



# Level of physical activity of students in Poland, Portugal and Belarus

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of the article

Król M, Latosiewicz R, Marques Brás RM, Barkow W, Zuzda JG. Level of physical activity of the students in Poland, Portugal and Belarus. *Ann Agric Environ Med*. doi: 10.26444/aem/142295

## Abstract

**Introduction and objective.** The WHO term ‘physical activity’ refers to all body movements produced by skeletal muscles which require energy expenditure. The ways to be active include daily activities, exertion in the performance of work, or active recreation. The objective of the study is to compare physical activity of the students of Białystok University of Technology, Higher School of Physical Education and Tourism in Białystok (Poland), University of Beira Interior in Covilhã (Portugal) and Janka Kupala Grodno State University in Grodno (Belarus).

**Materials and method.** A total of 1,136 persons participated in the study (398 men and 738 women). The level of physical activity of the students was assessed on the basis of a short version of the International Physical Activity Questionnaire (IPAQ). The individual value of the body mass index (BMI) was calculated for each respondent.

**Results.** Among men studying at WSWFiTB, in Portugal and Belarus, the dominant level of activity was high. Both in the group of men and women, people studying in Portugal spent the most time sitting during one working day. Without taking into account the gender of the respondents, a high level was the dominant among students of WSWFiTB, in Portugal and Belarus. With regard to overweight and obese people, the highest average amount of energy expenditure was recorded in the case of intensive activity.

**Conclusions.** Men, compared to women, were characterized by a higher average amount of energy consumption related to total activity and intensive exercise. Students in Belarus obtained the highest average amount of energy expenditure related to moderate and intensive activity, compared to students at BUT, WSWFiTB and in Portugal. A high level of activity dominated both in the group of underweight/normal body weight, as well as overweight and obese persons.

## Key words

exercise, Body Mass Index, students, physical fitness, energy metabolism

## INTRODUCTION

The WHO term ‘physical activity’ refers to all body movements produced by skeletal muscles which require energy expenditure. Ways to be active include daily activities, exertion in the performance of work, or active recreation [1].

According to the WHO guidelines, adults should undertake aerobic physical activity of moderate intensity for at least 150–300 minutes per week, or of high intensity for a minimum of 15–150 minutes. The recommended form of activity is also a combination of moderate and intensive activity. Aerobic exercises should be supplemented with strengthening exercises of high or moderate intensity, performed on at least two days a week and involving the main muscle groups [2].

Regular exercise of moderate intensity (i.e. cycling, walking) has a positive impact on the body: it reduces the risk of chronic diseases, including cardiovascular diseases, diabetes, obesity and osteoporosis [1, 3, 4, 5, 6].

## OBJECTIVE

The aim of the study is to compare the physical activity of students at the University of Technology, Higher School of Physical Education and Tourism in Białystok (Poland), University of Beira Interior in Covilhã (Portugal) and Janka Kupala State University in Grodno (Belarus).

## MATERIALS AND METHOD

A total of 1,136 persons participated in the study: 398 men and 738 women, of whom 456 were Polish – 182 persons studying at the Białystok University of Technology (group: PL-PB), 265 persons studying at the Higher School of Physical Education and Tourism in Białystok (group: PL-WSWFiTB), 437 were studying at the University of Beira Interior in Covilhã, Portugal (group PT), and 252 participants were studying at the Janka Kupala State University in Grodno in Belarus (group BY). The average age of the respondents was 20.19±2.26 years (Tab. 1).

The characteristics of the respondent group with regard to gender are shown in Table 2. The highest average results of BMI (Body Mass Index – kg/m<sup>2</sup>) were recorded among

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Received: 13.08.2020; accepted: 15.09.2021; first published: 29.09.2021

**Table 1.** Characteristics of respondent group (the average±standard deviation; n=1136)

Characteristics	Global	PL (PB)	PL (WSWFiTB)	PT	BY
Age (y)	20.19±2.26	20.79±0.68	21.06±1.01	20.03±2.70	19.12±2.62
Body mass (kg)	65.82±12.52	65.79±12.25	68.20±13.14	64.46±12.03	65.70±12.60
Height (cm)	171.50±9.05	171.79±8.02	174.36±8.43	168.66±8.82	173.23±9.38
BMI (kg/m <sup>2</sup> )	22.24±2.98	22.21±3.42	22.25±2.70	22.54±2.96	21.75±2.90

**Table 2.** Characteristics of respondent group with regard to gender (average±standard deviation; n=1136)

Men					
Characteristics	PL (PB)	PL (WSWFiTB)	PT	BY	
Sample size	59	131	113	95	
Age (y)	20.78±0.70	21.05±0.74	20.79±3.75	19.43±3.95	
Body mass (kg)	74.53±9.95	77.55±10.77	77.02±12.21	77.15±8.86	
Height (cm)	178.87±6.02	180.27±6.33	178.63±7.57	180.55±7.70	
BMI (kg/m <sup>2</sup> )	23.24±2.44	23.80±2.58	24.12±3.40	23.66±2.31	
Women					
Characteristics	PL (PB)	PL (WSWFiTB)	PT	BY	
Sample size	123	134	324	157	
Age (y)	20.79±0.68	21.07±1.22	19.77±2.17	18.93±1.25	
Body mass (kg)	61.60±10.99	59.06±7.68	60.08±8.33	58.77±8.95	
Height (cm)	168.39±6.51	168.58±5.81	165.18±6.19	168.81±7.31	
BMI (kg/m <sup>2</sup> )	21.71±3.70	20.72±1.80	21.99±2.58	20.58±2.59	

men studying in Portugal –  $24.12 \pm 3.40$  kg/m<sup>2</sup>, and among students in Belarus –  $23.66 \pm 2.31$  kg/m<sup>2</sup>. Women were characterized by a lower average BMI value compared to men studying at the same universities. The lowest average BMI result was recorded in the group of women in Belarus –  $20.58 \pm 2.59$  kg/m<sup>2</sup>.

A diagnostic survey method was used in this study by applying the questionnaire technique. The short version of the International Physical Activity Questionnaire (IPAQ) and the test record were used.

The level of physical activity of the students was assessed on the basis of a short version of the International Physical Activity Questionnaire (IPAQ), which includes 7 questions related to physical activities in everyday life, at work and leisure. The questions in the questionnaire are aimed at gathering information about the time spent by the respondents on performing activities related to walking and sitting, as well as moderate and vigorous efforts. Activities to be taken into account had to last at least 10 continuous minutes [7].

The unit of measurement used to evaluate each form of activity was the MET (Metabolic Equivalent of Task) intensity coefficient, a parameter that determines oxygen uptake based on the multiples of resting metabolic rate. One MET corresponds to 3.5 ml of oxygen per kilogram of body weight in one minute [8, 9, 10, 11]. The value of the MET coefficient in relation to the short version of the questionnaire is: 8.0 – for intensive exercise, 4.0 – for moderate exercise, and 3.0 – for exercise related to walking. By multiplying the value of the coefficient assigned to a specific activity by the number of days of this exercise and the duration (min) per day, the specific physical effort can be presented in MET-min/week units. After summing-up the results obtained for individual types of activity, weekly physical activity is obtained [7]. The obtained results allow classification of the respondents according to their level of physical activity. Three levels of activity were distinguished: high, sufficient and insufficient. People with a high level performed vigorous physical activity for 3 or more days (minimum 1,500 MET-

min/week) or for 7 days or more performed as a combination of vigorous, moderate, or walking exercises in excess of 3,000 MET-min/week. A sufficient level was assigned to those who performed intensive activity for at least 20 minutes during the day for at least 3 days, or who performed moderate activity or walking for more than 30 minutes for at least 5 days, or who performed for a minimum of 5 days a combination of physical activities: vigorous, moderate or walking of at least 600 MET-min/week. On the other hand, an insufficient level was characterized by people who did not perform any physical activity, or did not meet the criteria for a high and sufficient level [7, 12, 13, 14].

On the basis of the height and weight values given in the questionnaire, an individual body mass index (BMI) was calculated for each respondent.

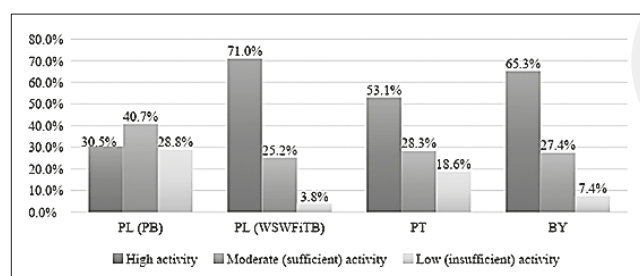
In order to interpret the results, the WHO classification was adopted according to which a BMI value below 18.5 kg/m<sup>2</sup> means underweight, 18.5–24.9 kg/m<sup>2</sup> – normal body weight, 25–29.9 kg/m<sup>2</sup> – overweight, while a value equal to or exceeding 30 kg/m<sup>2</sup> – obesity [15, 16].

The obtained results were analyzed statistically. The value of measurable parameters was presented with the mean value, standard deviation, interquartile range, and for non-measurable parameters – with the count and percentage. A significance level of  $p < 0.05$  was adopted, indicating the existence of statistically significant differences or relationships. Significance values for many of the tests were corrected by the Bonferroni method.

## RESULTS

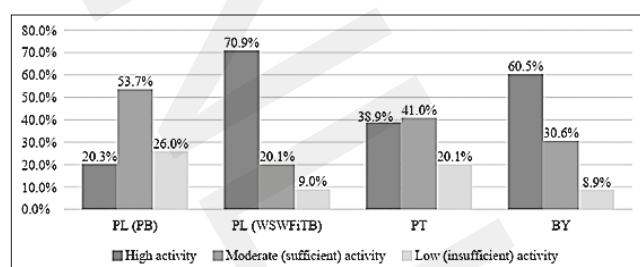
Among the men studying at WSWFiTB, in Portugal and Belarus, the dominant level of activity was high, 71%, 53.1% and 65.3% of the respondents, respectively. In the group of men with PB, moderate (sufficient) activity was predominant – 40.7% of the respondents. 28.8% of men studying at BUT, 3.8% of men studying at WSWFiTB, 18.6% of students in

Portugal, and 7.4% of students in Belarus were characterized by an insufficient level of activity (Fig. 1).



**Figure 1.** Level of physical activity of men studying at PB, WSWFiTB in Portugal and Belarus

The dominant level of activity among female students of BUT and in Portugal was moderate (sufficient) activity – 53.7% and 41% of the respondents, while among women studying at WSWFiTB and in Belarus, the level was high – 70.9% and 60.5% of the respondents). An insufficient level of activity was found in 36% of BUT female students, 9% of women studying at WSWFiTB, 20.1% of Portuguese female students and 8.9% of Belarusian students (Fig. 2).



**Figure 2.** Level of physical activity of women studying at PB, WSWFiTB in Portugal and Belarus

Table 3 shows the time spent by respondents regarding individual physical activity. Taking into account the activity related to walking, the highest average result was recorded among men studying in Belarus and women studying at WSWFiTB – 360 minutes and 350 minute, respectively. The lowest mean value of the same activity was observed in the men and women of PB – 140 minutes and 210 minutes, respectively.

**Table 3.** Time spent on performing specific physical activity with regard to gender (min)

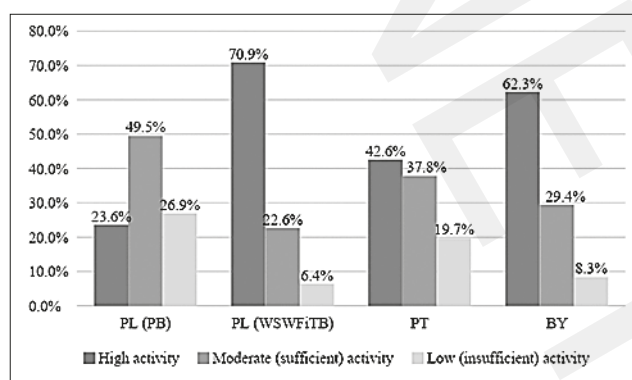
	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
<b>Men</b>								
Walking [min.]	140.00	225.00	300.00	275.00	280.00	415.00	360.00	420.00
Moderate activity [min.]	120.00	165.00	140.00	240.00	90.00	255.00	180.00	280.00
Vigorous activity [min.]	45.00	180.00	240.00	240.00	180.00	240.00	240.00	300.00
Sitting [min.]	370.00	180.00	300.00	180.00	420.00	300.00	130.00	180.00
<b>Women</b>								
Walking [min.]	210.00	315.00	350.00	420.00	300.00	450.00	300.00	437.50
Moderate activity [min.]	75.00	180.00	135.00	240.00	60.00	210.00	120.00	210.00
Vigorous activity [min.]	45.00	90.00	180.00	288.75	60.00	150.00	120.00	240.00
Sitting [min.]	360.00	180.00	300.00	157.50	465.00	247.50	120.00	120.00

Me – median; IQR – interquartile range

Among men, Belarusian students spent the most time on moderate physical activity, and the least time among Portuguese students – 180 minutes and 90 minutes, respectively. When analyzing the average time spent by men on intensive activity, the highest average result was recorded among students in Belarus and Portugal, and the lowest among students of BUT – 240 minutes, 240 minutes and 45 minutes, respectively. Both in relation to moderate and vigorous physical activity, the highest average value of time spent on the above-mentioned activity was recorded among female students of WSWFiTB – 135 minutes and 180 minutes, respectively. The female students in Portugal spent the least amount of time performing moderate exercises, and with regard to intensive exercises, female students of BUT – 60 min and 45 min.

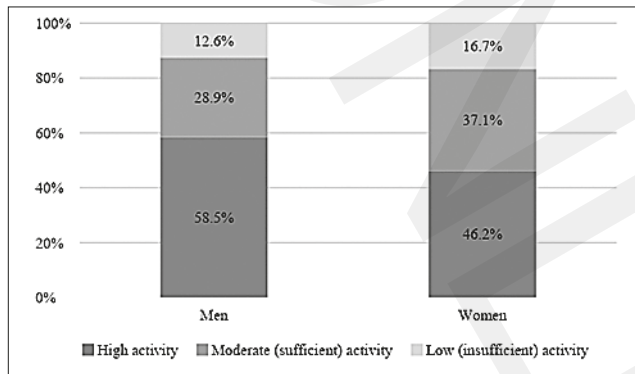
Both in the group of men and women, those studying in Portugal spent the most time sitting during one working day, and the least students in Belarus – 420 minutes and 465 minutes, and 130 minutes and 120 minutes, respectively.

Without taking into account the gender of the respondents, a high level was the dominant level among students of WSWFiTB in Portugal and Belarus – 70.9%, 42.6% and 62.3%, respectively (Fig. 3). With regard to BUT students, moderate (sufficient) activity prevailed – 49.5% of the respondents. An insufficient level of activity was recorded among 26.9% of BUT students, 6.4% of WSWFiTB students, 19.7% of respondents studying in Portugal and 8.3% in Belarus.



**Figure 3.** Level of physical activity of students of BUT, WSWFiTB, in Portugal and Belarus (n = 1136)

Both among men and women, excluding the information about universities where the respondents studied, the dominant level of activity was at a high level – 58.5% of the surveyed men and 46.2% of the surveyed women (Fig. 4). An insufficient level was recorded among 12.6% of male students and 16.7% of female students. The given differences were statistically significant –  $p < 0.05$ .



**Figure 4.** Level of physical activity of students with regard to gender ( $n = 1,136$ ). Pearson Chi-square test value  $\chi^2=15,765$ .png

Without taking into account the gender of the respondents, the highest average value of time spent by students on walking activity was recorded among those studying at WSWFiTB, and the lowest among students of PB – 315 minutes and 205 minutes, respectively ( $p < 0.05$ ). With regard

to walking activity, statistically significant differences were noted between the compared pairs of groups of students PL (PB) – PT, PL (PB) – BY and PL (PB) – PL (WSWFiTB) ( $p < 0.05$ ). Table 4 summarizes the average time spent by the respondents on walking, taking into account statistical significance.

With regard to moderate physical activity, students in Belarus devoted the most time to this type of exercise, followed by students of WSWFiTB, PB and in Portugal (Tab. 5). Taking moderate activity into account, there were statistically significant differences between the compared pairs of groups of the students PT – PL (WSWFiTB), PT – BY, PL (PB) – PL (WSWFiTB) and PL (PB) – BY ( $p < 0.05$ ).

Intensive activity was most often chosen by respondents of WSWFiTB and in Belarus – 210 minutes and 145 minutes, respectively, while among students in Portugal and BUT this type of exercise was performed sporadically – 45 minutes and 60 minutes, respectively. On analyzing the results relating to intensive activity, statistically significant differences ( $p < 0.05$ ) were noted between all the compared pairs of groups of students (Tab. 6).

Persons studying in Portugal spent the most time sitting, followed by students of BUT, WSWFiTB and in Belarus (Tab. 7). With regard to the same activity, statistically significant differences were noticed between all compared pairs of groups of students ( $p < 0.05$ ).

Men studying at PB, WSWFiTB and in Portugal had a higher average amount of energy expenditure related to walking, compared to women from the same universities.

**Table 4.** Time spent on walking activity (min)

	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Walking [min.]	205.00	275.00	315.00	345.00	300.00	450.00	307.50	446.25
	<b>H=20.780</b>				<b>p=0.000</b>			
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PL (PB) - PT	-121.037		28.880		-4.191		.000	.000
PL (PB) - BY	-130.814		31.844		-4.108		.000	.000
PL (PB) - PL (WSWFiTB)	-143.219		31.515		-4.544		.000	.000
PT - BY	-9.777		25.893		-.378		.706	1.000
PT - PL (WSWFiTB)	22.182		25.487		.870		.384	1.000
BY - PL (WSWFiTB)	12.405		28.803		.431		.667	1.000

Me – median; IQR – interquartile range

**Table 5.** Time spent performing moderate physical activity (min)

	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Moderate activity [min.]	90.00	202.50	135.00	240.00	60.00	225.00	150.00	240.00
	<b>H=17.921</b>				<b>p=0.000</b>			
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PT - PL (PB)	27.957		28.640		.976		.329	1.000
PT - PL (WSWFiTB)	159.262		25.276		6.301		.000	.000
PT - BY	-172.796		25.679		-6.729		.000	.000
PL (PB) - PL (WSWFiTB)	-131.305		31.254		-4.201		.000	.000
PL (PB) - BY	-144.839		31.580		-4.586		.000	.000
PL (WSWFiTB) - BY	-13.533		28.565		-.474		.636	1.000

Me – median; IQR – interquartile range

**Table 6.** Time spent performing intensive physical activity (min)

	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Vigorous activity [min.]	45.00	120.00	210.00	270.00	60.00	180.00	145.00	326.25
	<b>H=106.980</b>				<b>p=0.000</b>			
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PT - PL (PB)	-86.976		28.566		-3.045		.002	<b>.014</b>
PT - PL (WSWFiTB)	-234.951		31.499		-7.459		.000	<b>.000</b>
PT - BY	-316.996		31.173		-10.169		.000	<b>.000</b>
PL (PB) - PL (WSWFiTB)	-147.976		25.613		-5.777		.000	<b>.000</b>
PL (PB) - BY	230.021		25.211		9.124		.000	<b>.000</b>
PL (WSWFiTB) - BY	82.045		28.491		2.880		.004	<b>.024</b>

Me-median; IQR - interquartile range

**Table 7.** Time spent sitting during one working day (min)

	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Sitting [min.]	360.00	180.00	300.00	180.00	420.00	272.50	120.00	170.00
	<b>H=17.332</b>				<b>p=0.000</b>			
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
BY - PL (WSWFiTB)	271.112		28.762		9.426		.000	<b>.000</b>
BY - PL (PB)	372.329		31.764		11.722		.000	<b>.000</b>
BY - PT	478.409		25.839		18.515		.000	<b>.000</b>
PL (WSWFiTB) - PL (PB)	101.217		31.433		3.220		.001	<b>.008</b>
PL (WSWFiTB) - PT	-207.297		25.432		-8.151		.000	<b>.000</b>
PL (PB) - PT	-106.080		28.782		-3.686		.000	<b>.001</b>

Me-median; IQR - interquartile range

Among men, the median exercise was 462 MET-min/week and 990 MET-min/week, and 924 MET-min/week, among women: 693 MET-min/week, 1155 MET-min/week. and 990 MET-min/week. The given differences were statistically significant only in the case of persons studying at PB ( $p < 0.05$ ).

The lowest average amount of the weekly energy expenditure related to moderate exercise were recorded, both in the group of women and men among Portuguese students – 240 MET-min/week and 360 MET-min/week. The given differences were statistically significant ( $p < 0.05$ ). Taking into account the average value of the same activity, there were lower results for women than for men at all universities covered by the study (Tab. 8).

Men studying at WSWFiTB, in Portugal and Belarus, had a higher average value of energy expenditure related to vigorous activity, compared to women studying at the same universities (Tab. 8). In the case of people studying at BUT, the same value of the energy consumption median of intensive activity was recorded – 360 MET-min/week. In the case of respondents in Portugal and Belarus, the differences were statistically significant ( $p < 0.05$ ).

Women of PB and WSWFiTB obtained higher average results of total energy expenditure compared to men of the same universities. The median of physical exertion was 1,533 MET-min/week and 4,143 MET-min/week, respectively. 1,512 MET-min/week and 3,786 MET-min/week. Within the range of the same activity, statistically significant differences were noted among students in Portugal and Belarus ( $p < 0.05$ ). With regard to the above universities, a higher average result

of energy consumption was recorded among men compared to women – 3,333 MET-min/week and 4,110 MET-min/week; 2,106 MET-min/week and 3140 MET-min/week (Tab. 8).

Without taking into account the universities where the respondents studied, statistically significant differences were noted between men and women in relation to moderate, intensive and total physical activity ( $p < 0.05$ ). Women obtained a higher average amount of energy expenditure related to intensive and total activity compared to men. The median of energy consumption was 1,440 MET-min/week, 3,346 MET-min/week and 480 MET-min/week, 2,486 MET-min/week, respectively (Tab. 9). In the case of moderate activity, in both groups of men and women, the same average value of weekly energy consumption was recorded – 480 MET-min/week.

The lowest average values of energy consumption related to walking were recorded among students (men and women in total) of PB – 676.50 MET/week, followed by those studying in Portugal – 990 MET-min/week, in Belarus – 1014.75 MET-min/week, and of WSWFiTB – 1039.5 MET-min/week. Table 10 shows the energy expenditure of the respondents taking into account the university and statistical significance. In the case of walking activity, there were statistically significant differences between the compared pairs of student groups PL (PB) – PT, PL (PB) – BY and PL (PB) – PL (WSWFiTB) ( $p < 0.05$ ).

Without taking into account gender of the respondents, persons studying in Belarus were characterized by the highest amount of average energy expenditure associated

**Table 8.** Differences in physical activity of students of BUT, WSWFiTB, in Portugal and Belarus, with regard to gender and statistical significance

Men									
MET-min/week	PL (PB)		PL (WSWFiTB)		PT		BY		
	Me	IQR	Me	IQR	Me	IQR	Me	IQR	
Walking	462.00	742.50	990.00	907.50	924.00	1369.50	1188.00	1386.00	
Moderate activity	480.00	660.00	560.00	960.00	360.00	1020.00	720.00	1120.00	
Vigorous activity	360.00	1440.00	1920.00	1920.00	1440.00	1920.00	1920.00	2400.00	
Total physical activity	1512.00	2085.00	3786.00	3666.00	3333.00	3361.50	4110.00	3682.00	
Women									
MET (min/week)	PL (PB)		PL (WSWFiTB)		PT		BY		
	Me	IQR	Me	IQR	Me	IQR	Me	IQR	
Walking	693.00	1039.50	1155.00	1386.00	990.00	1485.00	990.00	1443.75	
Moderate activity	300.00	720.00	540.00	960.00	240.00	840.00	480.00	840.00	
Vigorous activity	360.00	720.00	1440.00	2310.00	480.00	1200.00	960.00	1920.00	
Total physical activity	1533.00	1456.50	4143.50	3495.75	2106.00	3001.50	3140.00	2744.50	
MET (min/week)	PL (PB)		PL (WSWFiTB)		PT		BY		
	Z	p	Z	p	Z	p	p	Z	
Walking	<b>-2.196</b>	<b>0.028</b>	-1.051	0.293	-0.159	0.873	-0.800	0.423	
Moderate activity	-1.874	0.061	-0.458	0.647	<b>-2.129</b>	<b>0.033</b>	-1.509	0.131	
Vigorous activity	-1.385	0.166	-1.798	0.072	<b>-5.866</b>	<b>0.000</b>	<b>-2.807</b>	<b>0.005</b>	
Total physical activity	-0.047	0.963	-0.112	0.911	<b>-3.357</b>	<b>0.001</b>	<b>-2.305</b>	<b>0.021</b>	

Me-median; IQR - interquartile range

**Table 9.** Differences in physical activity of women and men

MET-min/week	Women		Men		Statistic	
	Me	IQR	Me	IQR	Z	p
Walking	792.0000	1188.00	924.0000	1353.00	-1.412	0.158
Moderate activity	480.0000	1040.00	480.0000	960.00	<b>-3.493</b>	<b>0.000</b>
Vigorous activity	1440.0000	2400.00	480.0000	1440.00	<b>-7.875</b>	<b>0.000</b>
Total activity	3346.5000	3322.75	2486.0000	3133.95	<b>-5.058</b>	<b>0.000</b>

Me-median; IQR - interquartile range

**Table 10.** Differences in physical activity related to walking, not including gender

MET-min/week	PL (PB)		PL (WSWFiTB)		PT		BY			
	Me	IQR	Me	IQR	Me	IQR	Me	IQR		
Walking	676.50	907.50	1039.50	1138.50	990.00	1485.00	1014.75	1472.63		
<b>H=24.784</b>					<b>p=0.000</b>					
Samples	Statistic		SE		Standardized statistic		P		Adjusted p	
PL (PB) – PT	-121.037		28.880		-4.191		<b>.000</b>		<b>.000</b>	
PL (PB) – BY	-130.814		31.844		-4.108		<b>.000</b>		<b>.000</b>	
PL (PB) – PL (WSWFiTB)	-143.219		31.515		-4.544		<b>.000</b>		<b>.000</b>	
PT – BY	-9.777		25.893		-.378		.706		1.000	
PT – PL (WSWFiTB)	22.182		25.487		.870		.384		1.000	
BY – PL (WSWFiTB)	12.405		28.803		.431		.667		1.000	

Me – median; IQR – interquartile range

with moderate activity, compared to those studying at WSWFiTB, PB and in Portugal (Tab. 11). The median of moderate-intensity exercise was 600 MET-min/week. In the group of Belarusian students – 540 MET-min/week. among students of WSWFiTB – 360 MET-min/week in the group of BUT students, and 240 MET-min/week among Portuguese students. With regard to moderate activity, there were statistically significant differences between the compared

pairs of student groups PT – PL (WSWFiTB), PT – BY, PL (PB) – PL (WSWFiTB) and PL (PB) – BY ( $p < 0.05$ ).

Without taking into account gender of the respondents, those studying at WSWFiTB were characterized by the highest average amount of energy consumption related to intensive activity – 1680 MET-min/week. The lowest amount of energy was recorded among BUT students, with the median of energy expenditure at 360 MET-min/week

**Table 11.** Moderate physical activity of students (men and women jointly) of BUT, WSWFiTB, in Portugal and Belarus

MET-min/week	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Moderate activity	360.00	810.00	540.00	960.00	240.00	900.00	600.00	960.00
<b>H=67.599</b>				<b>p=0.000</b>				
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PT – PL (PB)	27.957		28.640		.976		.329	1.000
PT – PL (WSWFiTB)	159.262		25.276		6.301		.000	.000
PT – BY	-172.796		25.679		-6.729		.000	.000
PL (PB) – PL (WSWFiTB)	-131.305		31.254		-4.201		.000	.000
PL (PB) – BY	-144.839		31.580		-4.586		.000	.000
PL (WSWFiTB) - BY	-13.533		28.565		-.474		.636	1.000

Me – median; IQR – interquartile range

**Table 12.** Differences in intensive physical activity of students of BUT, WSWFiTB, in Portugal and Belarus, not including gender

MET-min/week	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Vigorous activity	360.00	960.00	1680.00	2160.00	480.00	1440.00	1160.00	2610.00
<b>H=142.457</b>				<b>p=0.000</b>				
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PL (PB) - PT	-86.976		28.566		-3.045		.002	.014
PL (PB) - BY	-234.951		31.499		-7.459		.000	.000
PL (PB) - PL (WSWFiTB)	-316.996		31.173		-10.169		.000	.000
PT - BY	-147.976		25.613		-5.777		.000	.000
PT - PL (WSWFiTB)	230.021		25.211		9.124		.000	.000
BY - PL (WSWFiTB)	82.045		28.491		2.880		.004	.024

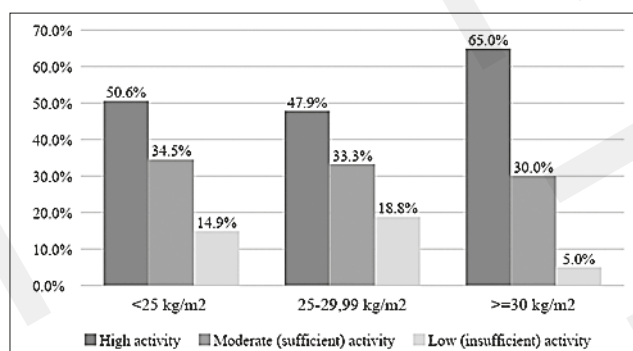
Me-median; IQR – interquartile range

(Tab. 12). The given differences were statistically significant ( $p < 0.05$ ).

Within the range of total activity, the highest average amount of energy expenditure was recorded in the group of students (men and women together) of WSWFiTB, followed by students of Belarus, Portugal and BUT (Tab. 13). The median total physical effort was 3,972 MET-min/week, 3,523 MET-min/week, and 2,346 MET-min/week, respectively, and 1524 MET-min/week. With regard to total effort, there were statistically significant differences between the compared pairs of student groups, excluding the pair of student groups BY – PL (WSWFiTB) ( $p < 0.05$ ).

The prevailing level of activity regarding persons with BMI below 25 kg/m<sup>2</sup> (underweight/normal body weight), students with BMI between 25–29.99 kg/m<sup>2</sup> (overweight) and respondents with BMI of at least 30 kg/m<sup>2</sup> (obesity), was high – 50.6%, 47.9% and 65%, respectively (Fig. 5). An insufficient level of activity was characterized by 14.9% underweight/normal weight, 18.8% overweight and 5% obese respondents.

The highest average amount of energy expenditure in the group of persons with underweight/normal body weight was recorded in the case of walking activity – 990 MET-min/week, followed by intensive activity – 800 MET-min/week, and moderate activity – 480 MET-min/week. With regard to overweight and obese people, the highest average amount of energy expenditure was recorded in the case of intensive activity (Tab. 14). Taking into account the above-mentioned groups, the mean value of intensive exercise was 960 MET-min/week. Students with a minimum BMI of

**Figure 5.** Activity level of respondents taking BMI values into account (n = 1136)

30 kg/m<sup>2</sup> obtained the highest average result of total energy expenditure, compared to those with a BMI of 25–29.99 kg/m<sup>2</sup> and less than 25 kg/m<sup>2</sup>. The median of energy consumption was 3,742.25 MET-min/week, 2,726.25 MET-min/week and 2726.25 MET-min/week, respectively. The given differences were not statistically significant ( $p > 0.05$ ).

## DISCUSSION

A study on the assessment of the level of physical activity among 692 Colombian students was carried out by Diaz Muñoz et al. [17], in which students of health sciences took part. The average age of the respondents was 18 years. The results obtained indicated that the dominant level of activity

**Table 13.** Differences in total physical activity of students (men and women together) of BUT, WSWFiTB, in Portugal and Belarus

MET-min/week	PL (PB)		PL (WSWFiTB)		PT		BY	
	Me	IQR	Me	IQR	Me	IQR	Me	IQR
Total activity	1524.00	1811.25	3972.00	3625.75	2346.00	2973.00	3523.00	2981.75
	<b>H=143.586</b>				<b>p=0.000</b>			
Samples	Statistic		SE		Standardized statistic		P	Adjusted p
PL (PB) - PT	-120.594		28.943		-4.167		<b>.000</b>	<b>.000</b>
PL (PB) - BY	-277.510		31.914		-8.695		<b>.000</b>	<b>.000</b>
PL (PB) - PL (WSWFiTB)	-325.855		31.584		-10.317		<b>.000</b>	<b>.000</b>
PT - BY	-156.916		25.950		-6.047		<b>.000</b>	<b>.000</b>
PT - PL (WSWFiTB)	205.261		25.544		8.036		<b>.000</b>	<b>.000</b>
BY - PL (WSWFiTB)	48.345		28.867		1.675		.094	.564

Me-median; IQR - interquartile range

**Table 14.** Energy expenditure of the respondents with regard to BMI

MET min/week	<25		25-29,99		≥30	
	Me	IQR	Me	IQR	Me	IQR
Walking	990.00	1386.00	693.00	924.00	841.50	1658.25
Moderate activity	480.00	960.00	480.00	960.00	240.00	900.00
Vigorous activity	800.00	1920.00	960.00	2400.00	960.00	2580.00
Total activity	2826.00	3309.75	2726.25	3306.25	3742.25	3195.63

Me-median; IQR - interquartile range

among Colombian students was insufficient (low), found in 49% of the respondents. The level of physical activity was also assessed by Walentukiewicz et al. [18]. The study included 74 first-year female nursing students. Insufficient (low) level of activity was noted in 58% of the respondents, and sufficient (moderate) in 42%.

On the other hand, research showed that the dominant level of activity among Portuguese and Belarusian students was high level, and among PB students was sufficient (moderate). WSWFiTB students who were studying professional or coaching programmes were also characterized by a high level of physical activity. Additionally, in relation to total physical activity, this research showed a higher average amount of energy consumption of students of BUT, WSWFiTB, in Portugal and Belarus, than of students in Colombia – Me = 1188 MET-min/week.

Tsos et al. [19], in turn, in their research using the short version of the IPAQ Questionnaire, noted even more people characterized by an insufficient (low) level of activity – 73.4% of respondents. The study group consisted of 308 women studying at the Lesya Ukrainka East European National University in Lutsk, Ukraine. Popowych et al. [20] in a study involving 333 students of the State Medical University in Ternopil, Ukraine, reported an insufficient (low) level in 80.2% of the respondents. The occasionally occurring activity level in this group was high in 3.9% of women.

Based on the performed study, it was found that the dominant level of activity among women studying at WSWFiTB and in Belarus was at a high level – 70.9% and 60.5% of the respondents, while among the female students of BUT and in Portugal, the dominant level was sufficient, or moderate – 53.7% and 41% of respondents.

Also, research conducted by Junger et al. [21] showed that the dominant level of activity among 2,237 students (1,169 women and 1,068 men) was high, amounting to 49.7% in the

group of people studying humanities, 50.9% among medical students and 50.1% in the group of students of technical faculties. Moreover, in the group of men, a high level of physical activity dominated, amounting to 56.2% of the surveyed students of humanities, 60.7% of medical faculties and 56.2% of technical faculties. In the case of women, as well as the female students of BUT and in Portugal, the dominant level was the sufficient (moderate) level found in 47.2% of respondents studying the humanities, 46.9% among medical female students and 49.1% in the group of technical students.

Papathanasiou et al. [22] in a study carried out on a group of 218 people (113 men and 105 women) studying at the Technological Educational Institute in Athens (TEI-A) and 175 people (77 men and 98 women) studying at the University of Ioannina (Greece, analyzed the physical activity undertaken by students. With regard to the first day of the study, among the surveyed women, the highest average amount of energy consumption was recorded in the case of exercise related to walking. The median of energy expenditure was 396 MET-min/week for female students from TEI-A and 330 MET-min/week for female students from Ioannina. As regards men, moderate exercise was the least frequently chosen form of activity, the mean value for this activity was 180 MET-min/week for men studying at TEI-A and 160 MET-min/week for men studying at Ioannina. Moreover, men studying TEI-A and Ioannina had a statistically significantly higher mean amount of total energy expenditure compared to women from the same universities ( $p < 0.05$ ).

The current study showed that women studying at BUT, in Portugal and Belarus, similarly to female students in TEI-A and Ioannina, obtained the highest average amount of energy consumption in relation to walking activity. Analysis of the results of the study also showed that men studying at WSWFiTB, in Portugal and Belarus, obtained the lowest average amount of energy expenditure in relation



to moderate activity. As in the case of respondents from TEI-A and Ioannina, men studying in Portugal and Belarus were characterized by a higher amount of average energy expenditure related to total activity, compared to women from the same universities.

Similar studies were conducted in Poland in a group of 953 students of the Academy of Physical Education in Wrocław (AWF) and 200 students of the University of Wrocław (UW), Starościak, Guła-Kubiszewska, Kałwa and Dębsk [23]. In the group of students (women and men jointly) from AWF and UW, the level of activity was high – 86.6% and 58% of the respondents, respectively. Moreover, among the women, the highest average amount of energy expenditure was recorded for vigorous activity, followed by walking and moderate activity. The median of energy consumption was 2,807.62 MET-min/week, 1,533.18 MET-min/week, and 1,084.23 MET-min/week, respectively.

The results of the current study, referring to the recorded levels of activity of students of WSWFiTB, in Portugal and Belarus, are consistent with the results obtained by Starościak et al. The high level of physical activity – 70.9%, 42.6% and 62.3% of the respondents, the same as in the case of female students of AWF and UW women studying at BUT, WSWFiTB, in Portugal and Belarus, who obtained the highest average amount of energy consumption in relation to intensive activity, followed by walking at a moderate level.

In turn, Stepień et al. [24] undertook the assessment of level of physical activity among 544 students of the State University of Pope John Paul II in Białą Podlaska (PSW), Poland. The most frequently observed level of student activity was the sufficient (moderate) level, recorded in 66% of IT students, 65.6% of public health students, 53.3% of nursing students, 52.9% of emergency medical students and 52% of tourism and recreation students. The students of BUT were also characterized by a sufficient (moderate) level of activity – 49.5% of the respondents.

In the study conducted by Łuczak et al. [25], the dominant level of activity among 249 female students of the College of Engineering and Health was at the sufficient (moderate) level, found in 52.21% of the respondents. A high level was characteristic of 30.12% of the respondents, and the insufficient (low) level – 17.67% of the respondents. In the group of women studied by Łuczak et al., the highest result for the average amount of energy expenditure involving exercise of walking was 1,463 MET-min/week, followed by intensive activity – 540 MET-min/week, and moderate activity – 521 MET-min/week.

The result, which was similar to that obtained by Łuczak et al., determining the level of physical activity was presented by Kościuczuk et al. [26] on the basis of a study carried out among 200 students of the Medical University of Białystok. The dominant level of activity was at the moderate (sufficient) level, found in 67% of the respondents, and the highest amount of average energy expenditure was recorded in relation to walking activity – 1,160.6 MAT-min/week.

The result of the current study are similar to those reported by Łuczak et al. and Kościuczuk et al. among the women studying at WSWFiTB and in Portugal. In the group of female students in Portugal, the level of activity was sufficient (moderate), found in 41% of the respondents, while the least number of women was characterized by an insufficient (low) level of physical activity – 20.1%. Women studying

at WSWFiTB obtained the highest average result of energy consumption in relation to the exercise of walking, followed by intensive and moderate activity.

Popovych et al. in their study also assessed the level of physical activity depending on the BMI value of the surveyed women [20]. The highest average amount of total energy expenditure was recorded in the group of female students with normal body weight – 5357.6 MET-min/week, followed by overweight people – 5,399.6 MET-min/week. On the other hand, in the group of students in this study, the highest average amount of energy expenditure was recorded among people with obesity – 3,742.25 MET-min/week, and then among those with underweight or normal body weight – 2826 MET-min/week).

Bergier et al. [27] conducted research in a group of 450 students of the State University of Pope John Paul II in Białą Podlaska (PSW). The authors found that men spent more time sitting in one working day compared to women – 347 min and 312 min, respectively. Analysis of the results of this study also showed that men studying at BUT and in Belarus spent more time sitting during one working day, compared to women studying at the same universities.

Dugas et al. [28] compared the time spent on performing specific physical activities by 2,500 people from the African communities studying in Ghana, South Africa, Seychelles, Jamaica, and Chicago in the USA. Women from all the universities listed, and men studying in South Africa, Seychelles, Jamaica, and Chicago, spent the most time sitting. Based on this study, similar results were reported for men and women studying at PB and in Portugal.

Matei and Ginsborg [29] also assessed the time spent by UK university graduates performing specific physical exertion. The highest mean amount of time noted by the authors was activity related to walking – 416 min. Similar results were recorded in the current study, in which specifically students (women and men jointly) studying at BUT, WSWFiTB, in Portugal and Belarus, spent most of their time performing activity related to walking.

The main limitation of the current study is the possible over-reporting and under-estimating of the duration and intensity of physical activity undertaken by students. Because the respondents themselves provided data on their height and body weight, values important for the analyzes and conclusions relating to BMI, this rendered them unreliable. Nevertheless, the results of research on the level of physical activity can be used to promote a healthy lifestyle, active rest, and to ensure an appropriate educational program at universities.

## CONCLUSIONS

Men studying at the University of Physical Education and Tourism in Białystok (WSWFiTB), in Portugal and Belarus, were characterized by a high level of physical activity, while students of Białystok University of Technology (PB) were characterized by a sufficient level of physical activity.

Among women of WSWFiTB and in Belarus, a high level of physical activity prevailed, while among female students from Portugal and BUT the level was sufficient.

Students in Portugal spent more time sitting during one working day than students of BUT, WSWFiTB, and in Belarus.

Men, compared to women, were characterized by a higher average amount of energy consumption related to total activity and intensive exercise.

The lowest mean values of total activity were observed for both women and men studying at BUT.

Students in Belarus obtained the highest average amount of energy expenditure related to moderate and intensive activity, compared to students at BUT, WSWFiTB, and in Portugal.

A high level of activity dominated both in the group of underweight/normal body weight, as well as overweight and obese persons.

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