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PHYSIQUE, BODY COMPOSITION AND AEROBIC PERFORMANCE OF MALE TEACHER EDUCATION STUDENTS

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ABSTRACT. Students in teacher education programs will have all sorts of assignments related to education at the public school setting, so it is important for them to carry a healthy active way of life and become a role model in this area as well. The aim of our survey was to characterize the status of physique, body composition and aerobic performance of male teacher education students at the beginning of their first year in program and at the end. All first year male students were selected at the teacher training program at Apáczai Csere János Faculty, University of West Hungary (N=102). Results in most areas were within a normal adult range. There were no difference in the physique characteristics between students in general teaching program and students in PE and sport program (Height, Weight, Metric and Plastic Index), but there were significant difference in body composition and Cooper-test results. The results did not change significantly over the year. It would be important to support teacher education students with scheduled and professional health-related training program based upon their individual needs and expectations towards healthy active living.

Keywords: teacher education, male students, physique, body composition, aerobic performance

Introduction

It seems that an unambiguous negative trend currently characterizes people's way of life, their different addictions and their level of fitness in most European countries. The complex and undesirable consequences of inactive lifestyle are now well recognized and necessary steps have been taken in many

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societies (Ridgers et. al., 2009). It is well documented that sedentary lifestyle is a strong risk factor for all age groups in chronic and non-communicable diseases (Pischon et al. 2008). However around one third of adolescents and adult population is physically inactive worldwide (WHO, 2011).

Measuring anthropometric characteristics is a useful mean to verify significant aspects of the population's health status (Radu, Hazar & Puni, 2014). Regular physical tests are also important because it reflects the body's adaptation to long-term physical and mental load and so ultimately the level of health (Degens et al., 2013; Meyers et al., 2015). The most accurate way to characterize the level of adaptation is to measure maximum oxygen intake and oxygen transfer under laboratory conditions. However, in everyday practice it is less complicated and inexpensive to use certain field tests (Szmodis, 1978). It is important to consider that abilities other than the functional capabilities of organs and organ systems also influence physical performance (Jaakkola et al., 2013; Blanchfield, et al., 2014). When anthropometric characteristics and performance are assessed, then all abilities and skills are considered altogether that impact performance level.

In most statistics from European countries, men appear as more active than most women are (Gerovasily et al, 2015). However, there are still questions raised about the characteristics of active lifestyle, body composition and performance as related to gender.

Higher education setting could serve efficient means to consolidate students' personal and professional lifestyles for healthy active living (Romaguera et al. 2011). Teacher education students will have teaching assignments at the primary or secondary school level, so it is important for them to understand their health and fitness status and become a role model in this area as well. From this information, future teachers' dedication and healthy active behaviour can be evaluated. Role modelling is a clear expectation towards teachers so the system of higher education gives students a good opportunity to adopt a healthy lifestyle.

The health-related indicators of the Hungarian population have been declining with cardio-respiratory problems and obesity being the main mortality causes (Szabó & Frenkl, 1996). Risk factors of metabolic and cardiovascular diseases are already present at school-age children and have a negative effect not only on physical but also on cognitive and affective functions (Anderssen et al., 2007; Aber et al., 2009). According to Gerovasily et al. (2015), the 18-64 years population's 32,8% of physically inactive and 52,7% highly active in Hungary.

The aim of our survey was to characterize the status of physique, body composition and aerobic performance of male teacher education students at the beginning of their first year in college and at the end. It was also our goal to compare the general education majors with those of the PE and Sport majors.

Methodology

Sample

All first year male students were selected at the teacher training program at Apáczai Csere János Faculty, University of West Hungary (N=102). The sample was divided into two groups based upon their field of study. Students in Non-PE group were gathered from general education program and they participated in two physical education lessons a week (non-PE group) (n=51, M_{age}=19,35). Students from the PE group were from the PE and Sport program and participated in 2-3 PE and health related theoretical and 6-8 physical activity practical courses (n=51, M_{age}=19,50).

Every participant signed an informed consent form. The research was conducted in agreement with the Declaration of Helsinki.

Data collection

Physique was examined according to the suggestions of Conrad (1963), body composition was determined following the methodology of Drinkwater and Ross (1980). Conrad's technique assumes the knowledge of body dimensions. It characterizes physique along two main paths of evolution. Types are summarized in indices derived from body geometry. The metric index (MIX) that describes variants of physique and body ratios, and the associated plastic index (PLX) that characterizes the development status of the musculoskeletal system, form a rectangular coordinate system, in which individual types are represented by discrete points.

The vertical axis is MIX: the linear function of the chest diameters (width, depth) adjusted with body height (roundness factor), that proved to be specific to the picnic or leptosome nature of physique (Szmodis et al., 1976). The horizontal axis is PLX: the arithmetical sum of three measures that are specific to the skeletal system and to the muscular system (shoulder width + lower arm girth + hand circumference). The growing number of experiences related to the index refers to the fact that MIX (which is based on bone measurements) indicates what and when has been realized from the hereditary (genetic) tendencies (Mészáros et al., 2001).

The body composition assessment method by Drinkwater and Ross determines the quantity of each body component, the sum of these must equal to the body weight that can be measured easily. With this methodology, the human body can be divided into the following fractions: striated muscle mass, bone mass, essential and storage body fat, and residual mass, which is mainly the visceral mass. To describe body composition, muscle mass as a percentage of total body weight we utilized. Also, body fat values were calculated in percentages of body weight (BF%) according to the suggestions of Pařišková (1961) and used measurement data of skinfold tests at biceps, triceps, subscapular, suprailiac and calf. With the 12 minute walk-run test (Cooper-test) aerobic endurance was estimated. Cooper found a correlation of r=0,9 between running performance and the maximum oxygen intake (VO_2 max) measured during spiroergometry (Cooper, 1970).

All tests were carried out in the beginning of fall term in 2010 and at the end of spring term in 2011. Each student was assessed twice to see if there are any differences in the parameters. The data of those students that missing in one or more measurements were taken out before statistical analyses.

Data analysis

After calculating basic statistical indicators (mean, standard deviation), the difference between two groups were carried out with two-sample t-test ($p<0.05$). To assess if there were any difference between the two data collections, paired t-test was applied ($p < 0.05$).

Results

PE vs. Non-PE groups

There were no difference between the age of the PE and non-PE and the standard deviations are moderate. The statistics of the two groups (PE; Non-PE) with the results of the two-sample t-test are shown in tables 1 and 2.

There was no difference observed in the physique characteristics of the two groups (BH, BW, MIX, PLX), but discovered a significant difference in body composition (BF %, M %) and Cooper-test result averages at both measurements (Tables 1 and 2). At the first examination the metrical index that refers to the linearity of the physique showed remarkable deviation around the mean value (PE_{2010}: 36,36, non-PE_{2010}: 44,61), which did not decrease for the second assessment (PE_{2011}: 35,33; non-PE_{2011}: 44,27). In case of the relative body fat mass there were already notable deviations at the first assessment, which increased further for the second one (PE_{2010}: 29,64; non-PE_{2010}: 26,59; PE_{2011}: 37,47; non-PE_{2011}: 30,13).

Table 1. Indicator differences between the groups in the fall of 2010

	PE_{2010} students (n=51)			Non-PE_{2010} students (n=51)			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,35	1,10	5,68	19,5	1,15	5,89	NS
BH (cm)	177,57	7, 64	4,30	177,42	7,51	4,23	NS
BW (kg)	70,41	11,74	16,67	69,42	10,47	15,08	NS
MIX	-1,32	0,48	36,36	-1,30	0,58	44,61	NS
PLX	87,69	4,79	5,46	86,56	3,96	4,57	NS
BF %	14,81	4,39	29,64	17,9	4,76	26,59	p<0,05
M %	45,19	1,81	2,21	43,02	2,94	6,83	p<0,05
Cooper (m)	2570,8	343,9	13,37	2295,1	319,1	13,90	p<0,05

Abbreviations: BH = body height, BW = body weight, MIX = metric index, PLX = plastic index, BF % = body fat percent, M % = muscle mass percent, Cooper = Cooper-test, NS = the differences between the averages is not significant, *= the differences between the averages is significant; CV=coefficient of variance.

Table 2. Indicator differences between the groups in the spring of 2011

	PE_{2011} students (n=51)			non-PE_{2011} students (n=51)			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,8	1,11	5,68	20,1	1,2	5,89	-
BH (cm)	177,41	7,57	4,25	177,2	7,27	4,10	NS
BW (kg)	71,65	12,48	17,41	69,25	10,0	14,44	NS
MIX	-1,33	0,47	35,33	-1,31	0,58	44,27	NS
PLX	88,31	4,96	5,61	86,21	3,58	4,15	NS

	PE_{2011} students (n=51)			**non-PE_{2011} students (n=51)**			
BF %	14,17	5,31	37,47	16,46	4,96	30,13	p<0,05
M %	45,57	1,95	8,34	43,88	2,07	4,71	p<0,05
Cooper (m)	2559,7	304,9	11,91	2268,8	274,8	12,11	p<0,05

Abbreviations: BH=body height, BW=body weight, MIX=metric index, PLX=plastic index, BF %=body fat percent, M %=muscle mass percent, Cooper=Cooper-test, NS=the differences between the averages is not significant; CV=coefficient of variance.

Pre- and post-test

The differences over time within the groups are presented in tables 3 and 4. There were no difference between the results of groups $PE_{2010\text{-}2011}$ and non-$PE_{2010\text{-}2011}$.

Table 3. Differences between the two examinations of PE group (n=51)

	PE_{2010}			**PE_{2011}**			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,35	1,1	5,68	19,8	1,1	5,68	-
BH (cm)	177,57	7, 64	4,30	177,41	7,57	4,25	NS
BW (kg)	70,41	11,74	16,67	71,65	12,48	17,41	NS
MIX	-1,32	0,48	36,36	-1,33	0,47	35,33	NS
PLX	87,69	4,79	5,46	88,31	4,96	5,61	NS
BF %	14,81	4,39	29,64	14,17	5,31	37,47	NS
M %	45,19	1,81	2,21	45,57	1,95	8,34	NS
Cooper (m)	2570,8	343,9	13,37	2559,7	304,9	11,91	NS

Abbreviations: BH = body height, BW = body weight, MIX = metric index, PLX = plastic index, BF % = body fat percent, M % = muscle mass percent, Cooper = Cooper-test, NS = the differences between the averages is not significant, *= the differences between the averages is significant; CV = coefficient of variance.

Table 4. Differences between the two examinations of non-PE group (n=51)

	non-PE2010			non-PE2011			
Variable	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**p**
Age (year)	19,5	1,15	5,89	20,1	1,2	5,89	-
BH (cm)	177,42	7,51	4,23	177,2	7,27	4,10	NS
BW (kg)	69,42	10,47	15,08	69,25	10	14,44	NS
MIX	-1,3	0,58	44,61	-1,31	0,58	44,27	NS
PLX	86,56	3,96	4,57	86,21	3,58	4,15	NS
BF %	17,9	4,76	26,59	16,46	4,96	30,13	NS
M %	43,02	2,94	6,83	43,88	2,07	4,71	NS
Cooper (m)	2295,1	319,1	13,90	2268,8	274,8	12,11	NS

Abbreviations: BH=body height, BW=body weight, MIX=metric index, PLX=plastic index, BF %=body fat percent, M %=muscle mass percent, Cooper=Cooper-test, NS=the differences between the averages is not significant, *=the differences between the averages is significant; CV=coefficient of variance.

Discussion, conclusions

Obesity is viewed as an imbalance between the energy amounts of intake nutrition and the level of physical activity (Farrel et al., 1998; Blair and Brodney, 1999; Wei et al., 1999). Flegal and Troiano (2000) already consider a little overweight as major health risk if it comes together with abdominal obesity. Our results demonstrate an average development regarding body height and body weight (Bodzsár, 1999; Fehérné, 1999; Joubert et al., 2006).

Differences between body dimensions, physique and body composition of the same gender, similar biological age and race are significant, which means that the anthropometric characteristics of healthy individuals may vary within very broad limits (Frenkl et al., 1987; Mészáros et al., 1989; Carter and Heath, 1990; Bouchard, 1991). The mean values and deviations of metric and plastic indices that represent growth types of our subjects show the differences in body composition. The metric index that refers to the linearity of the physique is slightly within the negative domain, the subjects are metro-leptomorf types. A normo-plastic musculoskeletal system is associated with this form indicator. The mean values of the metric index are basically identical at both groups. When evaluating the results we cannot ignore the huge standard deviations (around 35-45%) of the metric index. It is assumed that this remarkable deviation around the mean value is due to the high variability of body composition and to relatively low sample size.

The almost linear growth of body fat mass is a non-necessary, but a general consequence of secular changes (Eiben, 1985; Bodzsár, 1998; Mohácsi et al., 1994; Mészáros et al., 2001; Frenkl & Mészáros, 2002). Values of relative body fat mass are within the physiologically normal range, but the difference between the groups is significant at every assessment. Relative deviations were around 30% at the beginning and have increased significantly by the end of the test period.

We also found participants in both groups who were outside the healthy domain. It is certainly a fortunate sign and a justification of the positive effect of regular exercises on body composition that the members of the PE group are at the lower end of the healthy range (14-18%), but deviations are great even in their case (Zaccagni et al., 2014). Body composition is a highly variable attribute, and as we know, it depends on gender and age, and also on physical activity, hence we emphasize that teacher education students choose area of subject domain (for example physical education, arts, languages, etc.) after their successful entrance examination.

There are those students in the program who never competed in any sports, but after entering the university, they decided to study sports science. This explains that extreme physique and disadvantageous body composition are appearing within the PE group also.

The muscle mass relative to body weight is at the ideal level of around 45% only in case of the PE group. The difference exists between the two groups at every examination. Within the Non-PE group moderate physical activity resulted in the retardation of the musculoskeletal system (M% Non $PE_{2010-2011}$: 43,02%-43,88%).

According to Heyward (1998), field tests might be used to assess cardio-respiratory performance, as they enable the examination of a huge population within a short period of time, but field tests cannot be used for diagnostic purposes. The results of the Cooper-test can be considered good in case of the PE group and average in case of the Non-PE group (Cooper, 1968; Zwiren et al., 1991; Grant et al., 1995). The difference of means was not remarkable within the groups but was significant between the two groups at the time of each test. The fact that these endurance performances lower than the results of high school boys 20-25 years ago (Barabás, 1988) demonstrates a clear need for a change at the local and societal level as well.

The weaker physical performance of the Non-PE group is not surprising, it is more a straight consequence of their inactive lifestyle (Catenacci and Wyatt, 2007; Hamilton et al., 2008). Without any doubt, the main determinants of the physical performance are the quantity, quality and frequency of practice even on this moderate performance level (Rhea et al., 2003; Lustyk et al., 2004; Duncan et al., 2005). The irregular physical activity of the Non-PE group could not provide the frequency and intensity that is required for biological adaptation (Haskell et al., 2007).

As a general conclusion, we can state that the teacher education students, especially Non-PE students – do require scheduled and professional supported health-related training program based upon their individual needs and expectations towards healthy active living (Sebőkné, 1999). During their university program, students should study subjects related to health, physical education, mental hygiene and nutrition – with adequate theoretical and practical contents.

This knowledge and experience might better promote the realization of the preventive and recreational value of healthy lifestyle, physical activity and sport; the familiarization with methods of measurement and improvement of fitness and also their self-employed application; plus the independent expansion of this set of skills (Standage et al., 2003; Moreno Murcia, Coll & Ruiz Pérez, 2009). With this, future teacher will be able to develop the necessary competences for best student learning. For this reason, we cannot avoid the establishment of "theoretical" physical education classes in universities, which could provide a framework for the transfer of the above outlined knowledge.

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