CHRONOTYPE AND PHYSICAL ACTIVITY OF ADULT POPULATION AND COLLEGE STUDENTS

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ABSTRACT

The aim of the study was to identify chronotypes and to quantified their impact on the physical activity of the adult population (skDP) and college students (skVS).

The objective of this study was a $_{sk}$DP group (n = 81, age = 50,6±11,7 years old; body height = 1,66±0,06 m; body weight = 68,4±12,0 kg; BMI = 24,7±4,1 kg/m^2) and a $_{sk}$VS group (n = 50, age = 21,0±1,4 years old; body height = 1,72±0,08; body weight = 66,6±14,5 kg; BMI = 22,5±3,7 kg/m^2). The identification of chronotype was carried out questionnaire of Smith, Reilly, Midkiff (1989) and by physical activity questionnaire. The relevant chronotype and the physical activity of the respondents was identified on the basis of the achieved score according to the set point scale. To compare the correlation relationships between variables we used nonparametric Spearman´s test (r_s) and for median dependence we used sme U-Mann-Whitney test. Statistical significance was assessed at the level of significance of variables at a value of $p > 0,05$.

The results showed that in the skDP group of 53 respondents leaned towards the morning chronotype (65.4%), 26 respondents were neutral chronotype (32.1%) and 2 respondents leaned towards the evening chronotype (2.5%). In the $_{sk}$VS group we identifieds 6 respondents of morning chronotype (12%), 41 respondents of neutral chronotype (82%) and 3 respondents of evening chronotype (6%). In the $_{sk}$DP group we found a significant correlation relationship ($rs = 0.23$, $p < 0.04$) between chronotype and the physical activity. In the $_{sk}$VS group we

found an insignificant negative correlation relationship (rs =-0.05, p > 0.76).

By comparing morning chronotypes and physical activity we found out an insignificant differences between skDP-r group and skVS-r group (U = 88.5; Z =-1.778; p > 0.075) with low significance (r = 0.23. By comparing neutral chronotypes and the physical activity between the skDP-n and skVS-n group we noticed a significant differences (U = 376, Z =-2.028, p < 0.043) with low significance (r = 0.25).

INTRODUCTION

Chronotype represents the timing of physiological, biochemical, psychological and physical variables that are closely related to the sleep- wake cycle. Chronotype is controlled by central clocks stored in the suprachiasmatic nulcleus of the hypothalamus and is determined by genetical, environmental and by social factors especially by day light. People are generally daily creatures, which means that they are active during the day. However, individual differences often occur between individuals. The individual chronotype also determines the timing of the switching of hourly genes in cells called peripheral clocks. According to the individual chronotype the whole time system of the body is timed out by both central and peripheral hours.(Nováková et al. 2013). Physiological processes in people with different chronotype have a significant impact between biological and social hours. The natural light mode in different areas is known to affect human performance. (Jančoková, 2018).

Identification of chronotype in humans is determined by the timing of the secretion of melatonin or by sleep. It can be reliably identified through standardised questionnaires used in different countries of the world. Conducted studies across geographical areas of the globe agrees that the distribution of chronotype in the population is almost Gaussian (Bendová, Červená, 2016). Authors dealing with the identification of chronotype classyfied people in to many different views. Authors dealing with the identification of chronotype sort people in different respects. Currently the most frequently used classification of chronotype for the morning type (called lark) is the type of person who is more active in the early stage of the day. The evening type (called owl) is a type of person who is more active mostly in an afternoon. According to Caciho et al. (2009) is morning type and

evening type opposite ends of the continuum to which individuals are assigned with respect to their preferred time for cognitive and physical activities. In chronobiology we recognize another type of chronotype so-called the balanced type or neutral type which does´not have any time prefrerence to a specific time of the day. With above mentioned classification agrees the majority of authors for example: Horne, Ostberg (1976); Reilly et al. (2007); Harada et al. (2011); Muro et al. (2011); Adan et al. (2012); Roenneberg (2012); Waterhouse, Fukuda, Morita (2012); Jančoková et al., 2013; Levandovski (2013); Vitale et al. (2013); Díaz-Morales et al. (2014); Adan (2015); Loureiro, Garcia-Marques (2015); Vančová, Pivovarniček, 2016(a,b); Leone et al. (2017); Fuhr (2017), Montaruli et al. (2017); Jančoková, 2018) and others.

Research dealing with surveyes on the chronotype population state that chronotype in the ontogenetic development of an individual changes and it is influenced by exogenous factors (Lange a Radler, 2011). Children are the morning types in puberty they begins to outweigh towards evening type and by the end of the adolescence they can move up to the late evening type, but there are also exceptions to that. To similar results attain authors like (Randler, 2011; Simpkin et al., 2014; Nimrod, 2015; Rahafar et al., 2017). Research on chronotype preference in college students population indicates that this group tends to be a neutral type of the chronotype in particular because they do not have a fixed study schedule and the teaching takes place in the morning, in the afternoon and sometimes during the evening hours (Hagenauer, Ku, Lee, 2011; Werner et al., 2012; Kondrátová, 2018). Fernandes-Mendoza et al. (2010) in their study pointed out neutral type of the chronotype in the population. Paine et al. (2006) found that the morning and evening preference is independent of race, gender, socio-economic status, indicating that it is a stable characteristic of an individual studies have followed diurnal changes in the various parameters of the movement and which can be better clarified by endogenous factors.

Most of the previously published scientific sports activities as well as how to achieve the performance. The term "diurnal" corresponds to the light stage of the day, by in contrast the term "nocturnal" means "night". It is known that many physiological parameters related to the physical acticvity or sports activity of a person during the day

fluctuate both at rest and during an effort. Many research shows a link between chronotypes and physical activities. Many authors emergins from carried out the studies note that monitoring individuals show a preference to sports and physical activities with the achievement of best performance over a period of time during the day (Bird, Tarpenning, 2004; Edwars et al., 2005; Jančoková a kol. (2011); Randler, 2011; Aloui et al., 2013; Montaruli et al., 2017 a ďalší).

Reilly, Waterhouse (2009) and Kantermann et al. (2012) but they point out that during the day the performance and vigilance of a person changes depending on the time from getting up from the bed (the biological need for sleep to ensure homeostasis) but also from circadian rhythm. With similar implications also agrees Pivovarniček (2009) which complements the need to respect physiological regularities of biological rhythms. Based on the findings of Roenneberga et al. (2007), adolescents have two peaks of higher performance from 10. to 12. AM and between 16. and 18. PM. According to Barbosa, Albuquerque (2008) this is related to chronotype, because the morning types are exceled from 6-14 AM and the drop occurs from 14-22 PM.

Vitale, Weydah (2017) examined the impact of physical activity and chronotype. They came to the conclusion that the physical activity in the morning chronotype showed the highest performance compared to the evening and neutral type. Randler (2011) pointed to the correlation between the morning type and the physical activity.

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AIM

The objective of the study was to identify chronotypes and quantify their impact on physical activity in the adult population and college students.

METHODOLOGY

The adult population research group ($_{sk}$DP) formed 81 respondents (women n = 77, men n = 4; age = 50,6 ± 11.7 years old; body height = 1,66 ± 0.06 cm; body weight = 68,4 ± 12.0 kg; BMI = 24,7 ± 4.1 kg/m2) visiting Flow Pilates Centrum in Banská Bystrica and in Brezno. The researche group of college students (skVS) included 50

respondents (women n = 37, men n = 13; age = 21,0 ± 1.4 years old; body height = 1,72 ± 0.08; body weight = 66,6 ± 14.5 kg;BMI = 22.5 ± 3.7 kg/m2) attending general physical education class at the Department of Physical Education and Sports of the Faculty of Philosophy of the University of Matej Bela in Banská Bystrica. A collection of primary data occured from September 2016 to March 2018.

To identify chronotype we used Smith, Reilly, Midkiff, (1989) questionnare.The questionnaire contained 13 closed questions. All questions (A, B, C, D or E) in the questionnare have been assigned a certain number of points for each answer. When evaluating the questionnaire we counted the acqiure points and on the basis of the obtained score to each individual was assigned a specific chronotype according to the specified set point scale: evening type (0-27 points), neutral type (28-41 points) and rmorning type (42-55 points).

To obtain data for physical activity (PA) we used physical activity questionnaire which included 7 closed questions.Every answer had assigned a number of points. When evaluating the questionnaire we counted the obtained points and on the basis of the score obtained we assigned to each individual a category of physical activity: the average PA (0-21 points), the average PA (22-30 points) and above average PA (31-36 points).

For evaluation of data we obtained we have used the location level (arithmetic mean (x) of the descriptive characteristics from the degree of variability of the standard deviation (SD).To express the representation of each individual of chronotype we used percentages (%). As part of the inductive statistical analysis we have detected a significant difference between the point values in the groups and between the groups. To determine the correlation relationships between the chronotype and physical activity we used a nonparametric Spearman´s test (r_s). In all tests the probability of I. type error was set to $\alpha = 0.05$. The equality of position parameters (median) we examined by using nonparametric Mann-Whitney U test. As part of the factual analysis we used the significance coefficient „r“ to determine "effect size" (Cohen, 1988). The statistical analysis was implemented through the IBM ® SPSS ® Statistics V19 computer program.

RESULTS

In the adult population research group (skDP) from a total of 81 respondents we identified 53 respondents of morning chronotype (65.4%), 26 respondents of neutral chronotype (32.1%) and 2 respondents og evening chronotype (2.5%). In the college students research group (skVS) we have identified 6 respondents of morning chronotype (12%), 41 respondents of neutral chronotype (82%) and 3 respondents of evening chronotype (6%). Due to lack of the evening chronotype in both groups we have not further evaluated these groups.

Table 1 Identification of chronotype skDP and skVS

	Morning type $_{sk}$DP	Neutral type $_{sk}$DP	Morning type $_{sk}$VS	Neutral type $_{sk}$VS
	n 53	n 26	n 6	n 41
Physical activity	r_s = 0,23, p > 0,04 *		r_s = – 0,05, p < 0,76	

Legend: n - number of respondents in the group, morning / neutral – chronotype, r_s – correlation coefficient Spearman´s test, * - significant result of the statistical analysis(p < 0,05)

In the statistical analysis of the skDP group chronotype and physical activity we found a significant positive correlation relationship (rs = 0.23, p > 0.04 *). With a higher score of skDP physical activity the higher the score in the chronotype questionnaire is related.In the statistical analysis of skVS chronotype and physical activity we found an insignificant negative correlation relationship (rs =-0.05, p < 0.76).

The ratio of skDP group between morning and neutral chronotype is 53:26 i.e. prevailing morning types (Table 1). On the other hand, skVS has a significantly opposite result of 6:41 with the preference of neutral chronotype (Table 1). Roenneberg et al. (2003), Lange, Randler (2011) and Simpkin et al. (2014) in their studies note that people with increasing their age are moving more towards the morning chronotype which confirms our research. Fernandéz-Mendoza et al. (2010) in their studies showed the neutral chronotype are the most commonly occurring among population.

In the statistical analysis of the physical activity skDP group of morning chronotype

we found an average score is 26,3 ± 3.7 points for neutral chronotype we recorded a lower score of 24,8 ± 3.0 points (Table2). In the skVS group we found different results or higher average scores reached in neutral chronotype of 26.5 ± 3.7 points compared to morning chronotype 23.5 ± 4.2 points. Overall the highest score is reached in neutral chronotype of the skVS group (26.5 ± 3.7), the lowest score we also recorded in skVS in the morning chronotype (23.5 ± 4.2).

Table 2 Results of the physical activity questionare

	Morning type $_{sk}$DP (n 53)	**Neutral type $_{sk}$DP** (n 26)	**Morning type $_{sk}$VS** (n 6)	**Neutral type $_{sk}$VS** (n 41)
Point scale x ± SD	26,3 ± 3,7	24,8 ± 3,0	23,5 ± 4,2	26,5 ± 3,7

Legend: $_{sk}$VS - college students group, $_{sk}$DP - adult population group, n - number of respondents in the group, morning / neutral – chronotype, x ± SD - arithmetic mean ± standard deviation

Comparing the morning chronotype (Table 3)between the adult population (skDP-r) and college students (skVS-r), we experienced insignificant differences in physical activity (U = 88.5; Z =-1.778; p < 0.075) with low significance (r = 0.23).

Table 3 Comparison of variables skDP and skVS in morning chronotype

		Physical activity
Mann- U-Whitney test	morning $_{sk}$DP (n = 53) morning $_{sk}$VS (n = 6)	U = 88,5 Z = -1,778 **p < 0,075**
ES	**r = 0,23**	

Legend: morning $_{sk}$DP / $_{sk}$VS – groups based on chronotype, n – number of respondents in the group, * - significant result of the statistical analysis(p < 0,05), ES – result of substantive significance

By comparing the neutral chronotype (Table 4) between the groups (skDP-n) and (skVS-n), we experienced significant differences in physical activity (U = 376, Z =-2.028, p > 0.043) with low significance (r = 0.25).

Table 4 Comparison of skDP and skVS variables in neutral chronotype

		Physical activity
Mann-Whitney U test	neutral $_{sk}$DP (n = 26) : neutral $_{sk}$VS (n = 41)	U = 376 Z = -2,028 **p > 0,043***
ES		r = 0,25

The research skVS group of the morning chronotype (skVS-r) achieved a highly significant negative correlation (rs = – 0.83; p > 0.043) between physical activity and chronotye (Table 5). From above informations it appears that at higher scores of physical activity the respondents lower scores and vice versa.

In the skVS neutral chronotype group (skVS-n) we found an insignificant positive dependency (rs = 0.12; p = 0.45) between physical activity and chronotype. It means that at higher scores of physical activity the respondents lower scores and vice versa.

In the skVS neutral chronotype group (skVS-n) we found an insignificant positive dependency (rs = 0.12; p = 0.45) between physical activity and chronotype.

Table 5 Correlation relationship of the chronotype to the level of physical activity

		chronotype
morning **$_{sk}$VS** *n = 6*	correlation coefficient	r_s = – 0,83
	test results	**p > 0,043 ***
neutral **$_{sk}$VS** *n = 41*	correlation coefficient	r_s = 0,12
	test results	p < 0,45

CONCLUSION

The analysis of the chronotype presented in this study showed in the adult population predominate the morning chronotype (65.4%) and the neutral chronotype was represented only 32.1%. In college students predominate the neutral chronotype (82%) and than morning chronotype (12%) .

In our research we have seen in relation to the physical activity the highest preference in the morning chronotype skDP group (age around 50 years old), but in skVS it was the opposite-for the neutral we found higher

activity compared to morning chronotype. The argument of the morning type and physical activity can be supplemented by the research from Atkinson, Reilly (1996), which covers 50-year-old athletes of the morning type and their involvement in the physical activity during the morning, unlike the younger group of athletes. In college students dominated the neutral chronotype confirming a number of research, such as Fernandez-Mendoza et al. (2010), Vančova, Pivovarniček (2016) and others.

By comparing the morning chronotype in our research between the adult population (skDP-r) and college students (skVS-r) we experienced insignificant differences in physical activity ($p > 0.05$) with low significance, but differences were demonstrated in neutral chronotype. Between (skDP-n) and (skVS-n) we have experienced significant differences in physical activity ($p < 0.05$) with low significance.

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