors in the technical elements' learning process.

It was only in monotonous and low intensity workouts that we observed lengthening of the elementary motor reaction time. The changes concern chiefly, sound assignments with high frequencies (10000 Hz). As far as light signal is concerned an abrupt lengthening of the elementary motor response time in relation to the peripheral light assignment is noted which is accompanied by an abrupt variability increase up to 3σ .

As far as duration and stability of the positive changes after training stresses are concerned, we have repeatedly found that within an interval of 6-8 minutes after the workout, the mean RT values for at a given sound assignment become increasingly shorter at a very low variability. The measurements carried out 18-22 minutes after the training stress have mean RT values both for sound and light signals above the initial values, the variability in both cases being considerably higher.

V. THE IMPORTANCE OF GROUP MEAN VALUES IN ELEMENTARY MOTOR REACTION TIME MEASUREMENTS

In our investigations we limited the possibility for additional mistakes using only sound signals with a determined frequency, and sound signals with a definite intensity and space location. We feel it is necessary to call attention to the fact that using the mean values of the elementary motor response time as a group indicator is unfeasible. The differences both in the initial values, and in the dynamic changes and variability in the single athletes are remarkably high.

The elementary motor reaction time undergoes dynamic changes under certain conditions, and with appropriate methods it may find its place among the tests for prompt information about the training process provided it is applied strictly individually, dynamically, and a parallel interpretation of the two components - mean value dynamics and its variability - is made.

II THEME

MEDICAL ASPECTS OF HARD TRAINING WORK LOADS

MEDICAL ASPECTS OF HARD TRAINING WORK LOADS

P.Slanchev , Y.Afar , Iv.Georgiev, N.Dagorov,
S.Avramov - Bulgaria

Record performances in contemporary sports are impossible without exposing the athletes to all out efforts during training and competition. In the past sixteen years, i.e. during the last 4 Olympic cycles, the bulk and intensity of training and competitive work with top level athletes (national and Olympic competitors) have increased approximately 4 times, with the daily energy consumption showing an increase from 3600-4000 to 5000-6000 kg.cal.

Parallel to the improvement of training methods, the members of national and Olympic teams have been training two times a day and there are also some experiments where practice sessions have been carried out three times daily.

The general opinion is that hard training and competitive stress, as well as the perfection of the training programs are the key to high performances with which contemporary sport amazes its fans and admirers.

The great amount and intensity of training and competitive activities widen and improve the adaptation and compensatory capacity of the human organism. The latter results from a number of adaptive structural and functional modifications in the human body under the influence of hard training, namely:improved plasticity, strength and equilibrium of nervous processes, improved lability of the neuromuscular apparatus, increased resistance of the organism to hypoxic conditions, improved utilization of oxygen, changes in the biochemical indicators, structure and mechanics of cardiac activity, improved regulation of blood circulation, coordinated activity of different functional systems under conditions of excessive physical stress, improved structure and function of all units of the locomotor apparatus, improved metabolism and high activity of enzyme systems and many others.

Hard training and competitive stress can be regarded from a purely medical aspect which is essential not only for sports achievements, but also for the health of athletes.

High training and competitive loads make the organisms of sportsmen work at the limit of their functional possibilities, and lead to exhaustion of adaptation and compensatory mechanisms, and in turn to premorbid conditions, acute or chronic disorders.

Excessive physical loadings and nervous-psychic and emotional overloadings with which modern training and competition are closely connected lead not only to a high intensity of metabolic process, but also to a parallel abrupt consumption of vitamins, amino acids and other tissue proteins (Jakovlev, Rogozkin, Vassjutotchkin). This decreases the capacity for work and causes premature "wearing out" of tissues.

Acting as a stress factor, hard training and competitive efforts cause strain in the hormonal systems by upsetting endocrine equilibrium and regulation.

A number of investigations of Bulgarian and foreign authors (Buharin, Levin, Luda and others) show a decrease of the non-specific and specific resistance in conditions of hard training.

These stress factors may lead to overloading of kidney and liver functions, as well as to various morphological and functional disorders (proteinuria, hematuria, cylindruria, liver painful syndromes, fatty liver infiltration, nephrolithiasis, dyskynesia of bile and bile ducts etc.). Hematological indices may also undergo unfavourable changes.

Disorders of the cardiovascular system, locomotor apparatus and nervous system are essential since they are a main limiting factor in hard training as far as athlete's health is concerned.

The available data about the potential dangers threatening the health of sportsmen exposed to high training stresses by no means warrant bringing sports into discredit. (Dembo). It has been established that the above listed premorbid and morbid conditions do not depend as much on the degree of physical stress, as on the fitness of the organism and on a number of internal and external factors. Internal predisposing factors include: chronic focal infections, genetically determined morphological and functional deviations, concomitant diseases. The external predisposing factors include mainly the microclimatic conditions of places where work-outs are carried out and the complex influence of climatic-meteorological factors, the state of facilities, violations of the hygiene regimen, (daily regimen, sleep, unhealthy donditions of life, rhythmic alternation of work and rest periods, feeding etc.), the methods of training and others.

As a rule, premorbid and morbid conditions manifesting during hard training result from discrepancy between the degree of functional loading of tissues, organs and the organism as a whole, on the one hand, and the existing functional reserves, on the other.

The fight for preserving the health of sportsmen in conditions of hard training is a strive for mutual coordination and balance between the two factors.

The first one of these factors - the degree of functional loading can be controlled and regulated in two ways:

First, by means of perfecting the methods of training, i.e.

by means of improving the coach's work.

Second, through perfecting and improving the functional sports medical supervision, i.e. perfecting tests and functional diagnosis which makes it possible to obtain exact and "prompt" information concerning the functional condition of athletes.

The interaction between these two ways, i.e. collaboration between the sports doctor and the sports teacher provides for supervision of the training process where the norms of the training stresses placed on the organism correspond to its functional reserves.

The second of the above given factors, i.e. the functional reserves of organism might also be controlled and regulated in two ways:

First, by maintaining the existing functional reserves, i.e. restoration of the consumed energy and other potentials, creating optimal conditions of internal and external environment effective prophylaxis and treatment etc.

Second, by enhancing the functional reserves, i.e. increasing the training effect, using biological means to increase the general and specific capacity for work etc.

The use of these two ways requires a high-level sports-medical supervision: organization, personnel, equipment.

We would like to discuss in greater details two basic manifestations of sports premorbid and morbid conditions, arising during hard training, i.e. the chronic overstrain of heart and the sports microtraumatism.

Our observations have shown that in the last ten years the incidence of internal diseases in athletes have increased from 26.0% to 43.0%. A considerably high percentage is assigned to the by means of improving the coach's work.

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Our observations have shown that in the last ten years the incidence of internal diseases in athletes have increased from 26.0% to 43.0%. A considerably high percentage is assigned to the established deviations in cardiac activity - 32.3 %. This substantial rise in the number of premorbid and morbid manifestations of cardiac activity in well-trained athletes is attributed to the improved therapeutic-diagnostic sports-medical aid, and to the increased amount and intensity of training loads.

This thesis is confirmed by the analysis of the electrocardiographic variations observed by us in dynamically followed up outstanding athletes covering the period 1955-1972 (disturbances in automatism, excitability, conductivity and repolarization). The mean incidence values of these variations in the studied athletes is 15.75± 0.60%, with the interval minimum-maximum being rather high from 10-76% to 20.83 %.

An indirect confirmation of the dependence of the frequency of the occurring electrocardiographic deviations on the bulk and intensity of training loadings is obtained from the following two facts:

First, the incidence of electrocardiographic deviations in teams exposed to training loads (calculated on the basis of the average annual number of workouts during the last two Olympic cycles; Mexico-Munich) which were above the average level for the Olympic teams was higher (29.15± 2.75%) than in teams whose training loads were below the average level - (20.12 ± 3.20%), the difference being statistically reliable.

Second, the incidence of electrocardiographic deviations in Olympic teams (hard training) is higher (17.34 - 0.70%) than in the other national teams (exposed to lower training efforts, 10.69 - 1.30 %), the difference being statistically reliable, too.

The established direct correlation between the frequency of electrocardiographic deviations and the degree of training stress is also in support of our statement.

Fig. 1 shows the dynamics of training efforts and electrocardiographic variations. The top line in the diagram marks the dynamics of the number of practice days for the years 1965-1972 - the Olympic cycles Mexico and Munich, the middle line marks the dynamics of the number of electrocardiographic variations, and the bottom line marks the number of workouts. A high correlation was also established between the frequency of electrocardiographic changes and the number of training days ($r = \pm 0.71$) as well.

This dependence is even more clearcut in fig. 2 where the criterion for the amount of training work is the average annual training distance (in km), covered by Olympic teams in academic rowing, canoe-kayak, cycling and swimming for the Olympic cycles Mexico - Munich (the top thin line). The thick line marks the dynamics in the percentage of electrocardiographic deviations amount of training work is more strongly expressed ($r = \pm 0.92$). Without postulating a definitive opinion on the much disputable problem - to what extent these electrocardiographic deviations are of premorbid or morbid nature, and to what extent they are a sign of an expedient physiological adaptation - it is worth noting the different extent of correlative connection between the character of the electrocardiographic variation and the bulk and intensity of the training stress. In fig. 3 it can be seen that the correlative connection with repolarization deviations in the electrocardiogram - the second line from above is the biggest ($r = 0.95$). This relationship is smaller in electrocardiographic disturbances in automatism ($r = 0.89$) - the lowermost continuous line. In electrocardiographic disturbances in the autômatism and conductivity, the correlation is not statistically reliable.

Naturally, the analysis of the observed electrocardiographic deviations should not be considered separately from the general problem "athletic heart". Predominant at present are the concepts according to which the possibilities of both of physiological and morbid "athletic heart" formation depend on the concrete conditions of athletic training. The opinion that myocardial hypertrophy is a basic sign of a well trained athlete's heart was rejected. It is accepted that cardiac hypertrophy is not identical with cardiac hyperfunction, and that an increased fitness of the myocardium is possible without the presence of perceptible hypertrophy (Dembo, Moerson et al.).

Of considerable importance are the concepts that the forced hyperfunction of the myocardium, irrespective of the causes producing it, such as physical stress in athletic training, or difficult hemodynamics in a morbid process, and irrespective of its character (isometric or isotonic), mobilizes the energy resources and leads at the beginning to reversible, and later to irreversible distrophic changes which abruptly decrease the adaptation possibilities of the heart. Though the genesis is the same, the differences are a matter of principle: in athletics the influence is of comparatively short duration, and by means of proper supervision of the training process, the forced hyperfunction of the myocardium might be regulated.

From the sports-medical point of view, it is of interest to note the concepts about the genesis of non-coronary necrosis which in some cases is due to upset equilibrium of the hormones (ketocholamine disturbances), and in others - to derangements in electrolyte and protein balance (hypokalemia, protein deficiency) (Gasv, Raiskin, Dembo).

Often, along with dystrophic changes in the myocardium due to the above mentioned reasons in cases of so-called "dystrophy of myocardium resulting from chronic physical overloading" (Bang -

1935), coronary changes can be also observed. Irrespective of the young age of people engaged in sports, it has been established that while moderate physical exertion prevents the arteries from sclerosis, the excessive loads can play the role of an additional patogenetic factor (Lang, Myasnikov). The histomorphological studies of Sarkissov and co-authors, Lihatcheva and Pintchuk confirmed these ideas.

Personal as well as literature data illustrate our basic belief that the chronic overstrain of the heart (resulting from the discrepancy between physical stress and functional capacity) is a hazard to the health of athletes, potentially existing in conditions of hard training.

The second problem of sports pathology which we would like to deal with is the problem concerning athletic microtraumatism.

Fig. 4 presents the microtraumatism to acute injuries ratio. While in 1958 according to our investigations, the percentage of microtraumatism was 18.6 % of the total number of injuries, in 1973 the percentage of mirco traumatism increased to 30.2%. The cause for this increase in the percentage of microtrauma within the general structure of athletic injuries is the existing discrepancy between high physical exertion and the functional reserves of the musculo-skeletal system. This is confirmed by the data presented in the same figure. In club team competitors, microtraumas amount to 25.4% of the total incidence of ijuries. In national competitors whose training is characterized by high, excessive loads, the percentage of microlesions is considerably higher - 45%.

Making errors in the methods of athletic preparation under conditions of hard training might account for disturbances in the processes of musculo-skeletal tissue restoration. The overlaping