

Associations between Lifestyle Behaviors and Stress Related Symptoms in Senior Medical Students of the University of Osijek, Eastern Croatia

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Abstract

The study aimed to determine behavioral responses (symptoms) to chronic stress of senior medical students induced by academic demands and to identify learning and lifestyle behaviors associated with these symptoms. The study included 116 students of the two last university years (5th and 6th) of the Faculty of Medicine, University of Osijek, eastern Croatia. A newly formed 31-item questionnaire was used for this purpose. A large majority of students (95.7%) had at least one symptom and 62% had 3 or more, out of the maximum 6 symptoms examined. Symptoms showed a tendency for grouping in a graded manner. Participant students were divided into two groups according to the lower or higher levels of the symptom complexity expression (<3 vs ≥3 symptoms) and differences in their learning and lifestyle behaviors were assessed accordingly. Lifestyle behaviors which showed significant differences indicate low physical activity, lack of extracurricular activities, disrupted sleep schedule and variations in body weight in the exam period. Study results are expected to inform future studies and prevention of mental and global health decline in senior medical students.

Keywords: senior medical students, academic demands, chronic stress, questionnaire, lifestyle behaviors, stress related symptoms

Introduction

Young adulthood is a critical period in human life when a variety of mental disorders and unfavourable behaviors tend to get their roots (*Hoyt et al., 2011*). This is because young people are especially prone to different social influences and mood swings (*Zambon et al., 2006*). University students constitute a significant part of the young people community.

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Stressful life they are exposed to due to academic demands may negatively affect their lifestyles, leading to, e.g., poor eating and sleeping behaviors and changes in body weight (Nanney et al., 2015; van der Heijden et al., 2017). In those of them who are more prone to pressure internalisation, it can turn to alcohol and substance abuse (Eisen et al., 2009). Negative coping strategies may compromise their learning capacity and induce a variety of neuro vegetative and behavioral symptoms which precede the development of clinically overt disease (Stewart et al., 1999; Philips, 2009).

These problems are even more emphasised in medical students, because studying medicine is associated with demanding courses and work schedules which may cause chronic stress and do not leave much time for resting and extracurricular activities (Schiller et al., 2017). Proportions of anxiety and depression and different types of psychological distress were found to be higher in medical students than in age-matched peers and general population (Dyrbye et al., 2006). Also important is the fact that medical students are future doctors, who will continue under-the-stress life, which can cause further deterioration of their mental and physical health status (Hoyt et al., 2012).

A significant amount of available literature deal with stress related reactions and adjustment disorders of the first year medical students, while this issue in senior medical students has rarely been tackled (Heinen et al., 2017). An intriguing thing that might compromise results of such research is that senior medical students, distinctly from novices, have had enough time to develop also positive in addition to negative behavioral adaptation strategies and that they might have developed some signs of mental and global health decline (Schiller et al., 2017).

The aim of this study was to examine some aspects of senior medical students` life, associated with learning styles and lifestyle behaviors, that have been proposed as causes of the development of stress related behavioral symptoms. The study was conducted at the Faculty of Medicine, University of Osijek, eastern Croatia. In this institution, stress supporting services have not been yet developed, which provides opportunities for studying native mechanisms of stress generation and reactions to stress, which are not modified with interventions. Study results are expected to inform future studies and prevention of mental and global health decline of senior medical students.

Previous Studies

Initiatives for research on stress related reactions and mental health decline in medical students have been increasing (Dyrbye et al., 2006; Jafari N et al., 2012; Yusoff MSB et al., 2012). Two main approaches can be recognised: 1) research on risk factors associated with stress related reactions and mental health decline and 2) research on prevalence of stress related mental disorders, such as anxiety and depression, and identification of coping strategies (Dyrbye et al., 2007; Yusoff MSB et al., 2011). Previous research indicated a decrease in the students` learning capacity, as a reaction to chronic stress, which can compromise their academic achievements and overall functioning (Stewart SM et al., 1999; Yusoff MSB et al., 2013).

Aims:

The aim of this study is to get a more comprehensive view on senior medical students` behavioral responses (symptoms) to chronic stress, which have been proposed to be induced by high academic demands, and the way of how these symptoms are grouping with each other. The aim is also to identify the lifestyle patterns coping with these responses.

For this purpose, a range of symptoms have been assessed, known from the literature to represent reactions to chronic stress, especially those related to academic demands, including: sleep disorders, difficulties in social relationships, negative feelings (tension, tiredness, restless, indifference, irritability, pain) and neurovegetative symptoms (sweating, throat tightness), together with indicators of changes in body shape (Table 4) (Suchbeck et al., 2009; van der Heijden et al., 2017; Philips, 2009; Dyrbye et al., 2007; Zambon et al., 2006; Pelletier et al., 2016). Students` sociodemographic characteristics and lifestyle behaviors, assessed in the study, have been previously identified as factors which influence academic achievements, well-being and mental health of university students (Mokhtari et al., 2013; Dollinger et al., 2008; Bamuhair et al., 2016; Yusoff et al., 2012). Anthropometric measurements, BMI, a measure of overall obesity, and waist circumference, a measure of abdominal obesity, were also included in the survey, following the evidence that poor eating and sleeping behaviors, as a response to chronic stress, may lead to changes in body shape (Table 2) (Alberti et al., 2006; Block et al., 2009; Boyce et al., 2015; Nanney et al., 2015).

Method:**The survey**

The survey was performed in June 2016. Students of the 5th and the 6th academic years were tested at two separate places, but on the same occasion, to avoid interactions between them. The survey has not been announced in advance. Students participated voluntarily after signing the informed consent. The Institutional Review Board of the Faculty of Medicine of the University of Osijek approved the study.

Participated students needed up to 15 minutes to fill out the questionnaire. After the survey, research assistants, former medical students, have taken from students anthropometric measurements. A total number of students participating in the survey was 116. The overall response rate was 82.86%, including 49 out of 70 (70%) students of the 5th and 67 out of 70 (95.71%) students of the 6th academic year.

Participants:

Participants were students of the last two years (5th and 6th) of the integrated undergraduate and graduate medical studies of the Faculty of Medicine, University of Osijek, eastern Croatia. Sociodemographic characteristics of the respondents are provided in Table 1. Their age ranged from 22 to 30 years, with a major part of respondents being 23 (43.1%) and 24 (37.1%) years old. They have been prevalently females (3/4), unmarried and without children. A half of them had residence with families (parents) in the town of studying (Osijek), another half came from the broader Osijek area, only a minor part of them were from more distant areas, international students were rare to find. The commuting time, for more than 90% of students, was less than an hour.

The questionnaire:

A newly formed, 31-item questionnaire was used to assess the spread of particular aspects of students' life and lifestyle behaviors and their associations with behavioral reactions to stress. The content of the questionnaire was based on using information from the literature, the main author's work experience with students and the interview with research assistants, who have recently graduated from the university. Most of the questions (26) were closed type and 5 were open-ended questions. Closed-type questions targeted lifestyle and learning behaviors, while open-ended questions included data on age, gender, grade point average, height and weight and waist circumference. Distribution of answers to the questions of the questionnaire are presented in Tables 1–4. Sociodemographic factors are indicated with 5 items (Table 1), 14 items were used to indicate particular aspects of students' life and lifestyle behaviors, proposed as being associated with academic demands, as well as self reported information on academic achievements, satisfaction with the quality of life and variations in body weight in the exam period (Table 2), 3 items indicate anthropometric measurements (Table 2) and 6 items indicate stress related symptoms, including feelings, neurovegetative and behavioral symptoms (Tables 3 and 4).

Anthropometric Measurements, height and weight, for calculation of BMI, and waist circumference, are presented in Table 2.

Statistical analysis:

Nominal figures were presented as absolute and relative numbers. Differences between categorical variables were tested using χ^2 test and Fischer's exact test, if the expected number of observation was less than 5. The level of significance was set up to 0.05. The data were statistically analysed using the computer program SPSS (versión 16.0, SPSS Inc., Chicago, IL, USA) and Microsoft Office Excel spread sheet.

Results:

Table 1. Senior medical students` sociodemographic data

Item	Description	Distribution (N,%) Total N=116
Gender *	F 85(73.3%)	
	M 31(26.7%)	
Age(y)	Range 22–30 Median <input type="checkbox"/> 23(50)(43.1%) <input type="checkbox"/> 24(43)(37.1%)	
Residence	<input type="checkbox"/> With family <input type="checkbox"/> With a roommate <input type="checkbox"/> Single <input type="checkbox"/> In student residence	56(48.3%) 36(31.0%) 16(13.8%) 8(6.9%)
Have children	<input type="checkbox"/> Yes <input type="checkbox"/> No	2(1.7%) 114 (98.3%)
Commuting time(min)	<input type="checkbox"/> 15–30 <input type="checkbox"/> 31–60 <input type="checkbox"/> 61–90 <input type="checkbox"/> >90	84(72.4%) 22(19.0%) 6(5.2%) 4(3.4%)

Table 1. Indicates respondents` characteristics, including: gender, age, residence, parenthood and commuting time. Comments are provided in the Discussion section.

Table 2. Distribution of answers to the questions indicating aspects of students` life, lifestyle behaviors, academic achievements, self reported satisfaction with the quality of life and variations in body weight in the exam period; results of body measurements: BMI and waist circumference

Item	Description	Distribution (N,%)
<i>Aspects of students' life</i>		
Class attendance	<input type="checkbox"/> >75% <input type="checkbox"/> 50–75% <input type="checkbox"/> <50%	87(75.0%) 27(23.3%) 2(1.7%)
Learning time	<input type="checkbox"/> Very early in the morning (starting from 4-5 o'clock) <input type="checkbox"/> Morning time, after the breakfast <input type="checkbox"/> Afternoon and evening, not later than 11pm <input type="checkbox"/> Late in the evening and at night (usually after midnight)	2(1.7%) 12(10.3%) 73(62.9%) 29(25.0%)
Learning frequency	<input type="checkbox"/> Almost every day <input type="checkbox"/> Regularly, but not every day <input type="checkbox"/> Last minute studying (before the exam)	23(19.8%) 63(54.3%) 30(25.9%)
Eating while learning	<input type="checkbox"/> I like this, I usually eat sweets and snacks or fast food <input type="checkbox"/> I like this, but I carefully choose healthy food <input type="checkbox"/> Usually not eating while learning <input type="checkbox"/> Only when under the pressure, before exam	29(25.0%) 15(12.9%) 41(35.3%) 31(26.7%)
Last meal time	<input type="checkbox"/> Before 5pm <input type="checkbox"/> 5–8pm <input type="checkbox"/> 9pm–midnight <input type="checkbox"/> After midnight	2 (1.7%) 57(49.1%) 50(43.1%) 7(6.0%)
Consumption of stimulating drinks while learning	<input type="checkbox"/> Coffee <input type="checkbox"/> Energy drinks <input type="checkbox"/> Alcoholic beverages <input type="checkbox"/> Nothing	77(66.4%) 4(3.4%) 2(1.7%) 33(28.4%)
Consumption of stimulating substance while learning	<input type="checkbox"/> Cigarettes <input type="checkbox"/> Drugs <input type="checkbox"/> Nothing	17(14.7%) 1(0.9%) 98(84.5%)
<i>Lifestyle behaviors</i>		
Smoking habit	<input type="checkbox"/> Yes <input type="checkbox"/> No	24(20.7%) 92(79.3%)
Addictions	<input type="checkbox"/> Alcohol <input type="checkbox"/> Alcohol+marihuana (other substance) <input type="checkbox"/> Nothing	21(18.1%) 6(5.2%) 89(76.7%)
Physical activity	<input type="checkbox"/> Low <input type="checkbox"/> Low-moderate <input type="checkbox"/> Quite good <input type="checkbox"/> Intensive	23(19.8%) 53(45.7%) 35(30.2%) 5(4.3%)
Hobby or extra curricular activities	<input type="checkbox"/> Yes <input type="checkbox"/> No	95(81.9%) 21(18.1%)
Get up on time/Go to bed on time	<input type="checkbox"/> Mostly no <input type="checkbox"/> Variable <input type="checkbox"/> Mostly yes	31(26.7%) 46(39.7%) 39(33.6%)
Sleep hours at night (range)(h)	<input type="checkbox"/> <4 <input type="checkbox"/> 4–7 <input type="checkbox"/> ≥8	0 82(70.7%) 34(29.3%)
Use of sleeping pills	<input type="checkbox"/> Sometimes <input type="checkbox"/> Often (cannot sleep without) <input type="checkbox"/> Never	15(12.9%) 1 (0.9%) 100 (86.2%)
Academic achievements (grade point average)	<input type="checkbox"/> <4.0 <input type="checkbox"/> 4.0–4.49 <input type="checkbox"/> ≥4.5	39(33.9%) 55(47.8%) 21(18.3%)
Self-reported satisfaction	<input type="checkbox"/> Very satisfied	34(29.3%)

with the quality of life	<input type="checkbox"/> Mainly yes <input type="checkbox"/> Mainly no <input type="checkbox"/> Very unsatisfied	77(66.4%) 4(3.4%) 1(0.9%)
Self-reported variations in body weight in the exam period	<input type="checkbox"/> No <input type="checkbox"/> Yes, weight gain <input type="checkbox"/> Yes, weight loss	94 (81.0%) 10 (8.6%) 12 (10.3%)
Anthropometric measurements		
BMI (kg/cm²)	<input type="checkbox"/> <18.5 <input type="checkbox"/> 18.5–24.9 <input type="checkbox"/> 25–29.9 <input type="checkbox"/> ≥30	4(3.5%) 83(72.2%) 24(20.9%) 4(3.5%)
Waist circumference (cm)	F <input type="checkbox"/> <80 <input type="checkbox"/> 80<88 <input type="checkbox"/> ≥88 M <input type="checkbox"/> <94 <input type="checkbox"/> 94<102 <input type="checkbox"/> ≥102	66(82.5%) 9(11.3%) 5(6.3%) 25(80.6%) 4(12.9%) 2(6.5%)

Table 2. shows distribution of answers to the questions indicating aspects of students` life and lifestyle behaviors, in addition to the results of body measurements (BMI and waist circumference). Comments are provided in the Discussion section.

Table 3. Number of symptoms per student

Number of symptoms	0	1	2	3	4	5	6	7	
Absolute frequency	5	17	22	26	25	9	10	2	N=116
%	4.3	14.7	19.0	22.4	21.6	7.8	8.6	1.7	100.0

Table 3. shows distribution of 6 groups of behavioral symptoms assessed with the questionnaire and self reported variations in body weight in the exam period

Only 5 out of 116 (4.3%) students had no symptoms; 82% had 2 or more symptoms and 62% had 3 or more symptoms. Most of students reported 3 or 4 (22.4% and 21.6% students, respectively) out of the maximum 6 symptoms.

Table 4. Distribution of stress related symptoms and their top 10 combinations

A symptom	Number (%) of students affected with a symptom	Participation of a symptom in top 10 symptom combinations	The number of combinations a symptom is a part of
1) Poor concentration while learning	88 (75.9%)	1 1 1 1 1 1 0 0 1 1*	8
2) Daytime sleepiness	81 (69.8%)	1 0 1 1 1 1 0 1 1 1	8
3) Any of feelings: (tension, tiredness, restless, indifference, irritability, pain) or neurovegetative symptoms: sweating, throat tightness	58 (50.0%)	0 0 1 1 1 0 0 0 1 1	5
4) Disturbed sleep patterns (insomnia, restless legs, frequent waking up, waking up too early in the morning, snoring, sleep apnea)	47(40.5%)	0 0 0 1 1 1 0 0 0 0	3
5) The need for repetition while learning	42(36.2%)	0 0 0 0 1 0 0 0 0 1	2
6) Affected friendships	37 (31.9%)	0 0 0 0 1 0 0 0 1 0	2
Self reported variations in body weight in the exam period	22 (19%)	0 0 0 0 0 0 0 0 0 0	0

*1 means the presence of a symptom; 0 means the absence of a symptom

The most frequent symptoms were *difficulties in concentration while learning* (88 or 75.9% of students) and *daytime sleepiness* (81 or 69.8% of students). These symptoms may stand either as alone or as a part of combinations consisted of 2-6 symptoms. They make a part of the most (8 out of the top 10) symptom combinations.

Sleep disorders and the set of *feelings and neurovegetative symptoms*, were presented in 47 (40.5%) and 58 (50.0%) of students, respectively. These symptoms can not stand as alone, but only as a part of combinations consisted of 3 or more symptoms.

Symptoms, *the need for repetition while learning* and *affected friendships*, were the least common ones and found in 36.2% and 31.9% of students, respectively. These symptoms participated only in combinations consisted of 4 or more symptoms, indicating a higher degree of symptom combination complexity.

Table 5. Differences in aspects of students` life according to the number of stress related symptoms (< 3 or ≥ 3)

Item	Description	Frequency	Frequency No.	p
		No. of symptoms<3	of symptoms≥ 3	
		N = 44 (38%)	N = 72 (62%)	
Gender	F M	30 (35.3%) 14 (45.2%)	55 (64.7%) 17 (54.8%)	0.389 **
Residence	With family With a roommate Single In student residence	22 (39.3%) 12 (33.3%) 8 (50.0%) 2 (25.0%)	34 (60.7%) 24 (66.7%) 8 (50.0%) 6 (75.0%)	0.626 *
Learning time	Very early in the morning (since 4–5 am) Morning time, after the breakfast Afternoon and the evening, but not later than 11 pm Late in the evening and at night (usually until after midnight)	0 (0.0%) 5 (41.7%) 30 (41.1%) 9 (31.0%)	2 (100.0%) 7 (58.3%) 43 (58.9%) 20 (69.0%)	0.602 *
Eating while learning	I like this, I usually eat sweets and snacks or fast food I like this, but I take care to choose the healthy food I usually don't eat while learning Only when under the pressure, before the exam	11 (37.9%) 6 (40.0%) 18 (43.9%) 9 (29.0%)	18 (62.1%) 9 (60.0%) 23 (56.1%) 22 (71.0%)	0.639 **
Last mealtime	Before 5 pm 5 – 8 pm 9 pm – midnight After the midnight	1 (50.0%) 24 (42.1%) 16 (32.0%) 3 (42.9%)	1 (50.0%) 33 (57.9%) 34 (68.0%) 4 (57.1%)	0.675 *
Consumption of stimulating drinks while learning	Coffee Energy drinks Alcoholic beverages Nothing	27 (35.1%) 1 (25.0%) 0 (0.0%) 16 (48.5%)	50 (64.9%) 3 (75.0%) 2 (100.0%) 17 (51.5%)	0.443 *
Consumption of stimulating substance while learning	Cigarettes Drugs Nothing	4 (23.5%) 0 (0.0%) 40 (40.8%)	13 (76.5%) 1 (100.0%) 58 (59.2%)	0,333 *
Smoking habit	Yes No	7 (29.2%) 37 (40.2%)	17 (70.8%) 55 (59.8%)	0.32 *
Addictions	Alcohol Alcohol + marihuana (other substances) Nothing	8 (38.1%) 1 (16.7%) 35 (39.3%)	13 (61.9%) 5 (83.3%) 54 (60.7%)	0.676 *
Physical activity	Low Low-moderate Quite good Intensive	3 (13.0%) 15 (28.3%) 22 (62.9%) 4 (80.0%)	20 (87.0%) 38 (71.7%) 13 (37.1%) 1 (20.0%)	< 0.01 *
Hobby or extracurricular activities	Yes No	42 (44.2%) 2 (9.5%)	53 (55.8%) 19 (90.5%)	0.003 **
Get up on time/Go to bed on time	Mostly not Variable Mostly yes	5 (16.1%) 19 (41.3%) 20 (51.3%)	26 (83.9%) 27 (58.7%) 19 (48.7%)	0.008 **

*Fischer`s exact test; **chi-square test

Table 5. shows differences in aspects of students' life and lifestyle behaviors according to whether students had <3 ($N=44$, 38%) or ≥ 3 ($N=72$, 62%) stress related symptoms. Comments are provided in the Discussion section.

Discussion

Aspects of students life and lifestyle behaviors

Senior medical students in our environment live in relatively good conditions, as indicated with a short commuting time (less than an hour for 91.4% of students) and residence with families (for almost a half of students) (Table 1), which could be possible factors influencing their good satisfaction with the quality of life (95.7% of students) and good academic achievements (Table 2). High burden with academic demands is indicated with the facts that they still have no children (98.3 % of students), are used to learn on regular basis (74.1% of students) and are regular class attenders (98.3 % of students are present at more than 50% of lectures) (Tables 1 – 2).

A great part of examined students (65.5%) are insufficiently (low and low-moderate) physically active (Table 2). Consequently, there is a high proportion of students with increased BMI ($BMI \geq 25$ kg/cm²) (25%) and waist circumference (≥ 80 cm for F) (17.6%) and (≥ 94 cm for M) (19.4%) (Table 2). Yet, most of students (81.9%) had some hobbies or extracurricular activities (Table 2), which has been showed to decrease stress and depression and improve academic success (*Yusoff et al., 2013; Rasberry et al., 2011*). This apparently contradictory result indicates the ability of senior medical students to develop also positive, in addition to negative coping styles.

Behavioral disorders, changes in body weight in the exam period and addiction behaviors, are known to be results of bad coping mechanisms (*Boyce and Kuijer, 2015; Das et al., 2016*). This study has enabled some insights into mechanisms of changes in body weight in the exam period, as based on answers to the questions on learning styles. Students reported their learning time to be mostly in afternoon and the evening (62.9%) (Table 2). For a major part of students (92.2%), their last meal was in the evening, but usually before the midnight (Table 2). A significant part of students (25%) used to learn at the night time, but only a small part of them developed “an eating by night time behavior”, found to be associated with higher levels of perceived stress, maladaptive coping and poor psychosocial functioning (Table 2) (*Runfola et al., 2014; Wichiansonetal, 2009*). These results suggest that some internal predisposition, in addition to situational conditions, are needed for deeper eating disorders to develop. That bad coping with internal pressure might be a decisive factor in the development of behavioral disorders, this is in our study further supported with distribution of answers to the item “eating while learning” (Table 2). Namely, a great part of students, being aware that consumption of junk foods while learning may undermine their health, avoided their use, or chose healthier food options. Yet, a small part of students preferred junk foods while learning or used an extra feed when under the pressure, in the exam period, probably being guided by the internal pressure.

Also assesment of addiction behaviors showed the ambiguous coping styles which senior medical students have developed (Table 2). They reported a high level of smoking and alcohol addictions (20.7% and 23.3%, respectively), these figures similar to what was found in the developed countries, while, on the contrary, avoided to use alcohol beverages while learning (1.7%). The possible reason for this opposite result to the one intended is the need of maintaining good mental vigor, which is necessary for efficient learning (*Das et al., 2016; Dobmeier et al., 2011*). In contrast to high rates of smoking and alcohol addictions, a substance addiction behavior was reported to be a disproportionately low (Table 2), probably reflecting cultural and/or personal influences on the addiction choice.

It is well known that chronic stress alters sleep patterns (*Subeckiet al., 2009*). The reverse is also true, so that inadequate sleep quality and duration can augment the stress response, altogether leading to physical and mental health deterioration (*Brand et al., 2011*). Our results indicate a high level of stress in senior medical students, as based on the fact that a great proportion of them (66.4%) had disrupted sleep schedule, by means of irregular time of getting up and going to bed (Table 2), and that even a greater proportion of them (70.7%) had shorten sleep time at night, of less than 8 hours (Table 2), which is considered insufficient for young people (*Brand et al., 2011*). Moreover, a part of students developed a long-term sleep deprivation, as indicated with the reported need to use sleeping pills (13.8% of students) (Table 2).

Stress related symptoms expression and combination

Most of senior medical students were affected with chronic stress, as indicated with the fact that only a few of them (5 out of 166) were free from stress related symptoms, while the prevalent part (81%) had three and more symptoms (Table 3).

Symptoms showed a tendency of grouping in a graded manner, as indicated with the fact that some symptoms appeared only in combinations of higher degrees of the complexity. Symptoms presented with the highest frequency (75.9% and 69.8%, respectively), **poor concentration while learning** and **daytime sleepiness**, participated in all degrees of the complexity of symptom combinations, from standing alone, to being a part of combinations made up of two, three or more symptoms (Table 4). Symptoms, **subjective poor sleeping** and a series of non productive symptoms indicating feelings (**tension, tiredness, restless, indifference, irritability** and **pain**) and neurovegetative symptoms (**sweating** and **throat tightness**), taken as a group, showed intermediate frequencies (50.0% and 40.5%, respectively) and were presented only in combinations consisted of three or more symptoms (Table 4). Symptoms **need for repetition while learning** (learning memory) and **friendships** (social networking) showed the smallest frequencies (36.2% and 31.9%, respectively) and appeared only in the most complex combinations, consisted of 4-6 symptoms (Table 4). These results support the emerging assumption that mental health disorders represent a dynamic trait, characterised with a range of behavioral responses, spanning between multiple functional domains (Phillips, 2009).

Lifestyle behaviors associated with higher degrees of the complexity of symptom combinations

Participant students were divided into two groups, according to the lower or higher degrees of the complexity of symptom combinations (<3 and ≥3 symptoms). Differences in lifestyle behaviors were then assessed between them. Lifestyle behaviors which showed significant associations with higher, in contrast to lower degrees of the complexity of symptom combinations, include: 1) **low and low-moderate physical activity** (87% and 71.7% vs 13% and 28.3%), 2) **lack of hobbies or extracurricular activities** (90.5% vs 9.5%), 3) **invariable get up and go to bed time** (83.9% vs 16.1%) and 4) **taking sleeping pills** (86.7% vs 13.3%) (Table 5). The first two behavioral disorders indicate **bad coping and insufficient relaxation strategies** and the second two indicate the **disrupted rule-based sleep behaviors**.

The symptom **self reported variations in body weight in the exam period** links these two groups of lifestyle behaviors, known to be reactions to chronic stress, being a consequence of both, poor eating and sleeping habits and insufficient physical activity (Block et al., 2009; Brand and Kirov, 2011; Rasberry et al., 2011). This symptom was found significant in the analysis of differences (Table 5), but was not found in any of the top 10 combinations of stress related symptoms (Table 4). This apparently contradictory result might be due to the low frequency of this symptom (19%), compared to other examined symptoms (Table 4). Taken altogether, these results indicate, similar to what has been also suggested with some prospective studies, that variations in body weight can be expected to appear, in due time course of symptoms development, secondary to other stress related symptoms (Nieman and LeBlanc, 2012).

That students who showed higher degrees of the complexity of symptom combinations, as indicated with the presence of ≥3 symptoms, have really experienced higher levels of stress, compared to students with <3 symptoms, this is also supported with their tendency for more divergent BMI values (75% vs 25%), found for both, lower and upper limits of the ranges of BMI values (<18.5 and ≥30), as well as with their predisposition for increased waist circumference, predominantly expressed in female students (85.7% vs 14.3%), for waist circumference values of ≥88 cm (Table 5).

In this terms, evidence suggest that chronic stress, especially in adolescents, divergently affect body weight changes, either towards weight gain or weight loss (Pelletier et al., 2016; Nguyen-Rodriguez et al., 2009). This is because lean individuals are more prone to meal skipping and weight loss, while those of normal weight or overweight usually show feeding behavior and weight gain (Boyce and Kuizer, 2015). Increased waist circumference may precede the development of metabolic disorders and other symptoms of physical health deterioration (Alberti et al., 2006).

Lifestyle behaviors: learning at night time, eating junk food while learning, eating when under the pressure, use of stimulating substances while learning and smoking and alcohol addictions, showed insignificant but marked differences, indicating a higher level of variations, compared to behavioral patterns which showed significant differences (Table 5).

Conclusions

The study revealed that stress related symptoms in senior medical students tend to appear in a graded manner. Learning and lifestyle behaviors which showed to cope the best with higher degrees of the complexity of symptom combinations (consisted of ≥ 3 symptoms) include: low physical activity, lack of extracurricular activities and insufficient sleep due to disrupted sleep schedule. Subjective poor sleeping can be used as a single symptom to accurately indicate students with higher levels of the symptom complexity expression. Behavioral and mental symptoms may precede changes in body weight and physical health deterioration.

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