

## CHRONOTYPE AS AN INDICATOR OF PERSONAL CHARACTERISTICS AND FEATURES

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### **Abstract**

The aim of the study was to create the basis according to content analysis of many previous studies which focused on the chronotype's problem and personal features. The basis and information sources are important to realize a research which is aimed to verify the relationship between the chronotype and personal features of people who are interested in sport and they do it regularly and also of people who are not interested in any sport. The challenge is a question of confirmation of the chronotype's impact on realisation of sport or work activities in sport and general life during the day in term of diurnal and circadian rhythms. It is important to detect and verify an assumption that specific kind of chronotype has really impact on the human being's psychological, work and sport activity. Also, we want to detect and show the chronotype's impact on selected determinants of health which can show positive aspects in human-being's sport practice or everyday life by the specific application and the specific usage. If all assumptions and preconditions about chronotype's impact on work or sport in their suitable and complying time intervals are confirmed, it will also confirm the other important factor which makes our work more effective – time. This factor also respects the health of each human being. In other useful researches it would be suitable to correlate results of Clooninger's tridimensional personality questionnaire with questionnaire which is specialized on chronotype's identification (Horne & Ostberg, 1976). It would be very interesting to detect by the correlation of mentioned questionnaires- if people who tend to be the morning chronotypes (in different age groups) are characterized by more positive psychological features and traits than people characterized by the evening chronotype.

**Key words:** *circadian rhythm, psychological characteristics, temperament*

### **Circadian restriction of a chronotype**

The circadian rhythms present the section which is examined and recognized mostly in details. There are rhythmic oscillations, lasting about 24 hours. Zeman (2009) presents that the length of the circadian rhythm cannot be exactly 24 hours because each human being has specific and individual time period length approximately from 22 to 26 hours. It is also confirmed by Aschoff's researches (1990, 1995, and 1998). We recognize in connection with the characteristics of circadian rhythms according to Jančoková (2000) two phases of the biological day: a morning phase (lasting from 3 AM to 3 PM) and an evening phase (lasting from 3 PM to 3 AM).

On mentioned phases of the day we distinguish people's preference and inclination to one part of the day based on physical and psychological performance which is called a chronotype. Ronneberg (2012) presents that a chronotype is a genetic component or human's general behaviour within which there are phase changes in the human being's life which are different by the length of sleep, the level of melatonin, body temperature and by the other circadian oscillation physiological parameters. McEnany & Lee (2000) present a chronotype as an inclination of biological rhythms to present specific type of the human behaviour. Ottoni, Pantonioli & Lara (2012) present that a chronotype is a basic feature of temperament which everyone has and is responsible for mental and psychological disorders in the human organism.

Ronneberg, Wirz-Justice & Mellow (2003) differentiate chronotypes based on sleep length as in the morning chronotypes, also called as "the larks", which wake up in extreme cases in time when the evening chronotypes, also called as "the owls", fall asleep or go to sleep. Skočovský (2007) and a lot of other authors present that there is one more chronotype – neutral (neither type). This type hasn't got any preference – neither morning nor evening. In a new research Rosenberg et al. (2014) defines a chronotype as an individual disposition which differs in sleep. Based on the sleep schedule, they differ the morning chronotype, the evening chronotype and the neutral (neither) type. Werner et al. (2009) presents, that a chronotype varies from the the pubescence period up to the period in which the human being is independent - has regular work and own home. The pubescence is characterized by the evening or neither chronotype. Hagenauer, Ku & Lee (2011), Biss & Hasher (2012) and other researchers present that the human being's chronotype is changing according to the genetic conditionality during the life and according to the exogenous impacts

### **Chronotype's relationship to the human being's temperament**

The psychology presents four basic human being's temperaments and characters – sanguine temperament, choleric temperament, melancholy temperament and phlegmatic temperament.

Each of them has typical characteristics which present positive or negative facts about human behaviour. The studies of human being's psychological aspects and chronotype try to find out exactly the characteristics which describe the morning chronotype people and the evening chronotype people or if the chronotype is the determinant of concrete psychological characteristics. The human features and characteristic which were found as the most interesting for scientists and researchers are the following: moodiness, fatigue, stress, depression, fruitfulness. Jankowski (2012) used in his research the method of linear and quadratic hierarchical regressions thanks to which he has examined six temperament features of the chronotypes. He has compared briskness, perseverance, sensory sensitivity, emotional reactivity, endurance and activity. The results are the following: the morning chronotypes are characterised by higher endurance, briskness and the organism of the people who tend to be the morning chronotype are more active in general. The perseverance is not as high as the previous features. Also these people have lower level of emotional reactivity which can mean that they are stable (balanced personality). The evening chronotypes achieve better results only in activities (in the rest features they have achieved lower results). Chung et al. (2012) found out that the evening chronotypes have higher tendency to suffer from depression, fatigue and they are usually characterised as moody people. It is also confirmed and validated by research of Kitamura et al. (2010), Tzischinsky & Schochat (2011). The results of the studies made by Biss & Hasher (2012) and Reid et al. (2012) also confirmed the same results which had been found out in the previous researches. Biss & Hasher (2012) present that the morning chronotypes are in general happier than the evening chronotypes.

Roeser, Schlab & Kubler (2013) present that the chronotype is not the main determinant that modifies or dictates unsuccessfulness or fruitfulness of the human being but it has the main impact on the length of sleep and fatigue during the day. Muro et al. (2011) examined the character and performance (physical activity) of the female morning chronotypes and the female evening chronotypes. The research has shown that women who tend to be morning chronotypes are more active than women of the evening chronotypes. The results have even shown that women of the morning chronotype need to do some physical activity of whatever form. The significant differences of the chronotypes were examined by Roeser, Schlab & Kubler (2013). They identified lower presence of physical activity of the evening chronotypes and lower scores in temperament's tests. Their behaviour is more listless, aggressive, and they tend to be hostile and are conflict-like people. Ottoni, Antonioli & Lary (2012) agree with previous research and results who also added that the evening chronotypes are unstable people in general and are foresightless.

The psychological discomfort, low level of vitality, high emotionality, frequent arguments with parents and teachers are the main characteristics of female teenagers (12 - 16 years) of the evening chronotype. Schlarb et al. (2013) did researches on people belonging to adolescent or childhood period who tend to be the evening chronotype because they tried to confirm the fact that the evening chronotypes are more aggressive and they do need special programmes which would secure more social behaviour. They were interested in antisocial behaviour and aggression in general. The chosen respondents confirmed higher level of aggression and antic sociality. Merikanto et al. (2013) found out that the evening chronotypes have higher presence of the indicators which cause depressive mood. Lucassen et al. (2013) also identified that the evening chronotypes have more often psychological misbalance and they are usually moody. The authors claim that it was caused by lack of sleep which also caused higher blood pressure and irregular eating habits. The evening chronotypes had higher presence of the stress hormones compare to the morning chronotypes. Researches by Fossum et al. (2013) were focused on electronics and they monitored the impact of modern technical developments (such as mobile phones, television, personal computers) on chronotypes and their sleep. The study consisted of 532 students (18-39 years) who had used mentioned developments minimally 45 minutes before they went to sleep. Results have confirmed and showed that "chatting with friends and surfing" on the Internet could cause insomnia and psychological disorders connected to it.

The authors also present that excessive use of the internet in late night hours has negative impact mainly on the morning chronotypes whose "peak" of attention and activity is in the morning hours. Lemoine, Zawieja & Ohayon (2013) executed the research at the mental hospital where they monitored the chronotypes' behaviour. The research consisted of 1468 patients who filled in a sleep-quality questionnaire. They detected that the morning chronotypes go to sleep in early evening hours and they wake up early in the morning and they have shorter sleep than the evening chronotypes. It was diagnosed that the morning chronotypes very often suffer from depression and psychosis. The evening chronotypes are characterised mainly by the anxiety drug addiction, personality disorders. Martin et al. (2012) examined university students (who study and work). The experimental ensemble consisted of 88 students (36 men, 52 women between 19-21 years). The authors wanted to discover how physical work could influence their psychic and sleep. By the means of a standardised chronotype questionnaire they identified the morning/evening chronotypes. The evening chronotype was dominant for 17 students, the morning chronotype was identified in 13 students, and 58 students tended to be the neither chronotype.

The students filled in many questionnaires thanks to which Martin et al. (2012) denoted that the average sleep length of the working students is 6.38 hours. The evening chronotypes ( $n = 17$ ) had lower quality of sleep and they had usually chronic fatigue caused by work and school. Preckel et al. (2013) presents the results which show students' study results who attend the secondary school. The authors' predictions were the following: the evening chronotype students are not as successful as the morning chronotype students. The results confirm their predictions. The results significantly show that the evening chronotype students achieved worse results in scientific, mathematic and linguistic subjects. Another research which was focused on the relationship of a chronotype and temperament was made by Adan et al. (2010).

A group of 862 people was used to gather information by a questionnaire to determine a chronotype and by Cloninger's Tridimensional Personality questionnaire (the questionnaire consists of 7 scales and subscales which describe character and human being's personality). Their results documented gender differences in score they achieved. The evening chronotypes achieved higher score only on the scale of seeking new things. The research by Hidalgo et al. (2009) focused on the impact of the chronotype on human being's psychological rhythm. According to the results – the depression (its symptoms), inner tension, sadness, melancholic mood, low self-confidence, no ambitions or plans are characteristics which describe the evening chronotype, mainly female sex with this chronotype. McClung (2009) confirmed that abnormalities in circadian rhythms definitely influence the human psyche and can cause its bipolar disorders. These disorders are characteristic by the moodiness and can cause visible changes in behaviour. The human being often suffers from depression and they have a lack of energy to do some activity. Vollmer, Potsch & Randler (2013) made research in which they examined students' chronotypes (10-17 years).

The results show that the morning chronotypes are more successful at school and achieve better results than the evening chronotypes. Moreover, the authors recommend to delay and defer the start of teaching for the evening chronotypes because their "peak" is in the afternoon and only in these hours their work, endurance and fruitfulness can be compared to the morning chronotypes. Rosenberg et al. (2014) stated that according to their results the evening chronotypes have higher tendency to succumb to depression. This can be argued by the fact that the evening chronotypes have irregular sleep regime. Milfont & Schwarzenhal (2014) present that students of the morning chronotype have a tendency to not think only in presence (are out of stagnation) but they plan their future and they organise each moment of their life meanwhile the evening chronotypes are not interested in the future.

They still think about the past and presence because they may think about many situations in which they made some decision and they reflect it and consider if their conclusion was appropriate and good. Oginska & Oginska-Bruchal (2014) examined another sphere of chronotype's impact. They tried to find out if the chronotype could be influenced by the seasons of the year. 101 respondents ( $26.4 \pm 6.5$  years) filled in the chronotype's questionnaire to detect a chronotype, the questionnaire focused on the season's sensitivity and they also filled in the adult temperament questionnaire. The female results have shown that the seasons of the year influence them more than men ( $p = 0.014$ ) and they also try to avoid stress and stress situations more than men ( $p = 0.041$ ). Furthermore, the authors predict that factors like sensitivity, the impact of the seasons of the year and the environmental conditions are individual features which influence human being's psyche and they can cause moodiness. DelRio-Bermudez et al. (2014) examined the chronotype's impact on attention of adolescents ( $n = 47$ ) who drive a car in various time intervals during the day. They detected that if the chronotypes drive a car in time which does not correlate with their chronotype, their attention and safety will be lower.

### **Summary of the human being's chronotype in relation with psychological rhythms**

The inclination of each human-being to the particular chronotype (morning, evening, neither) influence not only their sleep cycle but also their behaviour. On the other hand it is possible to state that there is also an opposite relationship in which the sleep cycle influences the chronotype. The chronotypes are divided in two main groups – the morning chronotype which is called as a "lark". This "nickname" was stated by many authors like: &Lee (2000), Roenneberg, Wirz-Justice & Mellow (2003) etc. The second type is the evening chronotype which got the nickname "owl". Skočovský (2007) and other authors also present one more chronotype called the neither chronotype (neutral, mixed type) which has nothing in common with the morning or the evening preference. The chronotype influences various human spheres and its specific influence is on the human psyche. The chronotype's differentiation on the morning/evening chronotype was based on the sleep length and the quality of sleep by the authors Roenneberg, Wirz-Justice & Mellow (2003), Rosenberg et al. (2014) etc. The morning/evening chronotype's characteristics according to temperament were introduced by Kitamura et al. (2010), Tzischinsky & Schochat (2011), and Chung et al. (2012). Several results have shown that the morning chronotypes have higher tendency to be active, observant, friendly, ambitious, and successful. The evening chronotypes can be characterised according to Biss & Hasher (2012) and other authors' studies as types which tend to be more aggressive, less ambitious, have irregular sleep habits.

Those characteristics are given to the evening chronotype from temperamental and behavioral point of view and that is why people of this chronotype usually suffer from many sleep and psychological disorders. The most negative chronotype's synchronizer of people which causes sleep dissynchronization and health problems is a night shift (working at night). On the basis of studies' analysis from the sphere of mutual relations of the chronotype and psychological (temperamental) features of the human being, there are possibilities how to execute the researches in our conditions. The challenge is the question of real confirmation that the chronotype does have the impact on people's physical or work activity in their sport and general life during the day in terms of diurnal and circadian rhythms. It would be appropriate to detect, thanks to the researches, the prediction and assumption of chronotype's impact on the people's psychological, work and sport activity. At the same time it is important to detect and find out chronotype's impact on chosen health determinants which can be positively seen by

appropriate application in not only sports practice but also in general people's life. If we could confirm that identified morning or evening chronotype does have the impact on the human being's work or sport activity (the morning chronotype achieves better results in the morning and the evening chronotype in the evening) we would confirm that there is also another factor, the time, which makes people's work or sport activity more effective.

This factor simultaneously respects individual's health. In the further researches, it would be inevitable to correlate the results of Clooniger Tridimensional Personality questionnaire with the Questionnaire of chronotype's identification (Horne & Ostberg, 1976). By the correlation of the mentioned two questionnaires, we will come up with results, which can show if the people of the morning chronotype in various age groups are really characterised by positive psychological features and traits and if they are more friendly, ambitious and active unlike the people of the evening chronotype.

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## CHRONOTYPE KAO POKAZATELJ OSOBNE KARAKTERISTIKE I ZNAČAJKE

### Sažetak

Cilj istraživanja bio je stvoriti osnovu prema sadržaju analize mnogih prethodnih studija koje su usredotočene na problem chronotype i osobne značajke. Temelj i informacijski izvori su važni za shvaćanje istraživanja koje je ciljano na provjeru odnosa između chronotype-a i osobnih karakteristika ljudi koji su zainteresirani za sport i oni to čine redovito kao i ljudi koji nisu zainteresirani za bilo koji sport. Izazov je pitanje potvrde utjecaja chronotype-a na realizaciju sportskih i radnih aktivnosti u sportu i životu općenito tijekom dana u trajanju od dnevnih i cirkadijurnih ritmova. Važno je otkriti i potvrditi pretpostavku da specifična vrsta chronotype-a stvarno utječe na čovjekove psihološke, radne i sportske aktivnosti. Također, želimo otkriti i pokazati utjecaj chronotype-a na odabrane odrednice zdravlja što može pokazati pozitivne aspekte u ljudskom sportskom treningu ili svakodnevnom životu uz specifične aplikacije i specifične uporabe. Ako su sve pretpostavke i pretpostavke o utjecaju chronotype-a na posao ili sport u njihovim odgovarajućim podudarnim intervalima u skladu s vremenom potvrđene, to će također potvrditi i drugi važan faktor koji čini naš rad učinkovitijim - vrijeme. Ovaj čimbenik također respektira zdravlje svakog ljudskog bića. U drugim korisnim istraživanjima bilo bi prikladno povezati rezultate Clooninger's trodimenzionalno upitnika ličnosti s upitnikom koji je specijaliziran za identifikaciju chronotype-a (Horne i Ostberg, 1976). Bilo bi jako zanimljivo otkriti po povezanosti spomenute upitnike - ako su ljudi koji imaju tendenciju da su jutarnji chronotypovi (u različitim dobnim skupinama) obilježeni s više pozitivnih psiholoških obilježja i osobina od ljudi koje karakterizira večernji chronotype.

**Ključne riječi:** circadianski ritam, psihološke karakteristike, temperament

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