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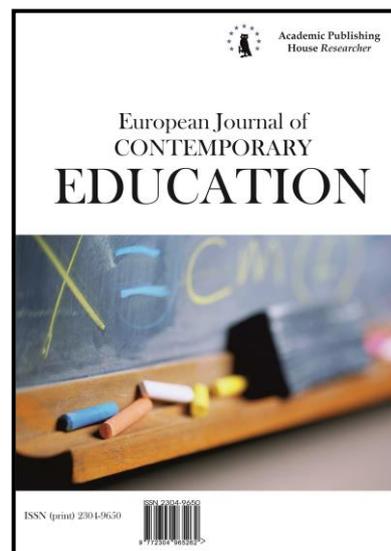
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## Wearable Activity Trackers Usage among University Students

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### Abstract

In spite of the fact that physical activity is inevitable in sustaining health, there are more people in the world who do not take it into account than who do. A growing number of young adults have been using wearable activity trackers, particularly step counts, to keep an eye on their health in the past few years. In an online survey university students were interviewed as a focus group. All members were current wearable activity trackers. Data was analyzed with SPSS 22 version. Beside descriptive statistics we applied Pearson's Chi square test ( $\chi^2$ ) and independent samples test, as well. We considered the results of statistical tests significant in case of  $p < 0.05$ . The wearable devices that participants used were wristbands (65.1%,  $n=95$ ) and smartwatches (34.9 %,  $n=51$ ). Their number one purpose was to measure step counts (93.2%,  $n=136$ ) and sleep patterns (63.7 %,  $n=93$ ) with the devices. The highest number of people answered to the question of what is the main purpose of using these devices that they monitored daily physical activity with it (56.2 %  $n=82$ ). The majority of the conveners do regular sports and in general exercise on 3.84 days for 30 minutes (Mode=3.0, Median=4.0, SD=1.78). Only 3.4 % of the ( $n=19$ ) are not engaged in any sort of physical exercise. A significant discrepancy could be observed in the number of days spent doing sports between wearable activity tracker users and non-users in favour of users (users: Mean=4.26 SD=1.83; non user: Mean=3.69 SD=1.74;  $t=3.279$ ,  $p < 0.01$ ). 70.6 % of smart watch wearers claimed that using the device took positive effects on their physical activity and only 29.4 % stated that their habits were not altered by the trackers. 42.1 % of those wearing wristband trackers increased their physical activity as a result of wearing the gadget, whereas 57.9 % of them were not affected in their physical activity ( $\chi^2=10.839$ ,  $df=2$ ,  $p < 0.05$ ). The publication is supported by the EFOP-3.6.1-16-2016-00022 project. The project is co-financed by the European Union and the European Social Fund.

**Keywords:** wearable activity trackers, physical activity, university students, smartwatch, wristband.

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## **1. Introduction**

Sedentary behaviour and the lack of moderate or vigorous physical activity can lead to the development of several non-contagious illnesses, such as coronary disease, type 2 diabetes, various mental disorders and certain types of cancer. In addition to this, a number of studies have proved that physical inactivity increase the risk of mortality, which is regarded the fourth most important risk factor nowadays (WHO, 2017; Haskell et al., 2007; Morris et al., 1953; Knowler et al., 2002; IARC, 2002; Chau et al., 2013, Bendíková, 2016a, b).

In spite of the fact that regular moderate intensity activities (adults: 150 minutes/week) are proved to act beneficially and protectively against chronic illnesses, the great majority of the adult population does not suit the guidelines of physical activity (Owen et al., Biswas et al., 2015; 2010; Warburton et al., 2007; Lee et al., 2003; Colley et al., 2011; Hallal et al., 2012). At the same time, several epidemiological examinations have shown that a higher percentage of time spent with sedentary behaviour – not applying to all kinds of sedentary behaviour – may have a negative effect on a lot of health results, independent from whether the individual carries out (moderate or vigorous physical activity) (Katzmarzyk, 2010; Katzmarzyk et al., 2009; Dunstan et al., 2010; Bendíková, Dobay, 2017).

These are the reasons why promoting the physically active way of life and altering the majority's present attitudes has a huge importance these days (Apor, 2012). Sadly, a high rate of the young population is typical of the sedentary behaviour, first and foremost the target group of university students, who spend most of their time sitting while studying whenever they are at lectures, use the computer, watch TV or travel.

Measuring physical activity is only possible with reliable and valid methods. Among these we can choose from self-report questionnaires, indirect calimetry, direct observation, heart rate monitors, or sensors measuring various movements. Quite a few gauges measuring physical activity are available, but oftentimes procuring them clashes with financial or technical obstacles. As a result of these obstacles, IPAQ – International Physical Activity Questionnaire based on self-report has become widely agreed. With the help of this method the observation of the measures and quality of physical activity has become fully implementable and easily accessible (Ács et al., 2018).

The subjective judgement of physical activity based on self-report as opposed to objective measurements tends to be unreliable as people often wrongly under- or overestimate the extent of their activity. The study of O'Neill et al. (2013) emphasized the accountability of the objective measures, where it was established that both gyroscopes and pedometers count the number of steps in a day properly. Gyroscopes show a more precise picture of the intensity of physical activity, while the results of IPAQ questionnaires might not show the reality as far as physical activity is concerned. For instance, it can happen that activities that are part of our everyday life, such as walking from the carpark to our workplace or to the shops, playtime with our children, are not seen as part of our daily physical activity, although they are organic part of it. In self-report questionnaires people usually concentrate on the actual sports activities, like jogging or workout at the gym. Objective measurements allow the record of all activity, even that is left out of the self-report method as explained above (Falck et al., 2015; McCormack et al., 2004).

Thanks to the extraordinary and dynamic development of innovative information technology, so-called wearable technological devices have appeared recently. The most wide-spread and well-known forms of wearable devices mean smartwatches and fitness trackers from the category of everyday tools. These tools usually apply an accelerator sensor, by the help of which they are able to determine physical activity and by means of smart phones or computer applications present it to the user (O'Brien et al., 2015). Activity monitoring devices most often have a built-in step count in them, but they can also measure other components of physical activity such as the intensity of the activity (for example a certain degree of intensity/day), estimated energy consumption (burnt calories), covered distances and also the number of floors climbed up and down stairs. A number of devices are able to take one's pulse or point out one's exact location by a GPS, but it is also possible to measure the quality of sleep (the period of sleep, wakefulness, quiet and active sleep periods) in devices of physical activity (El-Amrawy, Nounou, 2015). Early studies focused especially on the accuracy of these meters in respect of physical activity factors. Based on their findings it can be concluded that – while under- and overestimations occur in various examination and technological environments – the devices measure the number of steps most accurately and are less reliable in

terms of other components such as pulse or burnt calories (An et al., 2017; Chen et al., 2016; Evenson et al., 2015; Fokkema et al., 2017; Huang et al., 2016).

In spite of the fact that studies doubt whether using wearable technology, particularly activity trackers improve health conditions (Finkelstein et al. 2016; Jakicic et al., 2016), the grounds for tools monitoring physical activity have been justified in several fields. Different overview studies and meta-analyses have confirmed that sedentary behaviour with adults can be influenced by using activity trackers (Stephenson et al., 2017; Prince et al., 2014; Martin et al., 2017). Another research has proved that the use of pedometers correlates closely to the increase of physical activity and the decrease of body mass index (BMI) as well as blood pressure (Pal et al, 2009). Physical activity monitors can encourage their users to do more action by providing individuals with data about their performance, the possibility to focus on a number of aims and to get feedbacks, instructions and rewards (Bravata et al., 2007; Mercer et al., 2016; Lyons et al., 2014). The continuous and real-time feedbacks allow experts to work out widely manifestable low-cost intervention programs in order to roll back sedentary behavior (Macridis et al., 2018).

In general these investigations concentrate on short periods of time (usually a week) and they also do not touch upon the usability of mobile applications and the properties and attitudes connected to wearing activity meters and their functions. Finding out the experiences of users can provide workers of health care, researchers or suppliers with useful information.

Taking this deficiency into account the present study intends to survey the findings of people using wearable activity trackers about the device and its use. Almost half of tracker owners are under the age of 35: 42 % are 18 to 34 years old, 19 % are 35 to 44 years old, 16 % are 45 to 54 years old, 16 % are 55 to 64 years old, and 7 % are 65 and older (Khalaf, 2014) therefore they are the target group of the examination.

## **2. Methodology**

**Overview.** This present study has gathered data and surveyed experiences on wearable activity trackers among university students. For detailed understanding of the issue, a questionnaire survey and a focus group discussion was performed. Both examinations were completely anonymous. The principles of the Declaration of Helsinki and the new GDPR served as a basis for the experiment that all participants understood and thus gave their consent to.

**Participants.** Only people aged between 18 and 34 who wear some sort of technological device at present were examined in the questionnaire survey. Participants were selected from among the population of the university in general education courses. We searched an answer among non-wearers for what the cause of their decision was, namely not wearing the device and whether they were planning to gain one in the future. After interviewing 400 people we ceased to gather data by questionnaires. For in-depth interviews potential participants were approached and verbally recruited by authors. Until a desired number of test subjects were found, experts used snowball sampling and gathered the additional participants. In the focus-group interview the target group became young people aged between 18 and 34 currently using wearable activity trackers.

### **Measurement.**

**a) Questionnaire.** Beyond observing demographical data, the questionnaire was to explore the use, motivation for and effect on physical activity of wearable activity trackers as well as the technical parameters of using the device. During the survey CAWI (Computer-Assisted Web Interviewing) method was applied. The recruitment was carried out partly at university courses and partly on e-learning interface, where we placed the link directing to the questionnaire.

**b) Interview.** The focus group was specifically aimed to gather information that is to say to gain recognition in order to complement questionnaire surveys. In the paper we employed semi-structured focus group interviews so as to gain more comprehensible details on observations and insights to wearable devices in connection with the following topics: advantages and disadvantages of the wearing and functionality of the devices and also their effect on physical activity.

The group interview was carried out with the participation of ten young people on the basis of focus group interview format where they were required to answer questions in a conversational setting. It took an hour and throughout the interview questions were presented in a semi-structured questionnaire format used in a flexible fashion according to the flow of the process. The whole event was audio-recorded and later transcribed into a text file accordingly. Recruiting

the focus group took place partly with the help of the organizers from their own study groups and partly in online form through the e-learning interface of the University of Debrecen.

**Analysis.** Data was analysed with SPSS 22 version. Beside descriptive statistics (SD, Mode, Median), we applied Pearson's Chi square test ( $\chi^2$ ) and Student's t-test as well. We considered the results of statistical tests significant in case of  $p < 0.05$ ,  $p < 0.01$ .

### 3. Results and Discussion

**Demographical properties.** A total of 589 people filled in the questionnaire, 28 out of who were excluded afterwards because of faulty completion, another 6 people were over 34 years of age, so eventually as many as 555 people were taken into account in our sample. At present 146 people use such a device and the number of non-users is 409. Properties of the participants are presented in Table 1.

**Table 1.** Demographic characteristics of participants

Factors/n	User	Non user
<b>Gender</b>	n=146	n=409
<b>Male</b>	63 (43.2 %)	188 (46.0 %)
<b>Female</b>	83 (56.8 %)	221 (54.0 %)
<b>Age (average,18-34 years)</b>	20.55	21.96
<b>Education</b>		
<b>High school diploma</b>	139 (95.2 %)	371 (90.7 %)
<b>BSc degree</b>	6 (4.1 %)	37 (9.0 %)
<b>MSc degree</b>	1 (0.7 %)	1 (0.3 %)
<b>Settlement type</b>		
<b>Village</b>	21 (14.4 %)	71 (17.4 %)
<b>City with right of county</b>	59 (40.4 %)	197 (48.2 %)
<b>City</b>	64 (43.8 %)	139 (34.0 %)
<b>Capital</b>	2 (1.4 %)	2 (0.5 %)

The average age of participants was 21.59 years (SD=2.64), 45.2 % (n=251) of them were female and 54.8 % (n=304) were male. A great majority of the attendants live in a town or a city and their highest degree of education is secondary. The latter one is certainly the conclusion of the studied sample.

**The kind of technology used.** The most commonly used wearable devices were wristbands (65.1 %, n=95) and smartwatches (34.9 %, n=51). Each of the participants used one certain type and apart from the two above mentioned gadgets they did not use any others. In the market of wearable devices these two stood out in terms of sales volumes in 2017.

**How long they have been used.** Smartwatch users entered the market before fitness tracker users appeared. 51 % of them started wearing these watches over a year ago, 43 % of them in the past year and 26 % in the last 6 months. 25 % of fitness tracker wearers have been using the device for more than a year, 41 % for up to a year and 34 % of them for a maximum of 6 months. This can be explained by the fact that higher price category smart watches appeared in the market earlier, while lower price, relatively reliable performance second- and third generation fitness trackers only popped up in the past two years. On the other hand, the change in customer trends also give reasons for the discrepancy.

**Ways of acquisition.** Regarding the ways of acquisition, most typically people give smart watches to others as presents: 71 % of watch wearers got the device as a present and only 29 % of

them bought it for themselves. As opposed to that, it is the other way around in the case of fitness trackers: nearly 50 % bought the item for themselves.

**Table 2.** Wearable technology usage among participants

Factors/n	Smartwatch	Wristband
<b>Gender</b>	<b>n=51</b>	<b>n=95</b>
<b>Male</b>	23 (45.1 %)	40 (42.1 %)
<b>Female</b>	28 (54.9 %)	55 (57.9 %)
<b>Age (average,18-34 years)</b>	20.63	20.52
<b>How did you get the device?</b>		
<b>Purchase</b>	36 (70.6 %)	48 (50.5 %)
<b>Gift</b>	15 (29.4 %)	47 (49.5 %)
<b>How long have you been using the device?</b>		
<b>&lt; 6 month</b>	3 (5.9 %)	32 (33.7 %)
<b>6-12 month</b>	22 (43.1 %)	39 (41.1 %)
<b>&gt;12 month</b>	26 (51.0 %)	24 (25.2 %)

**Exercising, physical activity.** As far as doing exercise is concerned, it can be stated that a significant majority of the participants do regular sports (65.6 %, n=364); only 34.4 % (n=191) claimed not doing any physical activity at all. Most of the people doing regular sports do recreational level sports (78 % n=284), while the percentage of competitive level sportlers is 22 % (n=80). Among users and non-users of the device there was a remarkable difference as for doing sports ( $\chi^2=7.224$ ,  $df=1$ ,  $p < 0.01$ ).

150 minutes of moderate-intensity aerobic activity every week is recommended by the Physical Activity Guidelines for Americans to improve health. Therefore we asked them how many days they have a week, when they pursue a minimum of 30 minutes of moderate-intensity exercise. The answerers do it on 3.84 days on average (Mode=3.0, Median=4.0, SD=1.78). Only 3.4 % (n=19) of the interviewees do not get engaged in any exercise at all.

A notable difference could be found between wearable tracker users and non-users in the number of days they spend doing exercise ( $t=3.279$ ,  $p < 0.01$ ). Non users spend an average of 3.69 days a week (SD=1.83) doing exercise while wearable tracker users spend 4.26 days a week (SD=1.74).

Participants were asked whether the use of the device had any effects on their previous physical activity. A surprising percentage of 47.9 % believed that it did not change their physical activity and a little over half of the participants (52.1 %) said that it did to various extents. In respect of the wearers of the two devices, a large difference could be spotted in the change of physical activity. 70.6 % of smart watch wearers claimed that wearing the tracker had a positive effect on their physical activity and only 29.4 % said that it did not influence their physical activity. In case of the fitness trackers 42.1 % were positive about the effects and 57.9 % remained neutral about them ( $\chi^2=10.839$ ,  $df=2$ ,  $p < 0.05$ )

**Table 3.** Physical activity among participants

Factors/n	User	Non user
<b>Regular sport</b>	<b>n=146</b>	<b>n=409</b>
<b>Yes, recreational level</b>	84 (57.6 %)	200 (48.9 %)
<b>Yes, competitive level</b>	25 (17.1 %)	55 (13.4 %)
<b>No</b>	37 (25.3 %)	154 (37.7 %)
<b>Perceived physical activity (minimum 30 minutes moderate physical activity) / week</b>	Average: 3.84 day; Mode: 3.0; Median:4.0	
	4.26 days/week	3.69 days/week

**What is the reason for wearing it?** We found it crucial to investigate what was the participants' main purpose for using a wearable activity tracker? More than half of the interviewees (56.2 %, n=82) use the device in order to get a more precise image of their daily physical activity. Almost every fourth person (24 %, n=35) admitted that they wear such appliances because they like to follow information technology trends and enjoy trying new gadgets.

**Table 4.** Main purpose for using wearable activity trackers

Purposes	Users (n=146)
<b>Monitor my daily physical activity</b>	82 (56.2 %)
<b>I would like to live healthier</b>	11 (7.5 %)
<b>I like the gadgets / I like to keep up with IT trends</b>	35 (24.0 %)
<b>I would like to harden more</b>	5 (3.4 %)
<b>I would like to look better</b>	8 (5.5 %)
<b>Other</b>	5 (3.4 %)

**How often is it used?** More than half of the people (50.7 %, n=74) wear the device constantly, and 37.7 % (n=55) take it off from time to time, but wear it mostly. Only 11.6 % (n=16) wore the trackers with a varying intensity or rarely.

**What users measure and observe?** In this section, we present respondents' experience of using a wearable activity tracker, especially what kind of features they use them for. The most commonly used function is a pedometer (86.3 %, n=126), 63.7 % use the sleep watch function and more than half of the respondents (56.2 %, n=82) take their pulse with the help of the device. Only 5.5 % track their weight change with it.

**Table 5.** Monitored features

Features	Users (n=146)
Step counts	136 (93.2%)
Sleep pattern	93 (63.7%)
Heart rate	82 (56.2%)
Weight	8 (5.5%)
Blood pressure	5 (3.4%)
Burned calories	47 (32.2%)
Distance	66 (45.2%)

We also asked participants how often they examined their daily activity data. 76 % (n=111) of the people said they checked their data minimum once a day. 45.9 % (n=67) of them did so several times, 13.7 % (n=20) watched their data less than 2 or 3 times a week and 10.3 % (n=11) checked theirs even less frequently.

We asked users about whether they set any goals in any features. 77.4 % (n=113) of them set daily goals, which were usually the amount of steps (total n= 113; 86.7 %, n=98) and sleep (14.2 %, n=26).

**Detecting problems.** Apart from positive experiences, participants reported disadvantages, as well. Most of them did not encounter any problems while wearing the device (41.8 %, n=61). The most frequently occurring problem was low battery power (28.8 %), inaccurately measured data (20.5 %), synchronization problems with smartphone/tablet (15.1 %) and technical issues (14.4 %).

**Non-users.** We were curious to find out the reasons for not owning a wearable activity tracker device. Most people (50.4 %) named the price of the devices as a main factor. Every fifth respondent reported that the everyday use of the device would disturb them. 17.8 % were not interested in the item and 16.1 % had not used one because they found it imprecise. Only 26.7 % were planning to buy some sort of a wearable activity tracker in the near future, while most of them (73.3 %) still did not think that they would need such a device.

**The results of the deep interview.** Based on the interviews we distinguished 3 major themes: usage (advantages/limits), monitored features and impact on physical activity. 10 people took part in the deep interview, 5 men and 5 women and their average age was 21.8. Several advantages and disadvantages were mentioned by users in connection with the wearing of the devices. Quite a few users pointed out that wearing the device did not disturb them, moreover it was much more practical than measuring data by a telephone. More than one person stated that the outlook of these devices are trendy, have nice designs and suit most outfits.

*„I can wear the fitness tracker day and night, I do not need to hold another device such as my phone that would count my steps, in my hands.” [P1]*

*„The device is small, its size does not disturb me, and it is not conspicuous. Its color suits every outfit, it is not bright, but simple, black.” [P1]*

*„It is easy to wear, has a youthful design, is trendy and never blocks me in doing anything.” [P5]*

*„Its layout is youthful, modern. It can be worn even with a suit, but it also matches sportswear.” [P6]*

The fact that certain devices are non-waterproof and cannot be used in case of certain sports (swimming) and while washing was named as a univocal disadvantage among users. Others mentioned that wristband trackers disturbed users in doing sports and could even cause a skin reaction such as a rash. Some respondents claimed that the device did not match all of their outfits.

*„It is not waterproof and I need to take it off when having a shower and I find it uncomfortable. I have to watch out that the device does not contact with water when I wash my hands.” [P1]*

*„When I was doing exercise or even sleeping the meter fell out of the rubber part of the tracker.” [P2]*

*„When I did workout at the gym I had to take off the device, because it obstructed me, but other than that, I did not experience any setbacks while wearing it.” [P3]*

*„It disturbs and annoys me sometimes on my wrist.” [P4]*

*„It does not match all of my outfits.” [P7]*

One of the respondents emphasized that wearing a rubber band can lead to health problems on the long run.

*„Rubber covers may cause skin cancer, and it is uncomfortable daily that my skin sweats under the device more than otherwise.” [P1]*

Most respondents were interested in step counts, but data on sleep won great recognition, too, as people had not come across this function before.

*„I followed the pedometer especially.” [P8]*

*„I was really curious about my sleep results, the quality of my sleep every night.” [P1]*

*„Apart from the step data that I closely follow, I am keen to check the data on my sleep not because I want to improve it, just because I find it interesting.” [P2]*

*„I would first highlight sleep analysis as I have not met this application before and find it very useful.” [P5]*

There were users whom sleep watch function remained a dead square for, because wearing the device was not comfortable for them.

*„I did not use the sleep watch function, because I did not like to have it on while sleeping.” [P10]*

Most users spoke positively about the accuracy of data, but some participants expressed frustration that the tracker registered the moves of the hands, therefore showed inaccurate data.”

*„I checked the pedometer mostly, at the same time it did not measure my step precisely, because it counted my arm movement as well.” P8]*

Another user mentioned the problem of pulse measurement during load.

*„The device is not suitable for collecting data during load: it can either not take pulse during running or shows an unrealistically low value. In other normal circumstances it is perfectly reliable.” [P6]*

Users observed the data daily, but some of them did it far more regularly.

*„I follow my daily physical activity on it 7 or 8 times a day.” [P6]*

Wearable activity trackers provide insight into participants' physical activity, and all of them found this feedback very useful.

*„I have knowledge about how many steps I take and what my sleep is like.” [P4]*

*„I can track down my physical activity, if my organism receives the sleep and physical activity amount that it needs for proper functioning.” [P8]*

Users estimated the effects of the wearable activity trackers on their lives differently. Some of them stressed that the use of wearable activity trackers increased physical activity. When they started wearing them, data supplied by step counts acted as a trigger to spend more time with physical activity, however this enthusiasm faded with time.

*„In the first few days it was very exciting to see how many steps I take a day, how much I sleep. When the first month went by, my enthusiasm was far less intensive. I worked on fulfilling my goal that I set up for every day, though.” [P1]*

*„I was absolutely motivated by the numbers the gadget showed me, therefore I took it as a race and unconsciously I started doing more and more exercise. After I realized it, it became conscious. It affected the daily distance/step counts.” [P2]*

*„I feel motivated if I can see my results. In the beginning it expressly encouraged me to do exercise and to run a healthy way of life, but after 5 months it subsided. Still, my physical activity is much more intensive than when it was before wearing the tracker. I live reaching my daily goals and having a good quality of sleep as a positive experience.” [P7]*

A user had a guilty conscience when they could not reach their target for the day.

*„It gave me some pricks of conscience to see that I was not really active on the weekends.” [P1]*

In some cases users did not change their habits of physical activity as a result of wearing the device.

*„I reckon my activity has not changed to a great extent neither positively nor negatively since wearing the tracker. I would say that following the control of my activity has been an interesting new thing for me.” [P3]*

*„Wearing the tracker did not cause me to do more exercise, since I had been doing regular sports beforehand, too.” [P9]*

There have been relatively few surveys that examine the use of wearable devices by college students. The study investigated attitudes towards wearable technology among university students. Our research employed both quantitative and qualitative data analysis methodology in order to make a more in-depth analysis of user experience.

A common statement of the studies related to this theme was that wearable activity trackers were used to self-monitor physical activity and if users set goals, they enhance physical activity levels (Ridgers et al., 2018). Similar findings were observed in this study: most respondents wear the device in order to follow their physical activity and three quarters of them set some sort of aims for the day with the gadget.

In general we can conclude that most of the interviewees do regular sports, primarily on a recreational level. Among tracker users the number of those who do sports is remarkably higher than among non-users. This difference in favor of users was also noticeable when they were asked about how many days they have on a regular week when they do exercise of moderate intensity for at least 30 minutes.

When examining the effects of the device on physical activity we found that almost half of our respondents did not change their physical activity from starting wearing the tracker on. And among users, mostly smart watches had an effect on physical activity. We suppose its explanation could be that device users were most typically those who did regular sports. This supposition was supported by deep interviews. The primary purpose of using the device was to track down physical activity.

Also, it can be concluded that every fourth participant wears such a device because they are keen on following information technological trends or are interested in gadgets.

The use of wearable technology has been spreading more and more widely among customers recently with the most well-known and wide-spread form of smart watches and activity trackers in the category of everyday devices. Similar findings were observed in this study, namely that among university students the most commonly used gadgets were wristbands and smart watches.

As a general rule, the constant wearing of the device is influenced by aesthetic and comfort aspects in the age group of our respondents (Ridgers et al., 2016).

Congruent to the findings of Ridgers et al. (2018), there was contrasting data in relation to comfort and wearability: some university students pointed out that they found it comfortable and fashionable to wear (6 mentions) while others claimed that wearing the device restricted their movements in a way (4 mentions). Interestingly every fifth respondent reported that they did not use a tracker because they thought wearing them would be uncomfortable.

We found that fitness tracking devices are primarily used for tracking step counts (93.2 %). Apart from this function the amount of sleep was also checked by respondents and several people highlighted the novelty of this application.

The most commonly mentioned disadvantages of the device were the short lifespan of the battery, the difficulty in synchronization and the inaccurately measured data. These findings are consistent with a previous work, in which (Maher et al., 2017) found that the battery lifespan was the participants' main complaint regarding activity trackers (Schaben, Furness, 2018).

Both types of device motivate users to do more physical activity, thus having a positive effect on health.

The study is limited to a relatively small area, which must be taken into consideration when interpreting the results. One shortcoming of our study is a relatively small sample size of the population. We surveyed only 146 participants, so the generalization of our findings is not as extensive as we wanted it to be. Although the use of wearable activity trackers was more common in the younger age group sample, our findings should be explained with caution and data collected through a self-report survey might not be considered representative either because of the low attendance. Our results should also be interpreted with caution in case of the younger age group sample. With older generations we could have received different answers as far as usage and purpose of wearable activity trackers are concerned. We presume that university students' physical activity levels are probably higher than that to other age groups, therefore our results should not be generalized to all ages of people.

#### **4. Conclusion**

Wearable devices carry new possibilities for individuals to improve their health and physical fitness and mean new challenges to researchers and clinicians about this emerging domain. Wearable devices have positive effects on physical activity among university students. To sum it up, this study found that in the given age category wearable devices were used to self-monitor daily physical activity and sleep patterns.

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