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PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR OF UNIVERSITY STUDENTS ON THE RUSSIAN NORTH

***S.I. Loginov**, logsi@list.ru, ORCID: 0000-0002-6640-3385,*
***A.Yu. Nikolayev**, nik_212012@mail.ru, ORCID: 0000-0002-4113-4078*
***A.S. Snigirev**, snow-alex@male.ru, ORCID: 0000-0001-9183-2846,*
***R.O. Solodilov**, goodroman@mail.ru, ORCID: 0000-0002-4837-7427,*
***A.S. Kintyukhin**, anton-kintyuhin@mail.ru, ORCID: 0000-0002-8238-6474*
Surgut State University, Surgut, Russian Federation

The paper aims to analyze physical activity (PA) intensity levels and PA domains in Surgut State University (SSU) students in comparison with their EU peers on a gender- and age-specific basis. **Results.** Surgut State University students (n = 376, including 160 males and 216 females) of different ages participated in the study. It was found that PA averaged 1804 and 1707 MET-min/week for male and female subsamples, respectively; the correlations were found between age and transportation PA ($p = 0.0021$), walking PA ($p = 0.0021$), total PA ($p = 0.0253$) for the female subsample; and between age and working PA ($p = 0.0099$), walking PA ($p = 0.0278$) and sedentary time ($p = 0.001$) for the male subsample. The gender-unspecific equations were obtained to rate the correlations between age and working PA ($p = 0.0206$), transportation PA ($p = 0.0284$), walking PA ($p = 0.0001$), total PA ($p = 0.0086$) and sedentary time ($y = –3129 + 532x – 11.49x^2$ $r = 0.1479$; $p = 0.0041$). Furthermore, correlations were found between sedentary time and body mass indices for the male subsample ($y = –3283 + 425x – – 7.23x^2$ $r = 0.1578$; $p = 0.0463$) and the gender-unspecific correlations for students' domestic/gardening PA ($y = 1153 – 46x + 0.45x^2$ $r = –0.1321$; $p = 0.0103$). The reported weekend sedentary time of SSU students was much higher than that of their peers from Poland, Czech Republic, Hungary and Slovakia, with the female subsample weekend sedentary time being higher than in the male subsample both in SSU students ($p = 0.0015$) and EU countries ($p = 0.0000$). **Conclusion.** On the whole the study data and analysis showed SSU students' PA being inadequate for both gender groups.

Keywords: *health-related physical activity (PA), PA domain, PA intensity level, university students, urbanized Russian North, sedentary behavior (SB), sedentary lifestyle (SL), IPAQ.*

Background. Global physical activity has been reported to rapidly decline for the first decades of the new millennium [25]. Highly specialized industrial robots, automatic and mobile systems with feedbacks have put the traditional physical labor on the brink of extinction. This situation is typical for modern student communities, despite the widespread opinion that they are the leading and most active part of today's youth [23].

It is clear that the PA activation solutions for students need to be offered based on the modern PE technologies, methods and projects. For such PA activation / optimization projects being effective, they need to be supported by a reliable scientific groundwork. Such data are being provided by the national and international questioning surveys using the relevant internationally accepted standards – such as the International Physical Activity Questionnaire (IPAQ) [12]. The IPAQ forms have been used to survey students in many countries [3, 6, 15, 19, 20] to find that most of the students still fail to meet the Sport Medicine College recommendations on 150 minutes of moderate-intensity or 75 minutes of high-intensity weekly PA [11]. It was also found, among other things, that only 7% of the students are physically active whilst 26% prefer to avoid physical practices [24, 26]. Wide-ranging national IPAQ surveys demonstrate the global physical inactivity being rapidly expanded and, hence, it should now be ranked among the top priority theoretical and practical problems rather than a PA-specific issue only. It has become common for the research communities to use such relatively new terms as the *sedentary behavior* and *sedentary lifestyle* [8]. Studies of the sedentary lifestyle (SL) have lately evolved into a new research field, with the SL defined as the passive behavioral models (dominated by sitting and reclining positions) with the energy costs as low as ≤ 1.5 MET [9, 22]. The SL was found to expose people to the high

risks of general / cardiovascular diseases with growth of the mortality / morbidity statistics and the high incidence rates of diabetes and obesity [16, 18] – even when the SL is associated with a moderate physical activity. Moreover, some studies have shown that even a fairly habitual moderate-intensity PA only reduces – and never totally eliminates – the health risks of the SL [13]. Therefore, the students' PA and SL rating studies are getting increasingly relevant as they address the new underexplored aspects of the socially determined lifestyles – and the present study was designed to contribute to this ongoing research.

Research methods and contingent. We sampled for the study the Surgut State University students (n = 376 including, 160 males and 216 females), with the sample being 42.6% male and 57.4% female aged 19.2 ± 1.7 and 19.5 ± 1.7 years, respectively. Every sampled student gave an informed voluntary consent on the survey. The age and key anthropometric parameters are presented in Table 1.

Table 1

Age and key anthropometrics of the female / male subsamples ($\bar{X}$ ± SD)

Indicators	Females, n = 216	Males, n = 160	Both, n = 376
Age, years	19,5 ± 1,66	19,2 ± 1,70	19,4 ± 1,68
Height, m	1,65 ± 0,06	1,75 ± 0,07*	1,69 ± 0,065
Weight, kg	58,35 ± 10,1	71,9 ± 8,12*	64,1 ± 11,45
Body mass index, kg/m^2	21,3 ± 2,84	23,57 ± 1,85*	22,27 ± 2,72

Note: $\bar{X}$ – average, SD – standard deviation, *significance rate for the intergroup differences, $p < 0.05$.

Survey procedure and toolkit. The IPAQ survey of the SSU students was run in the autumn-winter time of the 2015/16 academic year, with every student requested to fill-in the Russian IPAQ form to report the following: PA time, energy cost and intensity level (low, moderate, high), with the PA classified into 4 domains: working, transportation, domestic / gardening and leisure time PA. The domain-specific PA was reported on a weekly (last 7 days) basis with indication of hours and minutes. The input data were processed as required by the standard basic IPAQ protocol [12] using special software tools. The PA data were classified for analysis as follows: (1) low-intensity PA (LIPA) with the metabolic equivalent (MET) < 1.5 and the total energy cost under 600 MET-min/week; (2) moderate-intensity PA (MIPA) of 3–6 MET and energy cost of 600–1500 MET-min/week; and (3) high-intensity PA (HIPA) of > 6 MET and energy cost of 1500+ MET-min/week. Ranked with the SL category were the people reporting the PA under 10 min a day. We computed the relevant energy costs for every of the above PA / MET classes as provided by the PA Compendium [1].

Statistical analysis. The survey data were processed by the Statistica 12 (made by StatSoft, USA) mathematical statistics toolkit, with the mean arithmetic values <$\bar{X}$> and standard deviations <SD> computed for dispersions within the parametric distribution model. Significance of the data differences were rated by the Student t-criterion, with the differences considered significant at $p < 0.05$. For nonparametric data distribution we used a mean arithmetic value and confidence interval of 0.95 <± CI 0.95> in addition to the median. When finding correlations of the gender- and age-specific PA rates, we used a single-factor dispersion analysis of variance (ANOVA) and regression analysis for every PA domain (work, transportation, domestic / gardening, leisure time and walking PA) and PA intensity level (low, moderate and high).

Results. The survey rated more than one third of the sample with the low-intensity PA; about one fifth with the moderate-intensity PA and one fifth with the high-intensity PA (Fig. 1A). By the PA domains, dominating for the male and female subgroups were the energy costs claimed by the working PA and domestic PA, respectively, with virtually no differences in the transportation and leisure-time PA (Fig. 1B).

The PA-domains-specific time cost analysis showed a few gender specifics (Table 2). The male subgroup was found to spend more time for the working high-intensity PA; and the female subgroup – for the domestic moderate-intensity PA, weekend sedentary lifestyle and the total PA ($p < 0.05$). We found virtually no gender group differences in the leisure-time PA, walking PA and total PA.

We ranked the sedentary time by 4 quartiles to find proportions of the low-, moderate- and high-active students. No one in the first quartile

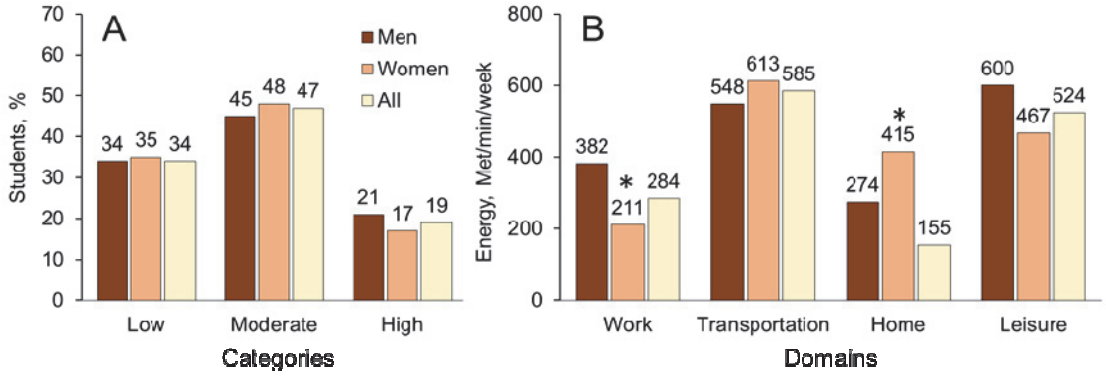

Fig. 1. PA intensity levels / categories (A) and energy costs of the PA domains (B): *gender group differences with p < 0.05

Table 2

PA domains and sedentary behaviors by gender subgroups, Min / day, ($\bar{X}$; 0. 95 CI)

PA domains	Females, n = 216	Males, n = 160	Both, n = 376
Work	7.7 (5.14; 10.3)	13.6 (10.1; 16.9)*	10.1 (8.1; 12.3)
Transportation	25.3 (21.4; 29.6)	158 (131; 185)	169 (150; 188)
Domestic/ gardening	123 (102; 144)	74 (56; 91)*	102 (88; 116)
Leisure time	102 (83; 121)	129 (103; 155)	114 (98; 129)
MIPA	181 (156; 205)	141 (114; 168)*	164 (146; 182)
HIPA	27 (21; 36)	43 (30; 56)*	35 (28; 42)
Walking	247 (215; 280)	271 (233; 309)	257 (233; 282)
TPA	456 (413; 499)	455 (403; 508)	456 (423; 489)
Weekly sedentary time	1937 (1858; 2016)	1741 (1650; 1832)*	1854 (1793; 1914)
Weekend sedentary time	649 (611; 687)	610 (563; 657)	632 (603; 662)
Total sedentary time	2943 (2830; 3056)	2696 (2566; 2825)*	2838 (2752; 2924)

Note: TPA – total physical activity, HIPA – high intensity physical activity, MIPA – moderate intensity physical activity, $\bar{X}$ – average, parentheses with 0.95 confidence intervals, *gender group differences with p < 0.05.

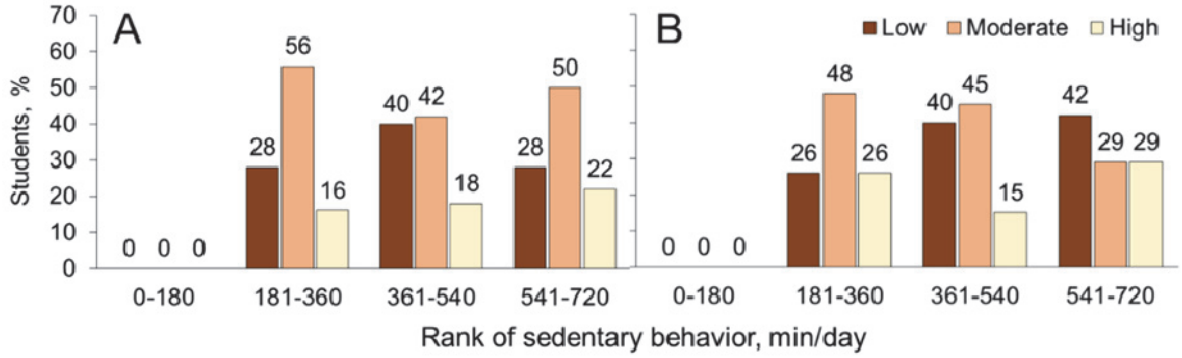

Fig. 2. Ranked sedentary behaviors, min / day: A – females, B – males

reported sitting more than 3 hours a day. With the physical inactivity expansion, the percentage of the low-active students grows from 28.6% to 40.4% (female subgroup) and from 25.7% to 40.3% (male subgroup) in the 3–6 and 6–9 hours/day quartiles, respectively (Fig. 2).

Correlation analysis. Based on our analysis of the age-specific PA rating data of the sample, the correlations were found in the working PA, transportation PA, walking PA, total PA and sedentary time domains. We found no correlations within the working PA and sedentary time domains for the female subsample; and in the transportation PA and total PA domains for the male subsample.

Correlations of the energy costs of the domestic PA and sedentary times in the male subsample was shown in Table 3.

Table 3

Relationship between age and gender physical activity indicators with body mass indicators in different domains

Domain	Females, n = 216	Males, n = 160	Both, n = 376
Age correlation			
Work	Not found	r = –0.2034; p = 0.0099	r = –0.1194; p = 0.0206
Transportation	r = –0.2614; p = 0.0361	Not found	r = –0.1130; p = 0.0284
Walking	r = –0.2085; p = 0.0021	r = –0.1739; p = 0.0278	r = –0,1966; p = 0,0001
Total physical activity	r = –0.1522; p = 0.0253	Not found	r = –0.1353; p = 0.0086
Sedentary time, min/week	Not found	r = 0.2575; p = 0.0010	r = 0.1479; p = 0,0041
BMI correlation			
Domestic/ gardening	Not found	Not found	r = –0.1321; p = 0.0103
Sedentary time, min/week	Not found	r = 0.1578; p = 0.0463	Not found

Note: y – computed PA rate in MET-min/week; x – age; r – Spearman rank correlation ratio; p – difference significance rate for the correlation ratio.

Discussion. Analysis of the few study reports on the students' daily physical activity shows the research community being seriously concerned by the uncontrolled growth of the sedentary behaviors commonly referred to as the "sedentary epidemic" [7]. As found by a broad-based study [10], low leisure-time physical activity on the verge of inactivity averages 23% in the student communities in the North-Western Europe, 30% in the Central and Eastern Europe, 39% in the Mediterranean countries and 44% in the developing countries. A higher leisure-time PA was found in the groups acknowledging health benefits of a good PA. However, the actual knowledge of the health benefits of habitual PA is still very poor – as only 40–60% of sampled students were found to know that a physical inactivity increases the risks of cardiovascular diseases.

Our Russian version of the IPAQ made it possible to run the SSU students' PA study on a gender- and age-specific basis and rate the results versus the survey data for a few EU and Ukraine universities. The comparative analysis ranked 34% of the SSU sample with the low PA class – versus 12.5% and 14.9% in the Visegrad Group (Czech Republic, Poland, Slovakia and Hungary) and Ukraine, respectively [4]. We also ranked 47% of the SSU sample with the moderate PA class – versus 68.1% and 72.8% in the Visegrad Group and Ukraine, respectively. As for the high PA class, it was found virtually the same – 19%, 19.4% and 12.3%, respectively. Average total PA of the SSU males and females was rated at 1804 and 1707 MET-min/wk, respectively – that is clearly too low as compared, e.g., with the Croatian sample (3242 and 2979 MET-min/wk, respectively) – which is still less active (in opinion of Z. Pedisic et al. [19]) than the Tuzla University (Bosnia and Herzegovina) sample (4619 and 6013 MET-min/wk, respectively) [5]. The relatively high total PA rates of the Bosnian sample was explained by their dominant off-campus lifestyle that requires everyday walking / transportation from home to university, library, sport gyms etc.

Somewhat different are the IPAQ survey data of four Russian universities that were tested with virtually no differences in the age groups, body mass indices and PA rates, with some other factors – including smoking, physical inactivity and unhealthy diets – found to be more influential ($p < 0.05$) [2]. Some data mismatches may be explained by the study being mostly focused on the intra-domain correlations and PA effects on the life quality.

It should be emphasized that the domain-specific and total PA of the SSU sample was tested significantly lower than that of their peers from the EU and Ukraine. The difference may be due to the fact that the Bosnian sample PA included not only the off-class working PA but also the academic studies viewed as the professional activity. One more reason is that the SSU sample resides in the extreme Northern climate and has to spend much more time indoors in the potentially unhealthy environments lagging far behind their peers in the outdoor PA [14]. For the gender-unspecific SSU PA data, we derived the following equation of the PA correlation with age for the working PA ($p = 0.0206$), transportation PA ($p = 0.0284$), walking PA ($p = 0.0001$), total PA ($p = 0.0086$) and the sedentary time: $y = –3129 + + 532x – 11.49x^2$ at $r = 0.1479$; $p = 0.0041$. We

also derived the following equation of the sedentary behavior correlation with the body mass index for the male students: $y = –3283 + 425x – – 7.23x^2$ at $r = 0.1578$; $p = 0.0463$); and for the gender–unspecific domestic / gardening PA: $y = 1153 – 46x + 0.45x^2$ ($r = –0.1321$; $p = 0.0103$).

These our findings agree with that of the Croatian researchers who analyzed the domain-specific PA correlations with age and body mass indicators [19] and with findings of a large-scale IPAQ survey that sampled about 18 thousand students (aged 20.8 ± 2.8 years) from 24 universities in 23 countries. The survey rated 41.4% of the students with a low PA class (from 21.9% in Kyrgyzstan to 80.6% in Pakistan) [21].

We found the SSU students' sedentary time averaging 1937 ± 592 min/week on business days and 649 ± 283 min/week on weekends in the female subsample and 1741 ± 585 and 610 ± 300 min/week in the male subsample, respectively. This is much higher than reported for their female peers from Poland, Czech Republic, Hungary and Slovakia [17] (432 ± 201 min/week and 297 ± 199 min/week on the business days and weekends, respectively); and their male peers (393 ± 237 min/week and 313 ± 232 min/week on the business days and weekends, respectively). The sitting time of female students on weekdays was tested significantly longer than that of their male peers both in Surgut ($p = 0.0015$) and in the four EU countries ($p = 0.0000$). It should be mentioned that the female students' sitting time on the weekends was found significantly higher than that of their male peers – both at the SSU ($p = 0.0015$) and in the above four EU countries ($p = 0.0000$).

Conclusion. Studies have shown that the low-, moderately- and highly-active SSU student groups were estimated at 34%, 47% and 19% of the sample, respectively – that is far behind their peers in the EU and Ukraine (13%, 68% and 19%, respectively). The total SSU male and female PA was estimated at 1804 ± 1391 MET-min/wk and 1707 ± 1208 MET-min/wk, respectively – that is 1.8–3.3 and 1.7–2.7 times less than that of their EU and Ukrainian peers. The working / high-intensity PA time was tested higher in the male SSU group than the moderate-intensity/ domestic PA plus sedentary time in the peer female group ($p < 0.05$). No gender group differences were found in the leisure time PA, walking PA, and the total PA rates. The SSU students reported the weekend sedentary time much higher than their peers from Poland, Czech Republic, Hungary and Slovakia, with the female subgroup's weekend sedentary time being higher than in the male subgroup both in Surgut ($p = 0.0015$) and EU countries ($p = 0.0000$).

We have analyzed some aspects of the physical activity/ inactivity and sedentary behaviors of the Surgut State University students versus their peers from a few European and Ukrainian universities. Further surveys are needed to clarify some outstanding health issues of the moderate-intensity PA associated with the sedentary behaviors. Combinations of the low-intensity PA with the expanding sedentary behaviors in the modern student communities are still underexplored at this juncture. Further comprehensive and focused research is needed to better understand the causes and effects of these relatively new and concerning social trends.

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ФИЗИЧЕСКАЯ АКТИВНОСТЬ И МАЛОПОДВИЖНЫЙ ОБРАЗ ЖИЗНИ СТУДЕНТОВ НА СЕВЕРЕ РОССИИ

С.И. Логинов, А.Ю. Николаев, А.С. Снигирев, Р.О. Солодилов, А.С. Кинтюхин

Сургутский государственный университет, г. Сургут, Россия

Целью статьи является анализ интенсивности и видов физической активности (ФА) у студентов Сургутского государственного университета (СурГУ) в сравнении с их сверстниками из ЕС с учетом пола и возраста. **Результаты.** В исследовании приняли участие студенты Сургутского государственного университета (n = 376, из них 160 мужчин и 216 женщин) разного возраста. Было обнаружено, что ФА составляла в среднем 1804 и 1707 МЕТ-мин / неделю для мужской и женской подвыборок соответственно; были обнаружены корреляции между возрастом и ФА во время перемещений (p = 0,0021), ФА при ходьбе (p = 0,0021), общей ФА (p = 0,0253) для женщин; а также между возрастом и ФА на работе (p = 0,0099), ФА при ходьбе (p = 0,0278) и малоподвижным образом жизни (p = 0,001) для мужской подвыборки. Уравнения, не зависящие от пола, были получены для оценки корреляций между возрастом и ФА на работе (p = 0,0206), ФА во время перемещений (p = 0,0284), ФА при ходьбе (p = 0,0001), общей ФА (p = 0,0086) и временем, проведенным пассивно ($y = -3129 + 532x - 11{,}49x^2$ r = 0,1479; p = 0,0041). Кроме того, были обнаружены корреляции между временем, проведенным пассивно, и индексом массы тела для мужской подвыборки ($y = -3283 + 425x - 7{,}23x^2$ r = 0,1578; p = 0,0463), а также не зависящие от пола корреляции для бытовой ФА/уличных занятий студентов ($y = 1153 - -46x + 0{,}45x^2$ r = –0,1321; p = 0,0103). Зарегистрированное время, проведенное пассивно в течение выходных, у студентов СурГУ было намного выше, чем у их сверстников из Польши, Чехии, Венгрии и Словакии, при этом тот же показатель в женской подвыборке был выше, чем в мужской, как у студентов СурГУ (p = 0,0015), так и у студентов стран ЕС (p = 0,0000). **Заключение:** В целом данные исследования и их анализ показали, что физическая активность студентов СурГУ находится на недостаточном уровне как у мужчин, так и у женщин.

Ключевые слова: *физическая активность (ФА), связанная со здоровьем, виды ФА, интенсивность ФА, студенты вузов, урбанизированный Север России, малоподвижный образ жизни, IPAQ.*

Логинов Сергей Иванович, доктор биологических наук, профессор, главный научный сотрудник научно-образовательного центра Института гуманитарного образования и спорта, Сургутский государственный университет. 628412, г. Сургут, пр. Ленина, 1. E-mail: logsi@list.ru, ORCID: 0000-0002-6640-3385.

Николаев Александр Юрьевич, старший преподаватель кафедры физического воспитания Института гуманитарного образования и спорта, Сургутский государственный университет. 628412, г. Сургут, пр. Ленина, 1. E-mail: nik_212012@mail.ru, http://orcid.org/0000-0002-4113-4078.

Снигирев Александр Сергеевич, кандидат биологических наук, доцент кафедры теории физического воспитания Института гуманитарного образования и спорта, Сургутский государственный университет. 628412, г. Сургут, пр. Ленина, 1. E-mail: snow-alex@male.ru, http://orcid.org/0000-0001-9183-2846.

Солодилов Роман Олегович, кандидат биологических наук, старший научный сотрудник научно-образовательного центра Института гуманитарного образования и спорта, Сургутский государственный университет. 628412, г. Сургут, пр. Ленина, 1. E-mail: goodroman@mail.ru, http://orcid.org/0000-0002-4837-7427.

Кинтюхин Антон Сергеевич, кандидат биологических наук, старший научный сотрудник научно-образовательного центра Института гуманитарного образования и спорта, Сургутский государственный университет. 628412, г. Сургут, пр. Ленина, 1. E-mail: anton-kintyuhin@mail.ru, http://orcid.org/0000-0002-8238-6474.

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