Med Educ Online [serial online] 2003;8:1. Available from http://www.med-ed-online.org

Selected Physical Characteristics of Medical Students

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Abstract: The purpose of this study was to measure selected anthropometrical characteristics, motor abilities and cardiorespiratory functions of medical students. Eighty-seven students were involved in this investigation. The students were categorized into five groups: (1) recreational, doing sport activities irregularly, (2) basketball and (3) handball players, having training at least two times per week, as well as men (4) and women (5) students entering medical school. In all groups the mean body mass index and waist-to-hip ratio were at the upper level of the normal range, while body fat percentage was similar to standards for sedentary subjects. Better motor performances were obtained from the basketball and handball players than from the other groups. Static strength for the sample was somewhat above the normal sedentary level. The resting blood pressure and heart rate for most subjects were in the normal. Cardiovascular risk factors were found in six students. Their systolic blood pressure was above 140 mm Hg. There were no subjects identified with low blood pressure. The heart rate was elevated for three students from the recreational group, and in the women. Bradycardia did not occur. The vital capacity and the ability to hold one's breath was at the upper level of the normal range. The present results emphasis the need to improve the students` prevention oriented life style through participation in exercising.

It is well known that regular physical exercise is an important determinant of healthy life style, and, to the contrary, physical inactivity is a serious risk factor for many diseases.[1-5] We examined the exercise habits and the physical condition of medical students. Medical students were studied because of the presumption that they were knowledgeable about exercise and would have future influence on their patients. However, there is evidence of a sharp contrast between their knowledge about the benefits of regular physical activity and their participation in exercising. Over 50% of the second-year medical students responding to a questionnaire reported no significant physical activity.[6] According to our previous pilot study there are only a few elite athletes (<3%) among the medical students. The proportion of the students who report regular sport activities was estimated at 49% for women and 22% for men (unpublished data). The others either participate in recreational activities irregularly at low level, or participate in the amateur sport-teams of the medical school, and do regular training at least two times per week. It was suggested that medical school schedules and demands appear to be the major factors hindering student exercise.[7] We examined the anthropometrical characteristics, the motor abilities and the cardio-respiratory functions of the medical students to demonstrate that their extracurricular recreational activity is insufficient to develop a high level of physical conditioning and to prepare prevention-oriented behavior for the future physician.

Subjects and Methods

The subjects were 87 medical students who agreed to participate in the study. They represent about 10% of the total student body of our medical school. All subjects participated in the examinations voluntarily with written informed consent. The Ethics Committee of the Medical School of University of Pécs permitted the study.

The participants were arranged into five categories: (1) recreational, (2) basketball and (3) handball players in the amateur teams, as well as men (4) and (5) women students at entrance to medical school. Members of the first group participate in sports (mainly football) occasionally without guidance of a physical education instructor. Basketball and handball players were coached at least two times per week. Fifteen participants were in the 1st, 2nd and 3rd groups, and 14 and 28 students in the 4th and 5th groups, respectively. We involved also women students from the first year for further follow up studies. The examination of the subjects started by recording the personal data followed by anthropometrics, dynamometry and measurement of cardio-respiratory

functions. Thereafter the motor tests were performed in the gymnasium.

Anthropometrical measures and body mass index were determined. Body fat was measured with bio-electric impedance technique (OMRON BF 300). Waist to hip ratio was also calculated.

Motor performances were measured by the tests based on EUROFIT.[8] The tests for this study were selected to give satisfactory assessment of the physical condition during tolerable time (about 30 min) for the subject. Measuring hip static flexibility: the subjects were standing on a footstool with feet together and knees straight. The task was to bend forward to reach for the maximum bending, and maintaining this position for two seconds. The maximum distance between the surface of the footstool (0 level) and the middle finger tip was measured, and expressed by negative numbers above the 0 level, and positive numbers below the 0 level. The result is given in centimeters (cm). Students also completed the "flamingo balance test" where the student balanced on one leg (shoeless) on a 50 cm long, 4 cm high, and 3 cm wide wood beam. A record was made of the number of attempts needed to keep in balance on the beam for one whole minute.

Motor coordination was measured by zigzag dribbling the basketball at maximum speed on 14 meter (m) long distance among traffic cones two m apart. This specific skill was believed to differentiate well among subjects.

Explosive strength was measured by vertical jump test. First the reach height was measured when the subject was standing erect on a smooth surface and lifting up his arm. Then the vertical jump was tested. The difference in distance between the reach height and the jump height is the score. The result is given in cm.

Static strength of hand and back muscular groups was measured by appropriate dynamometers (JAMAR grip tester, BACK-A). The arm and shoulder *muscular endurance* was measured by maintaining a bent arm position while hanging from a bar. The result is given in seconds. To obtain information about cardiorespiratory functions we measured the resting arterial blood pressure, heart rate, vital capacity and duration of breath holding after maximum inspiration.

Descriptive statistics and ANOVA were used for statistical analysis.

Results

The age of the participants was 19,6±0,5 (mean±standard deviation) years. Members of the first group did not participate in physical training on a regular basis, but performed some recreational activities (football, swimming, tennis, etc.) irregularly during their leisure time. The basketball players had participated in sports for 8,7±1 years and the handball players for 9,2±0,6 years. The physical activity of the students at entrance to medical school was very variable. None of the students participated in a sport team.

Table 1

Body Measures (mean±SE)

Groups	Height (cm)	Weight (kg)	Body mass index	Body fat (%)	Waist/hip ratio
Recreational	**182.9**	**78.8**	**23.5**	**14.4**	**0.95**
	±1.7	±4.2	±1.0	±1.6	±0.01
Basketball	**184.1**	**79.5**	**23.5**	**12.8**	**0.96**
	±1.4	±2.1	±0.5	±5.4	±0.02
Handball	**180.6**	**80.7**	**24.7**	**13.0**	**0.95**
	±1.7	±3.5	±0.7	±1.3	±0.03
1st year men	**179.5**	**73.8**	**23**	**12**	**0.9**
	±1.8	±2.9	±0.9	±1.5	±0.01
1st year	**165.2**	**57.6**	**21.1**	**19.8**	**0.80**
women	±1.2	±1.4	±0.4	±1	±0

Body Measures - The body measures are summarized in Table 1. There were no statistically significant differences among the groups of male students. The mean values of body mass index and the waist to hip ratio are at the upper level of the normal range, while the body fat percentages are at average compared to normal values. However, there was one individual with 29% body fat occurred in the recreational group. The maximum value in the basketball and the handball groups were 25% and 22% respectively. The freshmen's body measures are somewhat lower than that of the others, but these differences are not statistically significant. As it was expected, the gender differences in the body measures are highly significant.

Motor Function - The data obtained from the motor tests are summarized in the Table 2. The basketball and handball players performed better in all tests than the other groups. The lower performance of women in the motor tests is normal, but it was contrary to our expectation that no statistically significant differences were found in the zigzag dribbling of the basketball. The results of static strength measurements are shown in Table 3. Apart from the gender differences, only the strength of back muscle differences between the groups were statistically significant. All the static strength measures were highest in the handball players.

Cardiorespiratory Functions - As shown in Table 4, the averages of the cardiorespiratory functions were found to be in the normal range. Six students had high systolic blood pressure readings (>140 mm Hg); four in the recreational group, one in the basketball and one in the handball group. Also the heart rate means were in the normal range. Three individual heart rate values were above 80/min in the recreational group. The mean heart rate of the women was 84/min. Two subjects, had heart rates of 60/min , both in the basketball and the handball groups. The means for vital capacity are in the normal range. The subjects' ability to hold their breath was in the normal range. There was at slight but statistically significant difference between the groups in all cardiorespiratory parameters except the diastolic blood pressure.

Table 2
Motor Functions (mean±SE)

Groups	Hip flexibility (cm)	Flamingo test (steps down/min)	Jumping up (cm)	Running (sec)	Zigzag dribbling with basketball (sec)
Recreational	**4** ±2	**8.5** ±1.4	**52** ±1.6	**3.56** ±0.04	**12.01** ±1.4
Basketball	**6.58** ±2	**6.6** ±3.4	**57.8** ±1.9	**3.38** ±0.3	**10.42** ±1
Handball	**9.2** ±2.2	**6.0** ±0.8	**58.5** ±1.75	**3.25** ±0.2	**10.8** ±1.6
1st year men	**0** ±2	**13** ±1.2	**52.4** ±1.34	**3.5** ±0.07	**11.7** ±0.6
1st year women	**11** ±1	**13.2** ±0.9	**37** ±2	**4.1** ±0.05	**13.2** ±0.3
F	**6.5909**	**4.5806**	**26.4817**	**6.4636**	1.5688
P	**0.0001**	**0.0022**	**0.0001**	**0.0001**	0.1904

Discussion

Regular physical activity is an essential part of the healthy life style; therefore, the medical students' attitude towards the regular physical exercise is fundamental in developing prevention-oriented behavior of the future physicians.[9-16] The basketball and handball players were the among the most physically active students. in the medical school. However, there were relatively minor differences between the groups studied. Our intention is to validate these comparisons by follow-up studies starting with the present freshman students.

Table 3:
Static Strengths (kg)

Groups	Right hand (kg)	Back (kg)	Hanging (sec)
Recreational	**46**	**149**	**44.3**
	±4	±7	±2.6
Basketball	**49**	**150**	**49.8**
	±1.4	±5	±3.4
Handball	**50**	**165**	**55.8**
	±3	±10	±5.4
1st year men	**48**	**135**	**51**
	±1.7	±5	±6.5
1st year women	**30**	**74**	**23.8**
	±1	±2	±3.5
F	**19.0678**	**50.0069**	**10.8447**
P	**0.0001**	**0.0001**	**0.0001**

According to the principles of sports physiology, exercising two times a week is insufficient to develop a high level of physical conditioning.[5] Some recreational activities is better than doing nothing. The present data suggest that even this limited level of exercise helps to maintain health. All the averages of the fitness measures were within the normal ranges or somewhat better as compared to standards for sedentary subjects. Considering the frequency of the training, it is not surprising that no significant differences were found among the anthropometrical measures of the selected groups. Statistically significant differences were found between the cardio-respiratory data for the different groups, but these differences are not significant physiologically. However, the individual values of six students need attention. They had body mass index above 24, greater-than-desirable body fat, wrist/hip ratio above 1, and systolic blood pressure around 150 mm Hg. These are risk factors for cardiovascular disease.

Greater body mass index in young men is associated with an increased risk of subsequent knee osteoarthritis [17]. Consequently, the increase in the functional capabilities of the motor system (e.g. flexibility, power, acceleration) is better for physical condition than to improve the body mass index by forcing muscular hypertrophy. Body fat is an important component of body mass influencing various functional properties of the individual.[5] The percent body fat was found to be a significant predictor of VO_2max [18].

Table 4:
Cardiorespiratory Functions

Groups	Systolic BP (mm Hg)	Diastolic BP (mm Hg)	Heart rate (beats/min)	Vital capacity (L)	Breath-holding (sec)
Recreational	**124**	**75**	**79**	**4.26**	**84**
	±3	±2	±3	±0.2	±5
Basketball	**129**	**77**	**71**	**4.59**	**69**
	±2	±2	±3	±0.2	±5
Handball	**125**	**78**	**75**	**4.97**	**89**
	±3	±2	±2	±0.2	±7
1st year men	**133**	**79**	**78**	**4.86**	**65**
	±3	±2	±3	±0.2	±6
1st year women	**121**	**74**	**84**	**3.59**	**41**
	±2	±1	±3	±0.1	±3
F	**3.4801**	1.6643	**2.9513**	**13.5618**	**18.2573**
P	**0.0112**	0.1662	**0.0248**	**0.0001**	**0.0001**

However, besides the absolute body fat, its distribution in the body is essential. A waist-to-hip ratio 1 or higher indicates abdominal obesity, which is an important risk factor for various diseases. The waist-to-hip ratio is related to the life-style, and also secular changes have been published. [19, 20, 21, 22]

It is generally accepted that the resting heart rate of a well-trained, athlete tends to be lower than for a sedentary person.[5, 19, 23, 24] In the present study there were only four students having heart rate of 60/min and none of the 87 students had resting bradycardia. The minor tachycardia that occurred mainly in women might be a sign of the white-coat phenomenon. The resting blood pressure of a well-trained person tends to be at the lower level of the normal range. The systolic blood pressure of our students was normal. It is satisfying that the diastolic blood pressure was between 70 and 80 mm Hg in all groups. The vital capacity is normal for all groups, and the breath holding is slightly longer than that of the sedentary subjects

Basketball and handball players tended to perform better in the motor tests than the other groups. It indicates the value of regular training and the guidance of the coach. We believe the extensive training made the participants more skilful, stronger and faster than the students in the recreational group. However, the comparison of these results with those of the freshmen shows only small increases during the university years. It is comforting that the medical students, involved in this study, are healthy. However, they are not well trained. Their physical condition is below the level desired for a young, athletic man. It shows that their physical activity is behind the optimum for health promotion.

The low physical activity of medical students is probably related to their significant university obligations that leave little time for participating in sports. The finding that students were active in a fitness program when it was associated with an exercise physiology course involved in the curriculum supports this view.[25] A need for more undergraduate medical training in physical activity and exercise prescription was emphasized by a study examining the importance of physical activity in medical schools.[11] We have advocated a plan to involve physical education in the curriculum with the goal of improving the students` exercise habits, and to prepare them for physical activity counseling to advise patients properly.[9, 10]. The results of this study support the view that medical education should direct students' attitude toward exercising, and to increase the prestige of the well-trained physical condition among both the students and the professors.

Acknowledgements

The grant NKFP 1/026, 2001 from the Hungarian Government, and a grant from the Hungarian Society of Sport Sciences supported this investigation. The authors thank Mrs. Ágnes Szabó for her technical assistance.

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