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The Assessment of Medical Students' Chronotypes

José Reinaldo Maximo Gomes[1], Fátima Karine Ferreira Santos[1], Isaac Filipe Melo de Freitas[1], Ilma Ferreira de Oliveira[1], Hete Aguida dos Santos[1], José Cláudio da Silva[1], Janise Dal Pai[2], Lysien Ivania Zambrano[3], Euclides Mauricio Trindade Filho[1]*, Milton Vieira Costa[1]

[1]Laboratório de Neurociência e comportamento, Universidade Estadual de Ciências da Saúde de Alagoas—UNCISAL, Maceió, Brasil
[2]Universidade Nove de Julho (UNINOVE), São Paulo, Brasil
[3]Facultad de Ciencias Medicas, Universidad Nacional Autónoma de Honduras, Tegucigalpa, Honduras
Email: *emtfilho@gmail.com

Abstract

Objective: This study aimed to investigate the circadian typology of medical students at public universities from one of the northeastern states in Brazil, active in the morning and afternoon shifts, checking the compatibility between their study time, productivity, income and chronotype. **Methods:** To obtain the results, the assessment of the chronotype in 342 medical students of both sexes was considered. Each participant was submitted to the questionnaire developed by Horne and Ostberg, adapted by Cardinali, Colomberk and Rey. It's composed of 9 questions, providing the general ranking of each individual. Based upon scored, the chronotypes were classified. **Results:** The sample was composed of 49.12% (168) male and 50.87% (174) female subjects, a similar gender distribution of enrolled students during data collection time. By applying the questionnaire, the prevalent rating among the medical students as moderately morning (29.82%) and intermediate (43.85%) has been relevant. The academic performance assessment in two morning-intermediate groups (8.16) had no significant distance from others considered afternoon active (8.20). **Conclusion:** The health sciences student, especially Medicine, faces constant adaptation of scheduling, in the attempt of fulfilling the requirements throughout the course, causing chronogram desynchronization effects and forced readaptation to each different school semester.

1. Introduction

The preference for morning-afternoon shifts is the individual difference that ex-

plains the variation in the rhythmic expression of biological and behavioral patterns [1] [2]. It allows relate the adaptability and the daily performance when changes are required in sleeping habits, which may affect or disrupt this important functional status [1].

This occurs because light stimulates specific cells located in the *retina* (*melatonin* as photoreceptor) sending neural projections via retinohypothalamic tract directly to the suprachiasmatic nucleus (structure located in the hypothalamus). Due to the control of biological clock, light has been currently considered as the main synchronizer agent [3] in organism.

A proper functioning of this synchronization system allows an alignment between environmental cycles. It provides an anticipation capacity, which allows the organism obtain resources to be prepared for events and activities indispensable for life [4]. Though related to environmental cycle, the rhythms are not only variations in medium so, without temporal fluctuations it continues expressing for days, months or years, depending on species [5]. This study aims correlate chronobiological rhythms with academic performance in medical students, in order to serve as a guide to allocate them according to the time of greater disposition to carry out daily activities.

2. Methods

This is an observational study with cross-sectional approach. Participated in study medical studentd in Maceió, capital of Alagoas, a state in the Northeast region of Brazil. Maceió is a coastal city, with approximately 932,000 inhabitants, is located at 9°39'59''S. The study was conducted from August 2015 to August 2016.

Participants were recruited following the inclusion and exclusion criteria, they were aware of participation and signed an application of *Free and Informed Consent*.

Each of 342 students has been submitted to the questionnaire proposed by Horne and Ostberg [6], adapted by Cardinali *et al.* [7]. It is composed of 9 questions where the score assigned to each response followed the table proposed by Cardinali *et al.* [7] (**Table 1**). Based on the obtained result, chronotypes has been classified.

The academic performance has been analyzed using income coefficients from each student, provided by the *Academic Division.*

The study has been conducted following the ethical standards to chronobiological researches in humans, following *the Declaration of Helsinki's* guidelines of the *World Medical Association* [8], and approved by the *Research Ethics Committee* from *Health Sciences State University of Alagoas—UNCISAL*, as well as the approval of *Faculty of Medicine Council* from *Federal University of Alagoas—UFAL.*

3. Results

The study included 342 students, consisting 97.2% of 352 questionnaires, which

Table 1. Score board with the answer selection from the chronotype evaluation questionnaire, proposed by Horne & Ostenberg, adapted by Cardinali, Colomberk & Rey.

QUESTION ORDERING	OPTIONS				
	A	B	C	D	E
1	1	2	3	4	5
2	1	2	3	4	-
3	1	2	3	4	5
4	1	2	3	4	-
5	1	2	3	4	-
6	4	3	2	1	-
7	4	3	2	1	-
8	1	2	3	4	-
9	4	3	2	1	-

09 to 15 -> Definitely morning; 16 to 20 -> Moderately morning; 21 to 26 -> Intermediate; 27 to 31 -> Moderately.
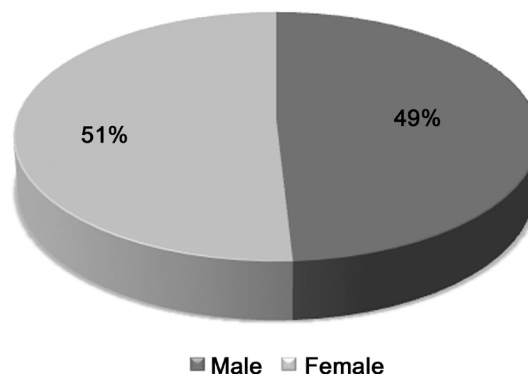

Figure 1. Disposition of individuals according to gender.

has been assigned and returned. Losses occurred due to incomplete and inconsistent filling. From the total amount of sample, 49.12% (168) were male and 50.87% (174) were female (**Figure 1**).

The ages of the students ranged from 18 to 61 years (24.11 ± 5.77; median = 24). Was observed a predominance of age in the range of 21 - 24 years (38.65%).
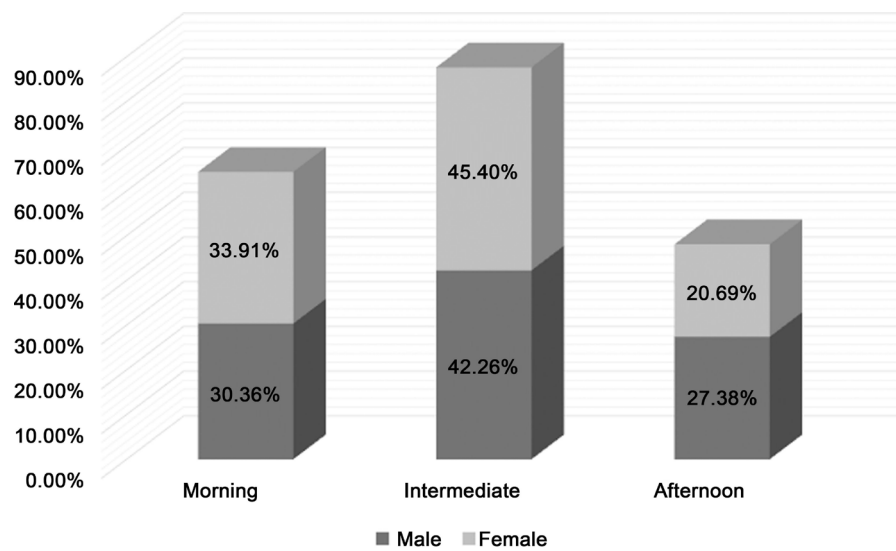
Chronobiological questionnaire showed that 8 (2.3%) were definitely morning (DM), 102 (29.82%) were moderately morning (MM), 150 (43.85%) were intermediates (I), 66 (19.29%) were moderately afternoon (MA) and 16 (4.67%) was definitely afternoon (DA) (**Table 2**). A marked difference has been found between genders, confirming a higher proportion of men preferring the afternoon shift (27.38%) compared to women (20.69%), with morning preference (**Figure 2**).

By analyzing the predominance of points according to their grouping, the frequency of scores displays a regular distribution (**Figure 3**). There were a variation between 10 and 37 points (13.03 ± 11.29), with a predominance of those who scored 20 points, representing 39.20% of the "moderately morning" rated.

**Table 2.** Chronotype division of interviewed participants.

Chronobiological Type	N#	%
Definitely morning	8	2.3
Moderately morning	102	29.82
Intermediate	150	43.85
Moderately afternoon	66	19.29
Definitely afternoon	16	4.67
Total	**342**	**100**

Caption: Frequency of chronotypes displayed by 342 medical students from public universities in the State of Alagoas, analyzed according to the questionnaire proposed by Horne & Ostberg, adapted by Cardinali, Colomberk & Rey.

Caption: Gender distribution according to greater chronobiological productivity.

Figure 2. Gender distribution according to the chronotypes.
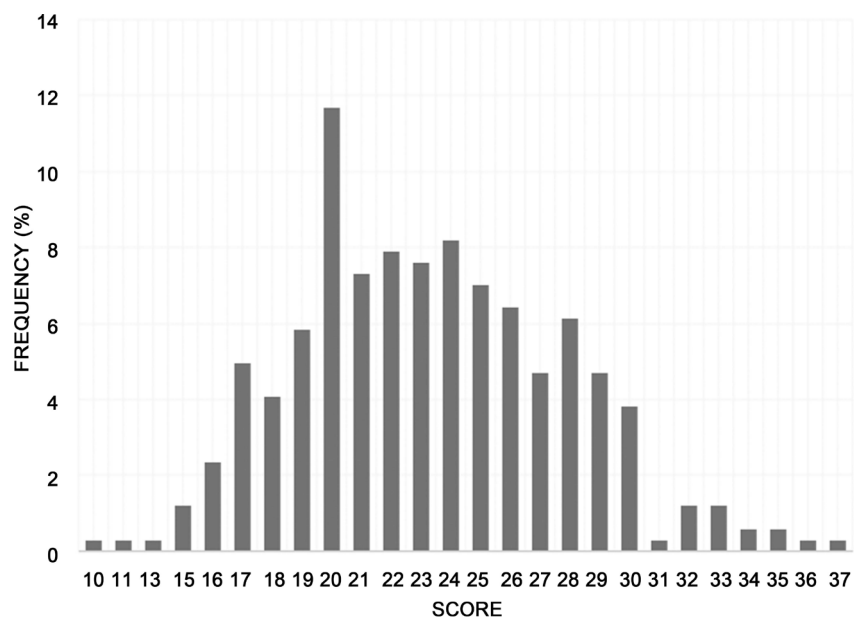
Caption: Frequency of scores in chronotype questionnaire from the total sample of participants.

Figure 3. Score distribution from the chronotype questionnaire.

Analysis of academic coefficients from all interviewed students revealed no correlation between academic developments with period of greatest productivity. Students classified as morning, intermediate and afternoon have obtained an academic coefficient average of 8.16, 8.23 and 8.20, respectively.

4. Discussion

Age and gender from participants were no considerably different, probably due to a homogeneity presented in both male and female samples, and a predominant consistency of young individuals. A study by Monk and Kupfer [9] reports individuals tend to advance the phase of their biological rhythms, prone to becoming most-morning active as the ongoing of the age.

Similarly, differences between preferences in both genders are observed in the results obtained by Mongrain *et al.* [10]. They have studied gender differences in young-adult students between 17 and 35 years old and. have showed higher scores reflecting most morning activities in women than men.

Classifying students as intermediaries' chronotype means that this group has greater flexibility compared to other groups when schedules are changed. These students are able to awake earlier or later, and fulfill daily academic activities with a satisfactory alert level in every moment. However, performing activities outside to own chronotype period may result in learning difficulties, due to cognitive troubles like, memory, visual perception, mental skill or muscle strength [11].

Higher-Education students, especially Medicine, are often susceptible to schedule shifting, because there is a greater effort and time disposition required by the course. This may compromise a proper functioning of the body and affect the performance of such operations. Forced to change or switch the period that show higher productivity they may compromise the academic performance. Alam *et al.* [1] have showed that students classified as morning-active do not adapt well to nocturnal tasks, due to unsatisfactory sleeping length of time, because they remain dissociated caused by the strict behavior when resting. Afternoon-active students may suffer more sleep deprivation (shortening), caused by the setting time of school appointments or work, establishing a conflict: a preference for sleeping until late but interrupted by an alarm clock.

When analyzing the income coefficient from individuals, according to chronotype in academic activity shifts, the afternoon-active shows a better performance (mean = 8.20) compared to morning and intermediate groups (mean = 8.16), however, there is no significant difference. In contrast, Ferreira and Martin [12], evaluating the distribution of individuals on work according to chronotype, have demonstrated that, morning individuals as better allocated. Campos *et al.* [13] indicate that both matutine and vespertine people generally have higher performance on tasks when matching to their own chronotypes.

In this context, courses in health sciences, especially Medicine, is constantly adapting the schedule, attempting to satisfy needs and exigencies throughout graduation. This, increase demand along the course and so, desynchronization

with chronotype needing new adaptations by every semester. Hence, promoting biological deregulation and changes lead to compromise the process of learning in the academic life. As displayed by Parks *et al.* [14], health science students need to be aware of difference in their vulnerability to errors, decisions and shortcomings in producing at night, especially when fatigued. Equally important the instruction on circadian rhythms in performance and cognitive abilities, as well as recognizing the drudgery effects, resulted by increased workload.

Due to increasing acknowledge of social significance in Chronobiology, an organization and a chronobiological planning for students' daily activities is required, aiming both a better academic performance and therefore, elevated course fulfilment. The adjustment between social and biological time, will increase the welfare of students, triggered by respecting their physiology.

Acknowledgements

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