PHYSICAL ACTIVITY IN RELATION TO THE RISK FACTORS FOR THE METABOLIC SYNDROME IN A GROUP OF MEDICAL STUDENTS

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Keywords: *physical activity, metabolic syndrome, risk factors*

Abstract: *Introduction: Physical inactivity has been recognized by the World Health Organization (WHO) as the fourth leading risk factor for global mortality. Aim: our study aimed at exploring the level of physical activity in a group of medical students, in relation to the risk factors for the metabolic syndrome. Methods: we performed a cross-sectional survey on a sample of 235 medical students. Due to the low prevalence of some risk factors, we restrained our analysis to gender and waist circumference (WC). Results: significant difference in energy expenditure and time dedicated to physical activity was found between girls and boys (in favour of boys). Globally, 16% of boys and 28% of girls had lower level of both moderate and vigorous physical activity compared to WHO recommendation. Subjects with increased waist circumference were not engaged in more recreational or vigorous activities compared to those with normal WC. No correlation between WC and physical activity variables was found in boys. In girls, significant, weak, direct correlation was found between waist circumference and energy expenditure for all physical activity and also time for moderate physical activity, but not for recreational or vigorous activities. Conclusion: Our results underline two public health problems. First, it is related to an insufficient level of physical activity in the young medical students, especially in girls, and especially for recreational and vigorous activities. The second problem is related to the passivity of the subjects with increased WC, which do not seem to be engaged in corrective programmes of physical activity. These problems could be higher in the general population of young adults, because our group had a high level of information on healthy lifestyle, being medical students.*

Cuvinte cheie: *activitate fizică, sindrom metabolic, factori de risc*

Rezumat: *Introducere: Inactivitatea fizică a fost recunoscută de Organizaţia Mondială a Sănătăţii (OMS) ca al patrulea factor de risc pentru mortalitatea globală. Scop: Studiul nostru şi-a propus să evalueze nivelul activităţii fizice într-un grup de studenţi medicinişti, în relaţie cu factorii de risc ai sindromului metabolic. Metodologie: Am efectuat un studiu transversal, pe un lot de 235 studenţi medicinişti. Deoarece unii factori de risc ai sindromului metabolic au fost întâlniţi la un număr foarte redus de subiecţi, am restrâns analiza la gen şi circumferinţa abdominală (CA). Rezultate: În studiul nostru s-au evidenţiat diferenţe semnificative statistic în consumul energetic şi în timpul alocat pentru activitatea fizică între băieţi şi fete (în favoarea băieţilor). Per total, 16% dintre băieţi şi 28% dintre fete au avut un nivel scăzut de activitate fizică - atât pentru activitatea fizică moderată, cât şi pentru cea de mare intensitate - comparativ cu recomandările OMS. Subiecţii cu circumferinţa abdominală crescută nu desfăşurau mai multe activităţi fizice recreative sau de intensitate mare (viguroase), comparativ cu subiecţii cu CA normală. Nu s-au evidenţiat corelaţii între variabilele activităţii fizice şi circumferinţa abdominală la băieţi. O corelaţie semnificativă slabă şi directă, a fost găsită la fete, între circumferinţa abdominală şi consumul energetic pentru activitatea fizică globală şi respectiv timpul alocat activităţii fizice moderate. Nici la fete nu s-au evidenţiat corelaţii ale CA cu activitatea fizică recreativă sau viguroasă. Concluzii: Rezultatele noastre descriu două probleme de sănătate publică. Prima este legată de nivelul insuficient de activitate fizică la studenţii medicinişti, în special în rândul fetelor şi în special pentru activităţi recreative şi de intensitate mare. A doua problemă este reprezentată de pasivitatea subiecţilor cu CA mare, care nu par a fi implicaţi în programe de activitate fizică pentru corecţia greutăţii corporale. Aceste probleme pot fi mai accentuate în populaţia generală a adulţilor tineri, deoarece subiecţii noştri au un nivel mai ridicat de informare privind stilul de viaţă sănătos, fiind studenţi medicinişti.*

INTRODUCTION

Physical inactivity has been recognized by the World Health Organization (WHO) as the fourth leading risk factor for global mortality, following high blood pressure, tobacco use, and high blood glucose.(1)

Physical inactivity is estimated to account for 6% of the global deaths and to be the principal cause for approximately

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21–25% of breast and colon cancer burden, 27% of diabetes and 30% of ischemic heart disease respectively.(1) Evidence on regular physical activity show a reduction in the risk of coronary heart disease, stroke, diabetes, hypertension, some cancers (colon, breast), depression and overweight/obesity.(2)

Well conducted studies suggest that regular, moderate-intensity physical activity may be preventive of metabolic syndrome and higher intensity physical activity may lead to greater benefits.(3) On another hand, decreasing in prevalence of physical activity demanding at work and also of daily commuting activities were shown over decades both in males and females.(4)

WHO recommends for the adults aged 18 – 64 years old to perform at least 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity per week.(1) Additional health benefits could be obtained by increasing the level of physical activity to 300 minutes (moderate) or 150 minutes (vigorous) per week.

PURPOSE

Our study aimed at exploring the level of physical activity in a group of medical students, in relation to the risk factors for the metabolic syndrome.

METHODS

We performed a cross-sectional survey on a conjunctural sample of 235 medical students (grade I to V) from the University of Medicine and Pharmacy "Carol Davila" Bucureşti, during the academic year 2010–2011 (70.2% females). The rnrolment in the study was done on voluntary basis, following an informed consent.

The study was approved by the Bioethics Committee of the National Institute of Infectious Diseases "Prof Dr Matei Balş".

Each student was examined clinically - weight, height, waist circumference (WC), blood pressure and also performed some lab tests (HDL cholesterol, triglycerides, glycaemia) and answered to Block Fat/Sugar/Fruit/Vegetable Screener combined with Block Physical Activity Screener for Adults.(5,6)

The questionnaires were translated into Romanian and the translation was verified as retroversion by an independent translator. The questionnaires were self-administrated on-line, and their registration was made only after filling in all blanks. The Block Physical Activity Screener for Adults includes 11 questions related to domestic activities (4), physical activity at work (4) and leisure time activities.(3)

Estimates for energy expenditure (for all activities and for recreational ones) and also for daily time (minutes) dedicated for physical activity of various intensities (light, moderate, vigorous) are provided by answering the questionnaire.

The data were analyzed based on Nutrition Quest methodology. The characteristics related to physical activity (energy expenditure and estimated time) were projected to be analyzed by gender and risk criteria for the metabolic syndrome. We considered the risk criteria for the metabolic syndrome according to the definition of the International Diabetes Federation: central obesity expressed by WC >94 and >80cm in boys and girls respectively, systolic blood pressure (SBP) > 130 mmHg or diastolic blood pressure (DBP)> 85 mmHg, increased fasting glucose (>100mg/dl), high density lipoprotein cholesterol (HDLc) < 40 / 50 mg/dl in boys and girls respectively, and value of triglycerides>150mg/dl.(7) Due to the very limited number of subjects with abnormalities in blood pressure, glucose, HDLc and triglycerides (8), we limited our analysis only to the relation to WC.

Data analysis: After testing for normality, indicators of central tendency and dispersion were calculated for all quantitative variables Differences by gender or by WC were assessed using the Mann Whitney U Test and $p<0.05$ was considered for the statistical significance. Spearman correlation was used to analyze the relation between WC and physical activity variables. All analysis was performed using the Statistical Package for the Social Sciences (SPSS) v 17.0.

RESULTS AND DISCUSSIONS

Population demographic characteristics and prevalence of risk criteria for the metabolic syndrome were described elsewhere.(8,9)

Analysis of physical activity by gender: Energy expenditure and time for physical activities in boys and girls are shown in table no. 1. High variability in the level of physical activity was found in each gender (the SD values are even above the mean). However, in terms of energy expenditure, boys seemed to spend more kilocalories for physical activities daily, compared to girls (Average: 1002.2 versus 517.8 kcal for all physical activity and 421.3 versus 155.1 kcal for recreational activities in boys and girls respectively; Median: 643.6 versus 384.8 kcal for all activities and 225.8 versus 94.8 kcal for recreational activities in boys and girls respectively, $p<0.001$).

There is a significant gap in energy expenditure in boys compared to girls (in favour of boys), and this gap tends to be higher for the recreational activities (median energy expenditure ratio in boys compared to girls reached 1.7:1 for all activities and 2.4:1 for recreational activities).

In terms of dedicated time, boys were also found to spend significantly more time than girls daily for vigorous physical activities (median time: 27.6 compared to 9 minutes daily in boys and girls, $p<0.001$) and for recreational activities (median time: 40 versus 19.8 minutes daily, $p<0.001$). Median time ratio reached 3:1 for vigorous activities and 2:1 for recreational activities (boys versus girls). No significant differences were found in the time spent for low or moderate physical activities.

Table no. 1. Energy expenditure and time for physical activity by gender

	Boys				Girls				
Parameter	**Mean**	**Median**	**Min**	**Max**	**Mean**	**Median**	**Min**	**Max**	**P*-value**
Energy expenditure (kilocalories per day)									
All activities	1002.2±918.9	643.6	215	2208	517.8±467.0	384.8	38	1983	<0.001
Recreational activities	421.3±516.7	225.8	0	1400	155.1±229.7	94.8	0	783	<0.001
Time for physical activity (minutes per day)									
Low intensity	113.1±96.8	82.8	9	315	101.9±90.1	68.1	9	365	0.424

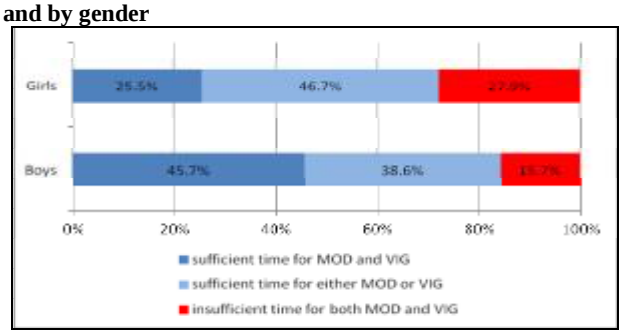
Moderate intensity	61.4±80.2	27.2	2	225	43.6±53.7	23.4	0	200	0.212
Vigorous intensity	45.1±52.5	27.6	2	180	15.0±23.9	9	0	72	<0.001
Recreational activities	61.7±74.4	40	0	194	29.8±37.9	19.8	0	117	<0.001

*Mann Whitney U test

According to WHO recommendation, for maintaining a good health, each adult needs at least 150 or 75 minutes of moderate or respectively vigorous physical activity per week (in average 21.4 and 10.7 minutes daily), but additional health benefits could be obtained for a doubled time. In our study, only 26% of girls and 46% of boys spent sufficient time for physical activity (above the WHO recommendation) for both moderate and vigorous activities, reaching so the maximum possible benefit for their health (figure no. 1).

Another 39% of boys and 47% of girls spent insufficient time for either moderate or vigorous activities, but 16% of boys and 28% of girls spent insufficient time for both moderate and vigorous physical activity compared to WHO recommendation.

Figure no. 1. Proportion of subjects according to the daily time dedicated to moderate and vigorous physical activity and by gender



Analysis of physical activity by WC: By analyzing the relationship between WC and physical activity we could expect either an indirect correlation (those with higher WC are less active), either a direct one (those with higher WC become more active in an attempt to lose weight).

In our overall group of subjects, the Spearman correlation coefficient suggests a direct but weak correlation of waist circumference with all the variables of physical activity. (table no. 2). However, these correlations were significant only for energy expenditure for all activities and for time dedicated to low and moderate physical activities.

No correlation was found with recreational and vigorous activities. No significant correlations were found in boys.

In girls, significant correlations were found in energy expenditure for all activities and in time for moderate activities. This means that increased waist circumference in girls is associated to increase in energy expenditure for all activities and increase in time for moderate activities, but not to more recreational or vigorous activities. So, the girls with increased WC do not practice, unfortunately, more recreational or vigorous activities.

Table no. 2. Correlations between WC and physical activity variables

Population	Parameter	Waist circumference	Energy expenditure (calories per day)		Time for physical activity (minutes per day)			
			All activities	Recreational activities	Low intensity	Moderate intensity	Vigorous intensity	Recreational activities
Overall	Correlation coefficient		.268	.122	.154	.174	.049	.089
	Sig. (2-tailed)		.000	.062	.018	.008	.453	.173
Boys	Correlation coefficient		.145	.005	.142	-.012	-.104	-.014
	Sig. (2-tailed)		.233	.966	.242	.922	.392	.907
Girls	Correlation coefficient		.255	.106	.141	.232	.032	.083
	Sig. (2-tailed)		.001	.177	.071	.003	.679	.289

The increased WC is an important criterion for diagnosis of the metabolic syndrome. We divided our subjects (each gender) in two groups: normal WC and increased WC, upon the international limits (above 94 cm and 80 cm in males and females respectively). 11 from 70 boys (16%) and 105 from 165 girls (64%) had increased WC. The analysis of medians for energy expenditure and time of physical activities did not show any significant difference in boys, although these medians seemed to be higher in the group of boys with high WC for all the variables except for the nergy expenditure for recreational activities and time for vigorous activities (table no. 3).

Also, in girls, all the variables seemed to have a higher median in the increased WC group, except for the time for vigorous activities. But significant differences in medians were found only for energy for all activities and for time, for moderate activities (table no. 3)

Increased WC both in males and females is recognized as a risk factor for the metabolic syndrome. So, the subjects with increased WC, especially in the young age suppose to be targeted by corrective interventions, involving implicitly an increased level of physical activity. This increasing in physical activity is

expected to be obtained especially from recreational activities. However, in our group, the subjects with increased WC were not significantly more active than the normal subjects in terms of recreational or vigorous activities.

Table no. 3. Medians for energy expenditure and time of physical activity by waist circumference

Gender	Boys			Girls		
Parameter	Normal WC	Increased WC	p-value*	Normal WC	Increased WC	p-value*
Energy expenditure (calories per day)						
All activities	638.1	983.9	.493	296.6	455.1	0.004
Recreational activities	226	178.3	.669	85.7	116.5	0.266
Time for physical activity (minutes per day)						
Low intensity	76.5	108.9	.550	63.9	73.4	.116
Moderate intensity	26.4	45	.483	20.4	27	.031
Vigorous intensity	27.9	18.9	.388	9	6.5	.498
Recreational activities	37.8	54.5	.790	18.9	22.5	.532

All our results need to be interpreted considering the limitations of the research. First of all, we enrolled a limited number of students (235) on voluntary basis (not randomly). We did not consider the year of study or the differences in programme (that could influence the level /energy expenditure for all activities) and the tool used for data collection was validated only for translation.

CONCLUSIONS

Girls were less active than boys in our study. We found significant differences by gender (in favour of boys) in daily energy expenditure for all activities and for recreational activities, but also in time for vigorous and recreational activities. Despite their excess of weight, subjects with increased WC were not more active than those with normal WC.

Our results identified therefore, two real public health problems. The first is related to an insufficient level of physical activity especially in girls and especially for recreational and vigorous activities. Another problem is related to the passivity of those subjects with increased WC, who do not seem to be engaged in corrective programmes of physical activity. These problems could be more expressed in the general population of young adults, because our group has a higher level of information on healthy lifestyle, being medical students. Further research is needed to explore the status of physical activity in the general population of young adults.

Also public health interventions are needed, aiming at increasing the level of physical activity, especially in girls and in subjects with abnormal WC, with focus on recreational and vigorous activities.

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