Trakia Journal of Sciences, No 4, pp 325-328, 2013

Available online at:
http://www.uni-sz.bg

ISSN 1313-7050 (print)
ISSN 1313-3551 (online)

Original Contribution

FUNCTIONAL AND ANTROPOMETRIC INDEXES FOR PHYSICAL WORKING CAPACITY EVALUATION IN YOUNG MEN

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ABSTRACT

Overweight and obesity are one of the basic health problems of the contemporary days.

Goal: estimation of youth physical working capacity in order healthy status and risks to be determined and prognosticated.

Material and methods: young men – 8 controls with normal body mass index (BMI) and 8 with overweight have gone ergospirometric test. The followed up parameters were: absolute and relative ergometric working capacity (WC), oxygen consumption (VO2), oxygen pulse $VO2.HR^{-1}$, respiratory quotient (RQ), heart rate (HR), systolic and diastolic arterial blood pressures (SBP, DBP).

Results: Young men with normal BMI (22.6±1) have better $WC.\ kg^{-1}$ ($P<0.05$) and higher $VO2.kg^{-1}$ at anaerobic threshold ($P<0.05$). Hypertension of diastolic type within submaximal activity in 50% of all the both followed up groups is registered.

Conclusion: The physical working capacity is decreased in young men with overweight.

Key words: physical working capacity, ergospyrometry, BMI, overweight.

INTRODUCTION

Overweight and obesity are among the basic problems for optimal health status nowadays. Their increasing frequency in young people is thought to be in correlation with decreased physical activity and irrational diet. According Garrison et al. overweight in men predicts essential hypertension etiology in 75% (1). It is considered that overweight determines prehypertonic reactions in young too (2). Physical activity is of major significance in obesity related hypertension (3). Regular physical activity decreases the risk of hypertension, coronary artery disease, insult, osteoporosis and depression. It is an important factor in socially significant diseases' prophylaxis (4, 5).

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GOAL

Young men' physical working capacities to be followed up in order their health status to be determined and eventual future risks to be predicted.

MATERIAL AND METHODS

Sixteen young men (students) - volunteers of age 20 – 25 years, not smokers, not trained and without any medication were followed up. They were divided into two groups: the first one (control) - healthy with normal BMI (group C) and the second one - with overweight (group E). The participants passed through medical examination and gave informed consent. The parameters that were registered were: anthropometric (Tanita BC 420, Japan), clinical: lipids (Olympus AU-600 autoanalyser, Olympus Corp., Japan), oral glucose tolerance test (Omnitest plus, B. Braun, Germany) and functional, carried up by ergometric test with step loading in a mode of an increasing intensity till refuse (Schiller AT104 SpiroErgo, Switzerland) – **Figure 1**.

Figure 1. Spiroergometric test provided with SCHILLER AT104 SpiroErgo (Switzerland) system.

The followed up indexes were:
- anthropometric: BM - body mass in kg, BMI - body mass index in kg.m-², waist and tip circumference and waist hip ratio;
- clinical chemistry: TC – total cholesterol in mmol.l^{-1}, HDL-C – high density lipoprotein cholesterol in mmol.l^{-1}, TG – triglycerides in mmol.l^{-1} and blood sugar profile in mmol.L^{-1};
- functional (at the start, at reached anaerobic threshold and at the end of the 5th minute): absolute and relative working capacity in W, W.kg^{-1}; VO2 - absolute and relative oxygen consumption in ml.min^{-1}, ml.min^{-1}.kg^{-1}, absolute and relative oxygen pulse - VO2.HR^{-1}, VO2.HR^{-1}.kg^{-1} in mlO2.bt $^{-1}$,' mlO2.bt $^{-1}$.kg $^{-1}$, HR - heart rate in bt.min $^{-1}$, systolic and diastolic arterial blood pressure (SABP and DABP) – in mmHg, RQ - respiratory quotient, anaerobic threshold (AT), expressed as % of the theoretical W max (W- AT % Wmax pred).

The data were statistically processed by SPSS 16.0 (Windows), descriptive statistics and pair t-test and expressed as X ±SD.

Within the spiroergometric test the following protocol of loading was used:
The examination begun with synchronizing the gauging – 40 seconds at physical rest, followed by 1-3 minutes period of warming up and real loading with step increasing manner of 30W every 2 minutes at velocity speed of 55-60 revolutions per minute till refuse. The recovery period was 10% of the peak loading for 5 minutes minimum.

The spiroergometric test was carried out at any lack of previous day heavy physical activity.

RESULTS

BMI of the controls is 22.6±1, while that of E group - 29.7±3.3 - ($p<0.05$).

Students from C group have higher relative, although doubtful VO2 and oxygen pulse and higher VO2.kg $^{-1}$ at anaerobic threshold ($p<0.05$). Students with obesity (E group) have worse relative ergometric WC ($p<0.05$) and lower although doubtful percentage of anaerobic threshold related to the theoretical maximal work capacity.

According to Weber's five degree scale, representing the physical working capacity (PWC), all students showed VO2.kg^{-1} – AT higher than 14 ml.min^{-1} kg.

The results, representing the functional tests at rest, within the loading and at the end of the 5th minute, are represented in **Tables 1, 2 and 3** respectively.

Table 1. *Variables at the start*

Variables	Normal Body Mass (n=8)	Overweight (n=8)	P
SBP (mmHg)	136.00±3.30	132.50±4.41	NS
DBP (mmHg)	79.20±8.10	83.30±4.10	NS
HR (bt.min-¹)	103.10±3.10	101.10±3.82	NS
VO2 (ml.min-¹)	564.12±91.12	650.±19	NS
Weist/hip ratio	0.82±0.10	0.77±0.10	NS
BMI	22.60±1.00	29.70±3.31	P<0.05

Table 2. *Variables within loading*

Variables	Normal Body Mass (n=8)	Overweight (n=8)	**P**
VO2 peak (ml. min-¹)	2390.12±726.23	2949.13±284.22	NS
VO2 peak.kg-¹ (ml.min-¹.kg-¹)	35.00±9.61	31.10±3.20	NS
VO2.kg-¹ (ml.min-¹.kg-¹)	20.72±3.34	17.81±1.84	P<0.05
VO2.HR-¹ (mlO2.bt-¹)	13.50±3.62	17.16±0.10	P<0.05
VO2.HR-¹.kg-¹(mlO2.bt-¹.kg-¹)x100	19.12±5.01	17.22±3.03	NS
RER peak	1.03±0.64	1.02±0.62	NS
HR peak (bt.min-¹)	181.00±6.20	176.31±17.21	NS
HR (mmHg)	143.67±16.81	128.00±9.61	NS
SBP (mmHg)	159.00±11.10	162.51±16.00	NS
SBP peak (mmHg)	181.72±14.70	190.12±11.00	NS
DBP (mmHg)	90.00±12.60	90.00±5.51	NS
DBP peak (mmHg)	95.00±12.21	97.50±6.13	NS
Wmax.kg-¹	3.50±0.10	2.80±0.30	P<0.05
W-AT % от Wmax. Pred.	40.30 ±5.30	38.00±4.50	NS

Table 3. *Variables at the end of 5th minute*

Variables	Normal Body Mass (n=8)	Overweight (n=8)	**P**
VO2 (ml.min-¹)	0.98±0.10	1.25±0.20	NS
VO2.HR-¹ (mlO2.bt-¹)	7.51±0.75	8.32±1.22	NS
RER	0.90±0.61	0.90±0.82	NS
SBP (mmHg)	142.53±9.90	147.50±24	NS
DBP (mmHg)	74.10±12.80	83.33±8.80	NS
HR (bt.min-¹)	146.30±13.00	139.53±16.31	NS

Hypertension of diastolic type at submaximal loading has been registered in 50% of all of both the followed up groups – in 30% of the students with overweight and in 20% with normal BMI.

As far as clinical chemical results are concerned, 21% of the students from E group are with higher TC and LDL-C and 14% - with higher TG. In C group lipids indexes are normal. The oral glucose tolerance test is in referent limits as in C as in E groups.

DISCUSSION and CONCLUSION

Our results, as more of the data discussed in the references, expressed the fact that the relative

functional indexes are more indicative for comparative analysis (6, 7).

PWC is not reduced as in C as in E groups. But instead of that only 18% of all the students showed PWC being 80-85% of the theoretically calculated – a data indexing decreased physical activity in the followed up groups of healthy men – students.

Students with obesity (E group) have lower relative doubtful VO2 peak, lower relative doubtful oxygen pulse, lower relative VO2 at anaerobic threshold ($p<0.05$) and lower relative ergometric WC ($p<0.05$) – indexes proving the reduced obesity students' PWC (8).

The registered hypertensions of diastolic type within submaximal loading in 30% of E group and 20% of C group are probably result of lack of physical activity and irrational diet (9).

The higher percentage of the increased plasma lipid fractions indexes in obesity students is a predictor for increased cardiovascular risk (10).

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