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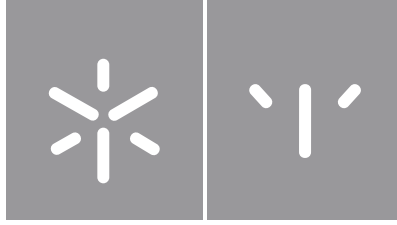
Vânia Cristina da Silva Ralha Mendes Cruz

**Sleep procrastination: An exploratory study  
with High School students**

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Dissertação de Mestrado  
Mestrado Integrado em Psicologia

Trabalho efetuado sob a orientação do  
**Professor Doutor Pedro Rosário**  
e da  
**Doutora Paula Magalhães**

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Sou-vos eternamente grata!

## **STATEMENT OF INTEGRITY**

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University of Minho, October 18, 2019

Full name: Vânia Cristina da Silva Ralha Mendes Cruz

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### Resumo

A insuficiência do sono afeta a nossa saúde física e psicológica. Muitos fatores contribuem para a insuficiência do sono, mas um possível contribuinte pode ser de natureza motivacional, a procrastinação. A literatura sobre procrastinação do sono tem-se concentrado nos comportamentos que as pessoas praticam antes de ir para a cama (procrastinação na hora-de-dormir), excluindo comportamentos que as pessoas praticam quando estão na cama (procrastinação na cama). O principal objetivo deste estudo é explorar se esta procrastinação na cama é um fenómeno novo que se acrescenta ao processo de procrastinação na hora-de-dormir. O estudo foi realizado online com estudantes do ensino secundário incluindo um questionário de autorrelato com questões sociodemográficas, Escala de Procrastinação na Hora de Dormir, Escala de Procrastinação na Cama e variáveis contextuais (descritivas do sono, rotina e contexto familiar). A procrastinação na hora-de-dormir e a procrastinação na cama transmitem baixo nível de correlação. ANOVAs entre variáveis contextuais com os dois tipos de procrastinação no sono demonstraram que estas se relacionam de forma diferente. Estes resultados sugerem que avaliar a procrastinação do sono apenas como um comportamento de procrastinação antes de ir para a cama não é suficiente, adicionando uma nova perspetiva à literatura.

*Palavras-chave:* insuficiência de sono; procrastinação no deitar; procrastinação no sono; psicologia; saúde

## Sleep procrastination: An exploratory study with High School students

### Abstract

Sleep insufficiency affects our physical and psychological health. Not only adults suffer the consequences of sleep deprivation, adolescents too are affected by this condition. Many factors contribute to sleep insufficiency, but one possible contributor may be of a motivational nature, namely procrastination. So far, sleep procrastination literature has focused on behaviors individuals engage in before going to bed (bedtime procrastination), but not on the behaviors individuals engage in after going to bed (while-in-bed procrastination). The main goal of this study is to explore whether this while-in-bed procrastination is a novel phenomenon that adds to the bedtime procrastination. The study was conducted online with high school students and comprised a self-report questionnaire with sociodemographic questions, Bedtime Procrastination Scale, While-in-bed Procrastination Scale, and contextual variables (related to sleep descriptives, routine related, and family related). Bedtime Procrastination and While-in-bed Procrastination conveys a low correlation degree. Several ANOVAs were conducted to analyze differences in Bedtime and While-in-bed Procrastination; these analyses showed distinct results. Findings indicate that solely assessing Bedtime Procrastination as representing the procrastination of Sleep is limited. This study adds a new perspective to the literature by stressing the role of While-in-bed Procrastination, thus opening new research pathways.

*Keywords:* bedtime procrastination; health; sleep insufficiency; psychology; while-in-bed procrastination



## Table of Contents

Agradecimentos _____	iii
Abstract _____	vi
Sleep procrastination: An exploratory study with High School students _____	8
Purpose of the study _____	11
Method _____	11
Results _____	14
Discussion _____	21
References _____	25

## Index of Tables

Table 1 <i>Descriptive statistics of sleep descriptives</i> _____	14
Table 2 <i>Descriptive statistics of family context</i> _____	15
Table 3 <i>Descriptive statistics of routine.</i> _____	16
Table 4 <i>Bedtime Procrastination Scale frequencies (Portuguese version)</i> _____	18
Table 5 <i>While-in-bed Procrastination Scale frequencies</i> _____	19
Table 6 <i>Bedtime Procrastination Scale and While-in-bed Procrastination Scale correlation</i> ____	20
Table 7. <i>Analyses of variance</i> _____	21

### Sleep procrastination: An exploratory study with High School students

A considerable body of knowledge has highlighted the key role of sleep in maintaining our body homeostasis, as it contributes for a good performance of various functions, like metabolic functions, brain plasticity, energy conservation, and neuronal recuperation (Diekelmann & Born, 2010; Siegel, 2005; Siegel, 2009; Tononi & Cirelli, 2006). Sleep is also important for offline memory consolidation (Diekelmann & Born, 2010; Krueger et al., 2008; Maquet, 2001), cognitive abilities (Clemens, Fabó, & Halasz, 2005; Kirov, Uebel, Albrech, Banaschewski, & Rothenbergert, 2011; Schabus et al., 2006), consolidation of emotional memory (Nishida, Pearsall, Buckner, & Walker, 2009; Walker, 2009), and emotional processing (Gujar, McDonald, Nishida, & Walker, 2011; McNamara, McLaren, Smith, Brown, & Stickgold, 2005). Therefore, it comes as no surprise that sleep insufficiency has been recently coined as a major health issue and should be treated as a chronic disease.

Until recently, sleep insufficiency was regarded solely as a medical problem, with most research focused on individuals with sleep disorders (e.g., insomnia, apnea) (Kroese, De Ridder, Evers, & Adriaanse, 2014). However, sleep insufficiency affects not only people with sleep disorders but also the general population. For example, in the United States individuals are sleeping, on average, 6 hours or less per night, when the recommended amount of sleep is seven to nine hours for young adults and adults (Gallup, 2013; Krueger & Friedman, 2009; Sheehan, Frochen, Walsemann, & Ailshire, 2018; The National Sleep Foundation, 2015). This is a disturbing scenario as sleep insufficiency affects our social, physical, and psychological health and wellbeing, having already been appointed as a “major public health problem” (Centre for disease control and prevention, 2014). Sleep deprivation can have a toll on our concentration, carry memory and performance problems (Belenky et al., 2003; Ram, Seirawan, Kumar, & Clark, 2010;), contribute to anxiety, pain, depressive symptoms and suicidal ideation (Conklin, Yao, & Richardson, 2018; Roane & Taylor, 2008; Strin & Chapman, 2005), and lead to road accidents or mortality (Connor et. al, 2002). Furthermore, studies show that not sleeping enough plays an important role on our health; for example, can lead to hypertension (Gottlieb et al., 2006; Knutson et al., 2009), obesity (Nishiura & Hashimoto, 2010; Watanabe, Kikuchi, Tanaka, & Takahashi, 2010) , diabetes (Holliday, Magee, Kritharides, Banks & Attia, 2013; Ohkuma et al., 2013), dyslipidemia (Petrov et al., 2013; Shin et al., 2016), and cardiovascular diseases (Buxton & Marcelli, 2010; Spiegel, Tasali, Penev, & van Cauter, 2004). Additionally, an unsuitable sleep hygiene compromises dietary intervention, thus contributing to weight gain (Nedeltcheva, Kilkus, Imperial, Schoeller, & Penev, 2010). Finally, sleep insufficiency is related to mortality triggered by drowsy driving. According to the National Sleep Foundation

## SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

Sleep in America poll (2005), 37% (or 103 million people) confirm to have fallen asleep while driving and 4% percent (11 million drivers) admit they have had an accident or near accident because they were too tired to drive. Disturbingly, between the years of 2011-2015, 3,662 out of 15,3297 accidents were due to drowsy driving, resulting in 4121 deaths (National Center for Statistics and Analysis, 2017).

Worryingly, not only adults suffer the consequences of sleep deprivation, adolescents too are affected by this condition. Adolescents are sleeping less than eighth hours per night, when the recommended amount of sleep for teenagers is eighth to 10 hours per night (Basch, Basch, Ruggles, & Rajan, 2014; Hirshkowitz et al., 2015). Literature shows that about 45% of adolescents between sixth and 12<sup>th</sup> grades are affected by sleep insufficiency (Gradisar, Gardner, & Dohnt, 2011; Ming et al., 2011). Sleep insufficiency is being linked to risk-taking behavior; for example, high use of alcohol, tobacco, and marijuana, and high risky sexual behaviors (Moore & Meltzer, 2008; Shochat, Cohen-Zion, & Tzischinsky, 2014). Sleep insufficiency constitutes also a risk for obesity, depression, and suicide attempts (Chen, Burley, & Gotlib, 2012; Gupta, Mueller, Chan, & Meininger, 2002; Lofthouse, Gilchrist, & Splaingard, 2006; Owens & Adolescent Sleep Working Group, 2014).

Furthermore, academic performance of adolescents is being affected by this condition. Sleep insufficiency leads to emotional problems and injuries, sleepiness and lower motivation to study, all of which affect learning and academic performance (Kadzikowska-Wrzosek, 2018; Meijer, Habekoth, & Van Den Wittenboer, 2009; Roberts, Roberts, & Duong, 2009;). In fact, literature shows that adolescents' poorer sleep quality, reduced sleep time, and excessive sleepiness is related to lower grades (Ming et al., 2011; National Sleep Foundation, 2006;). These consequences are expected to impact the adolescent's development, growth, and functioning. (Brand & Kirov, 2011; Fallone, Owens, & Deane, 2002; Moore & Meltzer, 2008).

In sum, sleep insufficiency is a problem with major repercussions to individuals' health, so it is important to further understand it. Ram, Seirawan, Kumar, and Clark (2010) reported that 90% of the United States population does not suffer any kind of sleep disorder. Still, 40% of individuals report to sleep less than the recommended by the international guidelines (Gallup, 2013). One possibility to explain data is that people are going to bed late, and consequently sleep less than recommended, simply because they delay going to bed. This delay can be regarded from a behavioral perspective, specifically, through the lenses of procrastination.

Procrastination refers to the act of "*voluntarily delay an intended course of action despite expecting to be worse off for the delay*" (Steel, 2007, p. 66). There is a voluminous corpus of data showing that, overall, procrastination behavior his highly prevalent. For example, Ferrari, Diaz-Morales,

O'Callaghan, Díaz, and Argumedo (2007) reported that 20-25% of the general population procrastinates, while 70% of university students consider themselves academic procrastinators (Day, Mensink, & O'Sullivan, 2000; Schouwenburg, 2004). Procrastination behaviors are likely to affect the well-being and health of individuals. For example, procrastination is linked with depression, anxiety (Haycock, McCarthy, & Skay, 1998), and distress (Rice, Richardson, & Clark, 2012). Many people delay the medical doctor appointment, exercising or eating healthily. Besides, individuals can even procrastinate their time to go to bed which may compromise a good night of sleep.

Bedtime procrastination is defined as the act of *"going to bed later than intended, without having external reasons for doing so"* (Kroese et al., 2014, p. 854). This procrastination behavior requires a delay (*"going to bed later than intended"*), the absence of a valid reason that could explain the delay (e.g., being sick) and, finally, knowing that their actions will result in negative consequences (Sirois & Pychil, 2016). Procrastination usually involves the delay of a task that individuals find aversive (e.g., writing a report or put the clothes to dry); however, sleeping is not a task that most people consider aversive. In fact, Gershuny (2013) states that enjoyment of individuals for sleeping is above average, which suggests that people do not avoid sleep on purpose.

Bedtime Procrastination is a relatively new concept; thus literature on this topic is limited. Nevertheless, some authors have already put forward possible explanations for the phenomenon. Some relate bedtime procrastination with differences in peoples chronotypes (Kadzikowska-Wrzosek, 2018). For example, Kuhnel, Syrek, and Dreher (2018) found that people with later chronotypes tended to engage more in bedtime procrastination. Still, others examined bedtime procrastination from a motivational perspective, particularly as a self-regulation dysfunction. This perspective interprets bedtime procrastination as a lack of self-control. The rationale is that individuals with low self-control skills will be predisposed to distractions and will not resist distractors, which prevents them from going to bed on time (Kroese et al., 2014; Kroese, Nauts, Kamphorst, Anderson, & De Ridder, 2016). Managing distractors require a high level of self-control, which may not be easy to attain at later time of the day (Kamphorst et al., 2018).

A third family of explanations analyzed bedtime procrastination as a result of the interaction between willpower theories and stress (Bernecker & Job, 2019). These authors argued that the interplay between willpower and daily stress levels can explain bedtime procrastination. Bernecker and Job (2019) found that, in stressful days, adolescents with limited willpower procrastinate more in their bedtime than their counterparts with a non-limited willpower. Lastly, another potential explanation could be general aversion to routines and not specifically to sleep. This aversion can be related to bedtime (e.g., brushing

the teeth or changing to the pajamas) or morning (e.g., catch two metros to go to work) routines. Nauts, Kamphorst, Sutu, Poortvliet, and Anderson and (2016) findings show that people who tend to engage in bedtime procrastination rated their bedtime and morning routines as aversive, but there was no relation to sleep aversion.

### **Purpose of the study**

Literature on Sleep Procrastination has typically focused on behaviors preceding bedtime (bedtime procrastination). However, there is also the possibility that individuals delay going to sleep by engaging in other activities while they are already in bed, which we have coined as *While-in-bed procrastination*. Nowadays, individuals have open access to a vast diversity of entertainment with the potential of keeping them up all night (Kroese et al., 2014). From cellphones to computers and television, the access to different distractions is unlimited, and the enrolment in distractions may cause the postponement of the desired hour to sleep. Additionally, these devices can be used everywhere, including in individuals' room. In fact, people are using electronic devices in bed, when they should be sleeping, as stated by a study developed by Vernon, Modecki, and Barber (2017) that showed that the use of mobile phones, when lights were off, increased during a three-year period. People can lay in their beds and scroll on their social networks, watch movies on TV or videos on YouTube for hours, losing control of their sleep schedule. This shows that individuals may accomplish their desired bedtime but fail to sleep the desired number of hours; in sum, people may go to bed on time but fail to sleep on time.

Acknowledging the extant research, the main goal of our study was focused on further examining the sleep procrastination process. The present study aimed to analyze the role of *While-in-bed Procrastination*, along with the *Bedtime Procrastination*, in the *Sleep Procrastination*.

Literature has shown that sleep plays a crucial part in brain maturation, particularly when the brain suffers significant changes (Dahl & Lewin 2002; Huber & Bon, 2014; Iglowestein, Jenni, Molinari, & Largo, 2003). Adolescence is a period of transition from childhood to adulthood which leads to transformations at a hormonal, somatic and behavioral level. These processes occur at the same time as maturational sleep mechanisms and other complex processes in our body (Brand & Kirov, 2011). All considered, our study will focus on adolescents (High School students) due to sleep crucial importance in this period.

## **Method**

### **Participants**

Participants were recruited through social media (Facebook and Instagram) and personal contacts. A total of 619 participants initiated the questionnaire and 415 completed it (completion rate of

67%). Data from 15 participants who scored an abnormal distance from other values in the sample (outliers) were excluded. From the remaining sample ( $N = 400$ ), 139 (%) were male. The mean age was 16.56 years ( $SD = 1.07$ , range 15-20). The majority ( $n = 156$ , 39.2%) attended the 12<sup>th</sup> grade, 129 (32.4%) the 11<sup>th</sup> grade, and 113 (28.4%) the 10<sup>th</sup> grade.

### **Instruments and measures**

**Sociodemographic Questionnaire.** Demographic questions included sex, age, and school year. Additionally, participants were asked about the presence or absence of sleep disorders or problems that could affect their sleep quality/quantity.

**Bedtime procrastination Scale.** Bedtime procrastination was evaluated through the Bedtime Procrastination Scale developed by Kroese et al. (2014). Originally, this is a nine-item instrument (e.g., “I go to bed later than I had intended”) and items are answered in a five-point Likert-like scale, from 1 (never) to 5 (always). Total scores range between nine and 45 with higher scores indicating more engagement in bedtime procrastination (Cronbach’s  $\alpha = .92$ ). The scale utilized in the current study, adapted to the Portuguese population, was composed with eight items (total scores range from seven to 35) and the Cronbach’s  $\alpha$  was .85.

**While-in-bed Procrastination Scale.** To assess whether adolescents delay sleep when they are already in bed, and to learn which activities they engage in before going to sleep, the While-in-bed Procrastination Scale was developed. This instrument is a seven-item scale and some example items are “In bed, before I fall asleep, I watch videos on Youtube” or “In bed, before I fall asleep, I eat snacks (cookies, cereals, milk, chips, chocolate).” Questions were answered on a five-point Likert-like scale, from 1 (almost never) to 5 (almost always). Total scores ranged from seven to 35 with higher scores indicating more while-in-bed procrastination (Cronbach’s  $\alpha = .732$ ).

**Contextual variables.** Variables related to sleep descriptives, family context and routine were included in the questionnaire. These variables were included for a better understanding of the environment and circumstances that the participants live in, and included the following:

**Sleep descriptives.** Questions regarding sleep habits and tiredness were included in the questionnaire. Participants were asked to indicate their usual waking time and their desired hour to fall asleep. Furthermore, they were asked the quantity of sleep they have, in average, per night and whether they usually feel tired during the day.

**Family context.** Participants were asked about their parents’ time for arriving home and the number of siblings.

***Routine.*** Participants were asked about their usual dinner time, their school starting time, and, finally, if they practice any sports (and at what time they usually finish). Additionally, participants were asked to position themselves regarding the following: “Do you consider that you procrastinate before or after going to bed?”.

### **Procedure**

The survey was posted on social media (Instagram, Facebook) and distributed through personal contacts and emails. An informed consent was obtained from each participant prior to their participation. Participation in the study was voluntary, anonymous, and unpaid. Participants who gave their consent to participate filled in the electronic questionnaire that evaluated sociodemographic questions, contextual variables, Bedtime Procrastination, and While-in-bed Procrastination, in this specific order.

### **Data analysis**

The questionnaire included three different sections for analyzes, respectively the sociodemographic questions, the contextual variables (sleep descriptive, family context and routine) and the Bedtime Procrastination and While-in-bed Procrastination scales. Context variables were collected through multiple choices answers. To facilitate the analyzes we have categorized the interval variables, with each answer corresponding to a number. For example, the question “usually, your waking time is around” was categorized as 1 (before 7:00 a.m.), 2 (between 7:00 a.m. and 8:00 a.m.), 3 (between 8:00 a.m. and 9:00 a.m.) and 4 (after 9:00 p.m.). The questions with open answer, for example “what time is your sport over?” were grouped according to participants’ answers. Answers were categorized as 1 (before 3:00 p.m.), 2 (3:00 p.m. to 3:59 p.m.), 3 (4:00 p.m. to 4:59 p.m.), 4 (5:00 p.m. to 5:59 p.m.), 5 (6:00 p.m. to 6:59 p.m.), 6 (7:00 p.m. to 7:59 p.m.), 7 (8:00 p.m. to 8:59 p.m.), 8 (9:00 p.m. to 9:59 p.m.) and 9 (10:00 p.m. to 10:59 p.m.). Answers regarding quantity of hours slept per night and number of siblings were not categorized.

The dataset collected were treated and analyzed using the IBM® SPSS® software (Statistical Package for the Social Sciences; IBM, Armonk, NY). Descriptive statistics and frequency analyzes were conducted for all variables in the study. Factorial analysis including the KMO and Bartlett Test, the Communalities test, the total explained variance test, the component matrix and the reliability test were conducted to both scales. Pearson’s correlation was conducted between the Bedtime Procrastination Scale and the While-in-bed procrastination Scale. Lastly, multiple analyses of variance were conducted between sociodemographic variables, the procrastination scales and the context variables.

## Results

Tables 1, 2, and 3 summarize the descriptive statistics for the Contextual Variables. Specifically, Table 1 displays the descriptive statistics of the sleep descriptives variables. Remarkably, 53.2 % of the participants reported sleeping seven hours or less per night, while only 10.3 % of the sample reported sleeping the recommended number of hours ( $M = 7.4$ ,  $SD = 0.9$ ). Additionally, 58.8% reported feeling tired sometimes during the day while 22.8% reported feeling tired almost always. Frequencies for the family context are displayed on Table 2. More than half of the sample reported that their parents arrive home between 5:00 p.m. and 7:00 p.m. Regarding number of siblings, the majority (62.3%) reported to have one sibling, while the minority (1.1%) reported to have four or more siblings. Lastly, Table 3 displays the frequencies of routine related questions. Regarding dinner time, 68% of the participants reported to have dinner between 7:00 p.m. and 8:00 p.m., while only 5.3% of the sample reported to have dinner at 7:00 p.m. Moreover, 68% of the sample have classes starting between 8:00 a.m. and 9:00 a.m. and 85.5% do not share their rooms. Relatively to physical activity, 56.8% reported not playing sports, against 43.2% who practice sports at least once a week. Of the participants who practice sports, 12.1% finish before 06:00 pm, 47.1% between 6:00 p.m. and 8:59 p.m., and finally, 40.8% after 9:00 p.m. Finally, participants were asked whether they procrastinate before going to bed or while-in-bed. The majority (59.5%) reported to procrastinate while-in-bed, weather the rest reported to procrastinate before going to bed.

Table 1

*Descriptive statistics of sleep descriptives.*

Hours of sleep		
	Frequency	%
Less than 5 hours	2	0.6
5-6 hours	52	13.1
6-7 hours	156	39.5
7-8 hours	148	36.5
8-9 hours	36	9.1
9-10 hours	6	1.2
Tiredness during the day		
	Frequency	%
Sometimes	235	58.7



## SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

Almost never	74	18.5
Almost always	91	22.8
Waking time		
	Frequency	%
Before 7:00 a.m.	103	25.8
Between 7:00 a.m. and 8:00 a.m.	266	66.5
Between 8:00 a.m. and 9:00 a.m.	23	5.8
After 9 a.m.	8	2
Desired time to fall asleep		
	Frequency	%
9:00 p.m. to 9:59 p.m.	26	6.5
10:00 p.m. to 10:59 p.m.	177	44.3
11:00 p.m. to 11:59 p.m.	153	38.3
12:00 a.m. to 12:59 a.m.	32	8
1:00 a.m. to 3:00 a.m.	6	1.5

Table 2

*Descriptive statistics of family context*

Parents arrival home time		
	Frequency	%
5:00 p.m.	65	16.3
Between 5:00 p.m. and 7:00 p.m.	211	52.8
Between 7:00 p.m. and 9:00 p.m.	101	25.3
After 9:00 p.m.	23	5.8
Number of siblings		
	Frequency	%
0	65	16.3
1	249	62.3
2	70	17.5
3	12	3
4 or more	4	1.1

Table 3

*Descriptive statistics of routine.*

Dinner time		
	Frequency	%
7:00 p.m.	21	5.2
7:00 p.m. and 8:00 p.m.	272	68
After 9 p.m.	107	26.8
School starting time		
	Frequency	%
Between 8:00 a.m. and 10:00 a.m.	393	98.2
Between 10:00 a.m. and 11:00 a.m.	2	0.5
In the afternoon	5	1.3
Room share		
	Frequency	%
Share the room	58	14.5
Sleeps alone	342	85.5
Sports		
	Frequency	%
Yes	173	42.3
No	227	56.8
Time sport is over		
	Frequency	%
Before 3:00 p.m.	3	2.1
3:00 p.m. to 3:59 p.m.	1	0.7
4:00 p.m. to 4:59 p.m.	6	14.3
5:00 p.m. to 5:59 p.m. p.m.	7	5
6:00 p.m. to 6:59 p.m.	9	6.4
7:00 p.m. to 7:59 p.m.	14	10
8:00 p.m. to 8:59 p.m.	43	30.7
9:00 p.m. to 9:59 p.m.	32	22.9
10:00 p.m. to 10:59 p.m.	20	14.3

## SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

11:00 p.m. to 12:59 p.m.	5	3.6
Self-reported procrastination		
	Frequency	%
Before going to bed	162	40.5
While in bed	238	59.5

Sleep procrastination was evaluated via two questionnaires, the Bedtime Procrastination developed by Kroese et al. (2014) and the While-in-bed Procrastination developed for the present study. The first scale has nine items with high inter-item reliability (Cronbach's  $\alpha = 0.92$ ). The current study validated the scale to the Portuguese population and was adjusted, ending with eighth items (instead of the original nine) and high inter-item reliability as well (Cronbach's  $\alpha = 0.85$ ). Table 4 displays descriptive statistics for this scale. Regarding the second scale, it comprises seven-items about while-in-bed behaviors (Cronbach's  $\alpha = .73$ ). The most performed behaviors were "send texts, make videocalls/calls" and "watch videos on YouTube", while the least performed behavior was "eat snacks (cookies, cereals, milk, chips, chocolate) (see Table 5).

# SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

Table 4

*Bedtime Procrastination Scale frequencies (Portuguese version)*

	Almost Never	Rarely	Neutral	Frequently	Almost Always	Mean (SD)
I go to bed later than I had intended	32 (8%)	78 (19.5%)	85 (21.3%)	124 (31%)	81 (20.3%)	3.36 (1.23)
I go to bed early if I have to get up early in the morning (R)	58 (15.5%)	98 (24.5%)	120 (30%)	94 (23.5%)	30 (7.5%)	2.85 (1.16)
Often I am still doing other things when it is time to go to bed.	20 (5%)	48 (12%)	64 (16%)	170 (42.5%)	98 (24.5%)	3.70 (1.12)
I easily get distracted by things when I actually would like to go to bed.	43 (10.8%)	60 (15%)	95 (23.8%)	129 (32.3%)	73 (18.3%)	3.32 (1.24)
I do not go to bed on time.	43 (10.8%)	61 (15.3%)	104 (26 %)	113 (28.2%)	79 (19.8%)	3.31 (1.25)
I have a regular bedtime which I keep to (R).	42 (10.5%)	94 (23.5%)	89 (22.3%)	84 (21%)	91 (22.8%)	3.22 (1.32)
I want to go to bed on time but I just don't.	76 (19%)	89 (22.3%)	85 (21.3%)	89 (22.3%)	61 (15.3%)	2.93 (1.347)
I can easily stop with my activities when it is time to go to bed (R).	30 (7.5%)	81 (20.3%)	118 (29.5%)	107 (26.8%)	64 (16 %)	3.24 (1.17)

# SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

Table 5

*While-in-bed Procrastination Scale frequencies*

	Almost Never	Rarely	Neutral	Frequently	Almost Always	Mean ( <i>SD</i> )
Watch videos on youtube	69 (17.3%)	58 (14.5%)	46 (11.5%)	129 (32.3%)	98 (24.5%)	3.32 ( <i>1.43</i> )
Watch TV	142 (35.5%)	82 (20.5%)	63 (15.8%)	59 (14.8%)	54 (13.5%)	2.5 ( <i>1.44</i> )
Watch movies and series	89 (22.3%)	67 (16.8%)	66 (16.5%)	100 (25%)	78 (19.5%)	3.03 ( <i>1.45</i> )
Listen to music	76 (19%)	66 (16.5%)	48 (12%)	100 (25%)	110 (27.5%)	3.26 ( <i>1.49</i> )
Send texts, make videocalls/calls	59 (14.8%)	46 (11.5%)	60 (15%)	110 (27.5%)	125 (31.3%)	3.49 ( <i>1.41</i> )
Play games (tablet, computer, cellphone)	158 (39.5%)	69 (17.3%)	68 (17%)	55 (13.8%)	50 (12.5 %)	2.43 ( <i>1.44</i> )
Eat snacks (cookies, cereals, milk, chips, chocolate)	185 (46.3%)	68 (17%)	58 (14.5%)	52 (13%)	37 (9.3%)	2.22 ( <i>1.38</i> )

Pearson's correlation was calculated between Bedtime Procrastination and While-in-bed Procrastination (see Table 6). This allows to test whether the scales are measuring the same construct, if they are highly correlated, or whether they are measuring different constructs, if they are poorly or not correlated. Data shows that correlation between scales is low ( $r = .158^{**}$ ), which supports the contention that Sleep Procrastination may be composed by two aspects: Bedtime Procrastination and While-in-bed Procrastination.

Table 6

*Bedtime Procrastination Scale and While-in-bed Procrastination Scale correlation*

	Bedtime Procrastination	While-in-bed Procrastination
Bedtime Procrastination	-	.158**
While-in-bed Procrastination	.158**	-

*Note.* \*\*The correlation is significant in a 0.01 level, two tailed.

Analyses of Variance were performed for some contextual and sociodemographic variables with Bedtime Procrastination ( $M = 3.2$ ,  $SD = 0.9$ ) and While-in-bed Procrastination ( $M = 2.9$ ,  $SD = 0.9$ ) (see Table 7). Regarding Bedtime Procrastination, results show that there were significant differences in Bedtime Procrastination regarding waking time and dinner time,  $F(3.396) = 4.63$ ,  $p < .005$  and  $F(2.397) = 7.13$ ,  $p < .005$ , respectively. Gabriel's Post-Hoc Test revealed that participants reporting waking up after 9:00 a.m. reported more bedtime procrastination compared to participants reporting waking up before 7:00 a.m. and between 7:00 a.m. and 8:00 a.m. Regarding dinner time, participants reporting having dinner after 9:00 p.m. report more bedtime procrastination compared to participants reporting having dinner at 7:00 p.m. and between 7:00 p.m. and 8:00 p.m.

Regarding While-in-bed Procrastination, the scenario alters. Results showed that there are significant differences regarding sex,  $F(1, 398) = 11.73$ ,  $p < .005$ , desired sleep time,  $F(4, 389) = 5.999$ ,  $p < .001$ , and dinner time,  $F(2, 397) = 6.181$ ,  $p < .005$ . Gabriel's Post-Hoc Test showed that male participants reported more While-in-bed Procrastination compared to female participants. Regarding desired sleep time, adolescents who reported wanting to sleep between 1:00 a.m. and 3:00 a.m. reported more While-in-bed Procrastination than adolescents who reported wanting to sleep between 9:00 p.m. and 9:59 p.m., 10:00 p.m. and 10:59 p.m., 11:00 p.m. and 11:59 p.m. and, 12:00 a.m. and 00:59 a.m.. Lastly, the Post-Hoc Test regarding the variable Dinner time showed that there are differences between the group of participants who report having dinner at 7:00 p.m. and the other two groups.

Accordingly, participants who reported having dinner at 7:00 p.m. tended to engage more in While-in-bed Procrastination than participants who reported having dinner between 7:00 p.m. and 8:00 p.m. and after 9:00 p.m.

Table 7

*Analyses of variance*

	Bedtime Procrastination	While-in-bed Procrastination
Sex	F (1, 398)	F (1, 398) **
Desired hour to fall asleep	F (4, 389)	F (4, 389) **
Usual dinner time	F (2, 397) **	F (2, 397) *
Usual waking time	F (3, 396) *	F (3, 396)
School hour	F (2, 397)	F (2, 397)
School year	F (2, 395)	F (2, 395)
Self-reported Procrastination	F (1, 398)	F (1, 398)
Number of siblings	F (6, 393)	F (6, 393)

*Note.* \*Significant at the  $p < .05$  level; \*\* Significant at the  $p < .01$  level.

### Discussion

Sleep plays a vital role in our health. Sleeping the ideal number of hours of sleep benefits cognition, mental and physical health, conveying wellbeing (Strazzullo, Cairella, Garbagnati, Cappuccio, & Scalfi, 2010; Curcio, Ferrara, & De Gennaro, 2006; Magee, Caputi, & Iverson, 2010; Mander, Santhanam, Saletin, & Walker, 2011; Van der Helm, Gujar, & Walker, 2010). The current study found that adolescents, who need a good sleep hygiene for their normative development, are sleeping two hours less per night than the recommended number of hours. This finding, despite worrying, is consistent with previous literature (Bernecker & Job, 2019; Woods & Scott 2016). Amidst this scenario, the purpose of this paper was to explore the possibility that sleep insufficiency may be due to procrastination of sleep. Particularly, we looked at Sleep Procrastination as a broader phenomenon, aiming to examine whether there is evidence that this construct consists of two facets: Bedtime Procrastination and While-in-bed Procrastination.

To measure Bedtime Procrastination, the Bedtime Procrastination Scale, developed by Kroese et al. (2014), was adapted and validated for the Portuguese population. The authors provided additional information about the scale results (frequencies of the items), and it can be concluded that the Portuguese

version follows the same tendency as the original scale. The means of the items were particularly similar (the maximum variation was one point in one item) as well as the general means of each scale. Regarding the concept of While-in-bed Procrastination, we developed a scale to capture this phenomenon. The correlation between both scales was low ( $p = .158^{**}$ ), suggesting that these instruments are measuring different phenomena, thus supporting our assertion that Sleep Procrastination may comprise two aspects: procrastination behaviors before going to bed and after going to bed.

Interestingly, the behaviours individuals reported engaging more while in bed were to watch videos on YouTube, watch movies, listen to music and send texts. These findings are consistent with those reported by the National Sleep Foundation (2006). This report indicated that all adolescents used at least one electronic device in bed, particularly: 57% television, 90% music players, 43% computers, and 64% phones. Additionally, the study by Calamaro, Mason, and Ratcliffe (2009) reported that adolescents were sending texts, making phone calls, playing computer games or were online after 9:00 p.m.; and the study by Van den Bulck (2007) using a Belgian sample reported that 62% of adolescents used their phone in bed, with the lights off, and consequently reported more tiredness during the following day.

Lastly, the present study allowed to examine differences in contextual variables as a function of type of procrastination, Bedtime or While-in-bed. Whereas Bedtime Procrastination was related to the context variables waking and dinner time, While-in-bed Procrastination was linked to sex, desired time to sleep, and dinner time. This pattern seems to indicate three essential aspects: sex, ambient control, and sleep goals. More specifically, it seems that sex, ambient control (dinner time) and sleep goals (desired sleep and wake hour) predicted distinctly the facet of Sleep procrastination (Bedtime or While-in-bed procrastination). According to the literature, men show lower self-regulatory skills than women and, therefore, engage further in procrastination (Özer, Demir, & Ferrari, 2009; Steel & Ferrari, 2012). However, we have not found potential explanations in the literature regarding the remaining results.

These results encompass extreme importance since this research is the first in the literature analyzing Sleep Procrastination from a different standpoint. The analysis of Sleep Procrastination as having two facets, Bedtime Procrastination and While-in-bed Procrastination, is likely to disclose new research opportunities and contribute to further accurate intervention. Current literature in the Sleep Procrastination domain remains in the path of discovering the underlying mechanisms behind the phenomenon, but current findings on sleep insufficiency have already showed the relevance of the phenomenon to our health and well-being. Consequently, a suitable intervention is needed, likewise other domains of procrastination, and having the knowledge that it could comprise two types of procrastinators will allow the development of more effective interventions. More precisely, an intervention design for



intervene in the behaviors participants enroll in before going to bed (bedtime procrastinators) should be accomplished as well as the development of an intervention that acts in the behaviors of participants when they are in their beds (while-in-bed procrastinators), having with basis the existing and further research to settle strategies to help individuals accomplish a proper sleep routine. In fact, a study made by Kroese et al. (2014) showed a high correlation between Bedtime Procrastination and general procrastination, which is linked to a low self-regulation, being a possible explanation for the phenomenon. However, another study found that Bedtime Procrastination was a result of biological individual characteristics, opposing to the idea of the phenomenon being a result of a lack of self-regulatory resources (Kühnel et al., 2018). The literature about this area remains scarce and inconsistent, and we suggest further research and the need to include both Bedtime Procrastination and While-in-bed Procrastination.

### **Limitations and future studies**

The current research has methodological constraints that should be considered when interpreting the results. The reader should bear in mind that the nature of this study was correlational and does not provide evidence about the causality of the effects. Additionally, data was collected online and through a self-report questionnaire. Thus, we suggest future studies to apply a momentary form of evaluation (e.g., sleep diaries), which would add additional validity to the research. Nonetheless, we have no reasons to believe that these limitations bring prejudice to the study, since the reliability of the measures was high.

Hence, this research provided an important opportunity to advance the understanding of Sleep Procrastination. Consequently, having into account that this study opened new research possibilities, future research may consider to develop further research and educational interventions on the underlying mechanisms of Sleep Procrastination. Furthermore, it would be of interest to relate Sleep Procrastinators with other health procrastination behaviors (e.g., medical and healthy eating procrastination). These findings are expected to help understand why people keep engage in behaviors likely to undermine their own health and well-being.

### **Conclusions**

To the best of our knowledge, this is the first study to undertake a different direction in Sleep Procrastination, adding a new perspective to the literature. The results suggest that assessing Sleep Procrastination solely focused on procrastinating behaviours before going to bed is not enough to fully understand the phenomenon. Delaying sleep while-in-bed is a common reality and need to be acknowledged as part of the Sleep Procrastination process. Hence, there are several important aspects in which this study makes an original contribution. As described above, sleep insufficiency is a subject of

## SLEEP PROCRASTINATION: AN EXPLORATORY STUDY

extreme importance and affects a significant size of the general population; so, hopefully this study will contribute to its improvement.

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