

Exploring the relationship between perceived academic pressure and sedentary time moderated by conscientiousness in university students using experience sampling

Bachelor Thesis

Lina Rath

B.Sc Psychology

Faculty of Behavioural Management and Social Sciences (BMS)
University of Twente

1 supervisor: G. Schaap, MSc
2 supervisor: Dr. J.T. Kraiss

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Abstract

Background: Sedentary behaviour is known to be related to several negative health consequences. Still, an increasing amount of sedentary time has been found within society. University students especially tend to engage in large amounts of sedentary times. For this group an influential factor might be perceived academic pressure, which is common within university students. Furthermore, mentally active sedentary times are analysed since mentally active studying sedentary behaviours are very common among university students. This study aims to explore the relationship between academic pressure and sedentary times in university students. Further, trait conscientiousness will be investigated as a moderator.

Methods: Experience sampling was used to measure total and mentally active sedentary time and perceived academic pressure in university students (sample: $N = 32$; $M_{\text{age}} = 20.75$; $SD_{\text{age}} = 2.25$; female = 71.9%), using the online platform Ethica. Both constructs were measured daily over the course of nine days. Trait conscientiousness was measured once in a baseline questionnaire. The data was analysed using Linear Mixed Models.

Results: The analysis of the relationship between academic pressure and sedentary time turned out to be insignificant ($p = .76$). Further, no significant influence of academic pressure on active sedentary time could have been found ($p = .50$). The moderation effect of conscientiousness on the relationship turned out to be insignificant as well ($p = .93$).

Conclusion: Against expectations, no statistically significant associations were found within this study. However, research with other closely related constructs might give a deeper understanding to the reasons for the high amounts of sedentary time observed in university students. Specifically, a more detailed analysis of the concept studying is advised.

Key words: Sedentary time, Active Sedentary time, Academic pressure, Conscientiousness, University students, Experience Sampling Methodology

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1. Introduction

Sedentary behaviour is known to be a crucial concept in modern society which received increasing attention by researchers in the past years. This is mainly due to its, well researched, negative impact on mental and physical health. Nowadays, there is a considerable amount of scientific papers indicating that diseases like coronary heart diseases, type 2 diabetes and some forms of cancer, as well as decreases in mental health are seen as consequences of sedentary behaviour (Rezende et al., 2014). Especially among university students a high amount of sedentary time can be observed (Castro et al., 2020). Furthermore, the very same group is known to be affected by high amounts of perceived academic pressure (pAP) (Reddy et al., 2018). A correlation of both concepts might explain the high amounts observed. However, a possible relationship between pAP and sedentary time is not very precisely explored by research right now. The present study aims to explore the relationship between pAP and sedentary time in university students and explore whether trait conscientiousness could have a moderating effect.

1.1 Defining sedentary behaviour

The most common definition of sedentary behaviour is given by the Sedentary Behaviour Research Network (SBRN) “Sedentary behaviour is any waking behaviour characterised by an energy expenditure ≤ 1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture” (Tremblay et al., 2017, p. 5). It identifies two factors relevant for the definition. One of which is the Metabolic Equivalent (MET), which describes the energy consumption in humans for a specific activity (Jetté et al., 1990). METs below 1.5 can be classified as rather low amounts. Sedentary behaviours are therefore not seen to be exhausting (Tremblay et al., 2017). Moreover, sedentary behaviour should be seen as independent from physical inactivity. A person can meet the requirements of physical activity in a day and still engage in a large amount of sedentary behaviour (Owen et al., 2011).

To better understand consequences of sedentary behaviour, different sub-categories are used. A distinction can be made between mentally active and mentally passive sedentary behaviours which concern the amount of mental efforts during a sedentary activity. While

active sedentary behaviour defines a construct in which extensive thinking is related to the type of sedentary behaviour that is performed, passive sedentary behaviour does not involve intense mental processes (Hallgren et al., 2020). An example for mentally active sedentary behaviour in university students is studying while sitting on a desk or in front of a computer. Mentally passive sedentary behaviour might be sitting on a couch and watching television.

Sedentary behaviour is related to mental and physical health risks. First, sedentary behaviour is strongly related to abnormal glucose metabolism. This is believed to result in an increased circumference and higher blood pressure (Owen, 2010). In long terms this might lead to several diseases including cardiovascular diseases, type 2 diabetes, obesity, musculoskeletal disorders, cancer, and increases in mortality rate (Katzmarzyk, 2010). Next to physical disadvantages, long periods of sedentary behaviour might also be correlated with depressive symptoms and poorer cognitive functions. This relationship could be a reason for decreases in mental health (Hallgren et al., 2020; Hamer et al., 2014).

Although it has been found that high sedentary times are related to issues in mental and physical health, the amount of sedentary behaviour has been increasing in the European (EU) population over the past decade. Accordingly, between 2002 and 2017 an increase of sedentary behaviours in European adults of 5% was observed. Furthermore, there is a steady difference between men and women, where men show more sedentary time than women (López-Valenciano et al., 2020). Notable is the high amount of sedentary times observed in university students. According to Castro et al. (2020) there is a significant difference between the sedentary time of university students compared to other young adults. Accordingly, university students spend around 9h every day engaging in sedentary behaviours (Castro et al., 2020).

1.2 Defining perceived academic pressure

Perceived academic pressure (pAP) is highly common among university students (Reddy et al., 2018). The construct defines the pressure from studying aspects sensed by university students (Reddy et al., 2018). A student experiencing pAP is “under heavy demands of time and energy to meet academic goals” (Bisht, 1989, as cited in Lal, 2014, p.123). Examples of studying aspects, which trigger pAP can be examination, competing with peers, meeting the academic expectations of teachers, parents and own expectations (Aihie, & Ohanaka, 2019).

As a result of high pAP a “fight or flight” reaction might develop. Along with this, physiological symptoms of the sympathetic nervous system like an increased heart rate and blood pressure can occur. Next, decreased immune functions and problems in sleeping patterns can be related to pAP (Wunsch et al., 2017). In addition, high amounts of pAP can result in an inability to concentrate, a fear of failure, negative evaluations of the future, depression and especially stress (Reddy et al., 2018; Kumaraswamy, 2013; Deb et al., 2015). Positive results of high amounts of pAP can be higher motivation of students (Kumaraswamy, 2013).

It is estimated that 48.8% of the university students experience moderate to severe pAP levels (Reddy et al., 2018). Besides, it is seen as the primary stressor for university students (Wunsch et al., 2017). Especially during the current Covid-19 pandemic an increase in academic pressure has been observed among university students (University of Amsterdam, 2021). There is a notable difference between the academic fields. The highest pressure was perceived in the commerce study program and the lowest pressure in the humanities and the science study program (Reddy et al., 2018).

1.3 Perceived academic pressure and sedentary behaviour

The question which arises concerns the reasons for the high amounts of sedentary times observed in university students. Since this group experiences higher amounts of pAP, compared to non-university students, pAP will be investigated as a possible explanation for the high amounts of sedentary times (Reddy et al., 2018). This was supported through a focus group analysis by Deliens et al. (2015). Here, pAP was found to be a moderating factor for the relationship between determinants and sedentary behaviour in university students. Therefore, it could be that pAP might also have a direct influence on sedentary time. Furthermore, Moulin (2016) analysed several factors that might explain the high amounts of sedentary time in university students. His findings showed that long study times inside and outside class are a relevant factor for students to be sedentary (Moulin, 2016; Castro et al., 2018).

The same association was found for office workers. Here, workload resulted in longer sedentary times (Parry & Straker, 2013). The workload for office workers is seen as comparable to the concept pAP in the current study, because for students high workload can lead to increases in pAP (Aihie & Ohanaka, 2019).

Especially in university students, pAP could trigger mentally active sedentary behaviour. This is because pAP is known to cause students to engage in studying activities, which are seen as active sedentary behaviours (Kumaraswamy, 2013).

PAP is related to perceived stress, the undesirable response people have to extreme strain (Khan, et. al., 2013, p. 146). This concept is known to be an outcome of high amounts of pAP (Deb et al., 2015). Stress might be interesting for the relationship between pAP and sedentary time because a relationship between stress and sedentary time has already been found (Ashdown-Franks et al., 2018). Therefore, because pAP can be a predictor of stress and stress can be a predictor of sedentary time, an association between pAP and sedentary time seems to be possible as well. Although, a relationship between pAP and sedentary behaviour in university students was not explored by research before, the above-mentioned findings suggest a possible relationship between the two concepts.

1.4 Conscientiousness

A possible moderating construct within this analysis could be the trait conscientiousness. The construct was defined as “the propensity to follow socially described norms for impulse control, to be goal directed, to plan, and to be able to delay gratification” (Roberts et al., 2009). This trait is known to be very prevalent among university students, which might be due to the fact that the concept is associated with academic success (MacCann et al., 2009). Among other factors, highly conscientious people are known to have better abilities to deal with stress (Bartley & Roesch, 2011). Stress is known to be positively related to sedentary time and seen as a possible result of pAP, therefore the trait conscientiousness seems to be influential in the current study. Further research shows that low levels of conscientiousness are related to high amounts of sedentary time (Allen et al., 2017). Due to these findings, conscientiousness is assumed to moderate the relationship between pAP and sedentary time in university students negatively.

1.5 Experience sampling

For this study the Experience Sampling Method (ESM) seems to be most appropriate. Through the use of ESM, researchers are able to gain knowledge about the everyday circumstances of test subjects over a certain period. This is done through a diary-like method in which sedentary time and pAP can be measured daily. For this purpose, the data is most often collected through rather small surveys in the form of self-reports, which need to be filled out several times throughout the data collection period (Myin-Germeys et al., 2018). Since the surveys are identical over time repeated measures are comparable over time. Advantages of

this method include the access to information that might otherwise not be easily obtained. This includes daily changes pAP and sedentary times. Further, the recall bias is reduced, which enhances the accuracy of the collected data. Last, thoughts and feelings are expected to be connected to environmental circumstances. Through the use of ESM the feeling of pressure can be better associated with contextual factors, like the exact day and time they were measured (Myin-Germeys et al., 2018). For the construct of sedentary time and pAP, time might play an important role. pAP for example is known to be decreased on weekends since usually no university activities take place on a Saturday or Sunday (Ragsdale et al., 2011). So, measuring the constructs over a time period instead of one specific day is expected to give a better overview of actual scores.

1.6 Current study

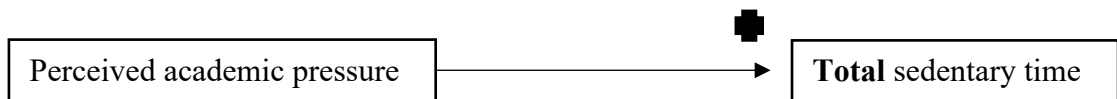
It has become clear that high amounts of sedentary behaviour are related to negative health issues. In order to be able to reduce the amount of sedentary time, the concept as well as related factors must first be explored precisely (Gardner et al., 2016). It has been found that university students engage in a high amount of sedentary time in relation to non-university students (Castro et al., 2020). In addition, university students experience high amounts of pAP (Reddy et al., 2018). A possible relationship between the two factors within the sample of university students will therefore be explored in this study. This is further supported by the fact that related constructs of pAP, like stress, are already known to increase sedentary times (Ashdown-Franks et al., 2018). Furthermore, students are known to engage in a lot of studying sedentary activities which can be further triggered through academic pressure (Moulin, 2016). Therefore, the first research question is: *How are daily perceived academic pressure (pAP) and total daily sedentary time related in university students?* It is expected that pAP is positively related to sedentary times in university students. Beside total sedentary time, a closer look at the association between pAP and active sedentary times might be insightful. This is because some students tend to study more when they experience high amounts of pAP and therefore engage in higher amounts of active sedentary behaviours. The second research question is: *How are daily perceived academic pressure (pAP) and daily active sedentary time related in university students?* For the mentally active subtype of sedentary behaviour a positive relationship is expected. The trait conscientiousness could be a crucial factor within the relationship between pAP and sedentary time. The trait is known to influence the way people deal with stress (Bartley & Roesch, 2011). It is therefore assumed to be a moderating factor with a negative

influence on Sedentary behaviour. The third research question is: *Is the relationship between perceived academic pressure (pAP) and **total** sedentary time moderated by trait conscientiousness?* The goal of this study is the exploration of the effect of pAP on sedentary time in university students. A presentation of the research questions can be found in Figure 1.

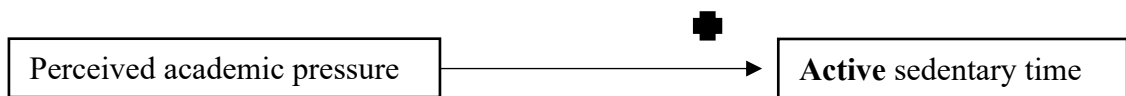
Figure 1

Visualisation of research questions and expectations

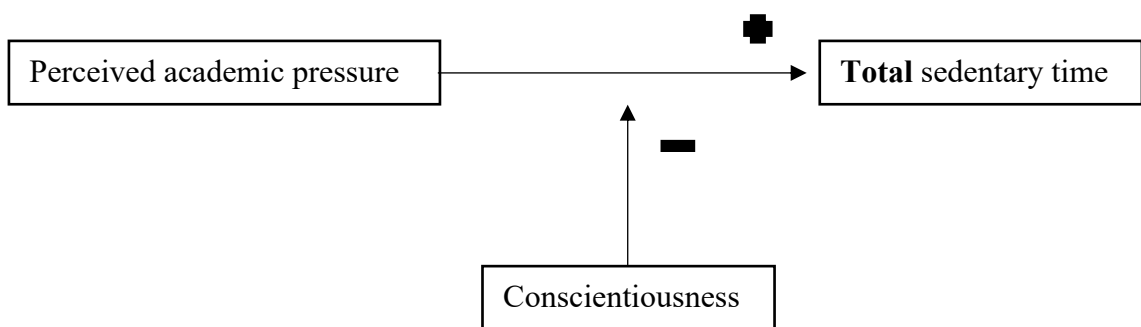
1. *How are daily perceived academic pressure (pAP) and **total** daily sedentary time related in university students?*



2. *How are daily perceived academic pressure (pAP) and daily **active** sedentary time related in university students?*



3. *Is the relationship between perceived academic pressure (pAP) and **total** sedentary time moderated by trait conscientiousness?*



2.Methods

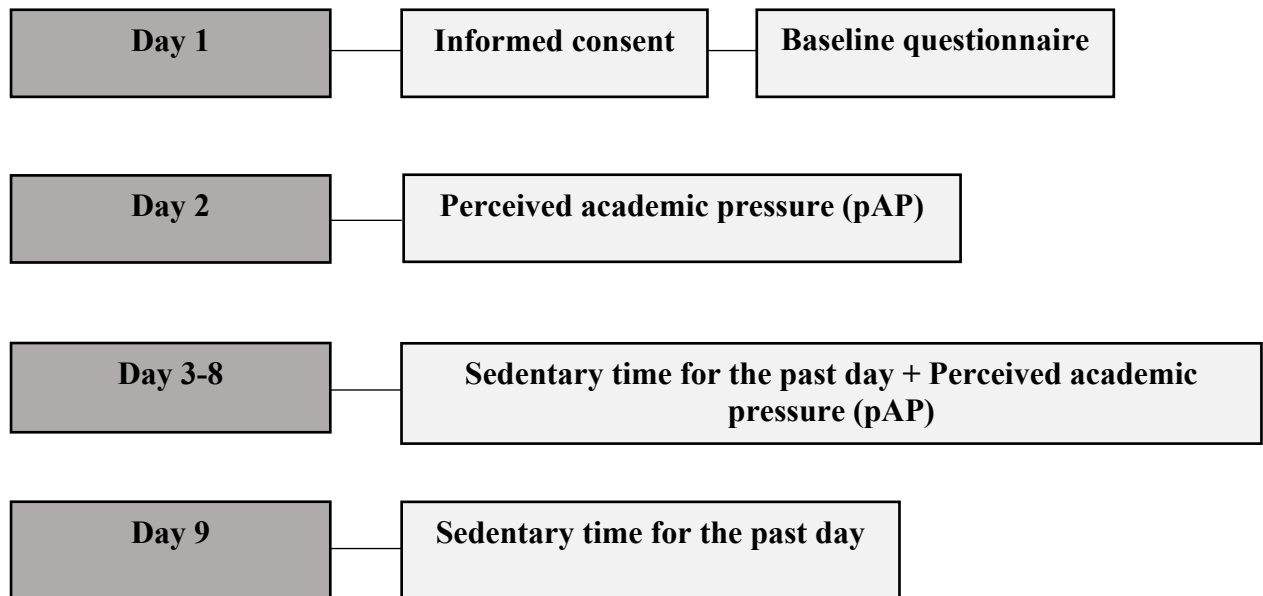
2.1 Design

The overall study design focused on quantitative data collection using an ESM method. Surveys were presented using the online data collection application Ethica. All materials were presented in English. The data collection period took nine days and was conducted in November 2021. The duration of nine days was chosen because no data concerning the state measures were received for the first and the last day. Therefore, the seven days of full data give an overview over each day of a week. This was seen as necessary because the days themselves might influence the constructs in this study (Myin-Germeys et al., 2018). On the first day of the study the baseline questionnaire and the informed consent were sent. From then on, participants received one short survey every day about self-reported sedentary time and pAP as repeated measures. On the last day only sedentary time of the past day was measured, as it was measured retrospectively of the previous day. An overview is presented in Figure 2. The morning survey was the same every day which makes the results comparable. Data collection was done with a group of four bachelor students. Accordingly, other items concerning concepts that are not relevant for this particular study were integrated into the survey. Ethical approval was given by the BMS ethics committee of the University of Twente (Reference number 211236).

In order to test the applicability of the design a pilot study was conducted. Therefore, eight participants, including social contacts of researchers as well as the researchers themselves, tested the study over the course of three days. The pilot study worked fine and no adjustments concerning the design or triggering logics were made.

Figure 2

Timeline of the data collection



2.2 Participants

University students and students of applied sciences were recruited using a convenience sampling method. The SONA system of the university was used as a platform for students to register and become aware of the study. In addition, personal networks of researchers were used to increase the number of participants. Being enrolled students at a university or university of applied science were recruited, a minimum age of 18 years and fluent English proficiency were inclusion criteria. In addition, participants must own a device on which Ethica could be installed and used on a regular basis, preferably smartphones because a high prevalence of usage of these devices among university students has been found (Carbonell et al., 2018). Therefore, participants who use Ethica on their smartphones are assumed to notice upcoming surveys sooner, which is assumed to increase the response rate. The minimum sample size for this study should be >19 . This equals the median of participants for ESM studies found by Van Berkel et al. (2017) and is consequently seen as a good number of participants for an online ESM study.

The final sample included 32 participants aged between 18 and 26 years ($M = 20.75$), which were mainly female (71.9%, $n = 23$) and mostly German (56.3%, $n = 18$). The majority of the participants studied Psychology (81.3%, $n = 26$). Further information can be found in Table 1.

Table 1: *Descriptive statistics of the sample*

Variable		<i>n</i>	<i>%</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Age				20.75	2.25	18	26
Gender	Male	9	28.1				
	Female	23	71.9				
Nationality	German	18	56.3				
	Dutch	7	21.9				
	Other EU	5	15.6				
	Other non-EU	2	6.3				
Study Programm	Psychology	26	81.3				
	Mechanical engineering	2	6.2				
	Informatics	1	3.1				
	Mechatronics	1	3.1				
	Business Mathematics	1	3.1				
	Physiotherapy	1	3.1				

2.3 Materials

2.3.1 Ethica

The questionnaires were presented through the online data collection software Ethica (<https://ethicadata.com>). This platform is suitable for ESM studies, since the application can be downloaded on any device. This also makes it applicable for a large number of participants. Features of the application that have been relevant for this study were the adjustable triggering logics which allow one to trigger a survey once or daily in fixed or random intervals. The study description as well as the informed consent have been presented to the participants within the app. Moreover, through features like reminders in the form of notifications, subjects can be notified about surveys and reminded to fill them out if they are about to expire.

2.3.2 Informed consent

The informed consent (see Appendix B survey B1) was presented through the Ethica application right after a participant joined the study. It includes all relevant information as well as guidelines for the respondents, and anonymity and confidentiality information. Further, a comment was made concerning a possible increased awareness of mood, anxiety, academic pressure, or stress in order to inform participants who are sensitive to these topics.

2.3.3 Baseline questionnaire

The baseline questionnaire (see Appendix B survey B2) consisted of demographic items, which include the age, gender, nationality, and study program of a participant, as well as a trait conscientiousness questionnaire. Since conscientiousness is part of the Big five personality model, the conscientiousness scale of the Big Five Inventory-SOEP (BFI-S) was used to assess the trait. The BFI-S is the short version of the BFI and includes 25 items in total. This inventory is a very applicable and well known instrument with good reliability and validity (Gerlitz & Schupp, 2005; GESIS, 2021). Therefore, using the conscientiousness items of this scale in the current study was seen as appropriate. Further, the instrument involves items which are both negatively and positively phrased. Negatively formulated items are recoded in the data analysis. Items of the conscientiousness strain were presented on a five-point-likert scale (option 1 Disagree? – option 5 Agree). Example items are: *I see myself as someone who tends to be disorganised (-)* and *I see myself as someone who does a thorough job (+)* (GESIS, 2021). Next, an additional item was included to measure whether participants had a condition that affects their sitting behaviour.

2.3.4 Daily repeated measures

The morning survey assessed the state measures (see Appendix B survey B3). It includes a revision of the Past Day Adults' Sedentary Time University survey (PAST-U). The PAST-U was used to measure sedentary time from the day before. It was made out of 13 items out of which eight measure active sedentary time. The original PAST-U survey is seen as a reliable and valid measurement (Clark et al., 2016). In its modified version, the tool was adjusted to the target group of university students. Accordingly, behaviours that were seen to be typical for a university student were included. These behaviours were streaming of video on-demand content, and gaming on the TV and computer. Other behaviours that seemed to be more adequate for an older group were reformulated. For example, it was stated that chatting with friends online should be included in social sedentary time. Also, an additional item was included concerning creative sedentary activities. An example of questions in the PAST-U is "How long were you sitting for studying yesterday?". Answer possibilities were given in 15 minutes intervals.

Moreover, the level of pAP for the day was measured within this survey. The item has been taken from the Lakaev Academic Stress Response Scale (LASRS), which measures the stress university students experience through their study (Resolving Vilification, 2016). The item was: "I am feeling overwhelmed by the demands of study" and it was measured on a five-point Likert scale (from 1. "Not at all" to 5. "Extremely").

2.4 Procedure

Participants received an email with an instruction to download the Ethica application. Those who participated through the SONA system of the University of Twente received the instructions to download the app through the study description in the system. After the successful registration for the study the informed consent and the baseline questionnaire were triggered through the app on the first day of the study. Then, from the second day on, the data collection of the state measures started. On the first day only the pAP item was included in the morning survey since no data concerning sedentary time for the first day of the study was needed. From the third day on, the complete morning survey was triggered every morning at 7 am over the course of six days. After the first notification, two reminders at 9 am and at 11 am were sent to the participants if they had not already filled out the survey. The questionnaire

expired at 12 noon. Since data from the PAST-U questionnaire in the morning always concerns the previous day, the study consisted of seven days of data for sedentary time and pAP in total (Figure 2). On the last day, the participants were thanked for their responses through a notification within Ethica. Those who participated through the SONA system received 0.5 credits.

2.5 Statistical analysis

The results were analysed using the statistical program SPSS (version 27). Therefore, the data was exported from Ethica as a CSV file. This was done separately for each survey. Further, the data was imported to the program SPSS (as a long-format) in order to be adapted and merged into a final dataset.

The adaption included a data cleaning process. Three guidelines were agreed upon, which define the exclusion of participants. First, respondents who did not fill out the informed consent were excluded. Further, those with a low response rate ($< 70\%$) were removed. The value of 69.6% was found as an average response rate in analysed papers and served as a guide for this decision (Van Berkel et al., 2017). Last, everybody with a disorder or restriction that affects sitting time was removed.

For the merging process, each dataset needed to include similar variables. Hence, several variables needed to be renamed or new computed. Individual sum scores of trait conscientiousness were computed after recoding negatively phrased items. Last, new variables for the total sedentary time, as well as mentally active time scores were computed by adding up the items.

After having a complete workable SPSS dataset, sample characteristics were retrieved. Some students showed unrealistic data and needed to be removed. This was applicable for every participant with continuous sedentary times $> 24\text{h}$ (1440 minutes). Next, the reliability of the items and scales was calculated. For the reliability analysis of the sedentary time items and the pAP item the split-half reliability was measured using spearman's rho. Correlation coefficients $> .4$ or $< -.4$ are seen as moderate, and scores $> .7$ and $< -.7$ are seen as strong coefficients. Further, p values of $< .01$ are seen as significant (Akoglu, 2018). The reliability

of the conscientiousness scale was assessed using Cronbach's alpha. Here, a score of $\alpha > .7$ is defined to be acceptable (Tavakol & Dennick, 2011).

For the descriptive statistical analysis and hypotheses testing, linear mixed models (LMMs) were used. LMMs are able to deal with nested data, repeated measures and missing values (West, 2009). The day variable was used as a repeated measurement and the number for each participant was selected as the subject for this analysis. The repeated covariance type was AR(1).

Further, the estimated marginal means (EMM) of sedentary time in total, mentally active sedentary time and pAP were calculated for each participant and plotted within a bar graph. Further, EMMs for sedentary time and pAP were calculated per day and plotted within a line graph.

For the hypothesis testing, LMMs were used. For the first research question sedentary time was used as the dependent variable and pAP was set as a fixed covariate. For the second hypotheses, active sedentary time was defined as the dependent variable and pAP as the fixed covariate. The third hypothesis concerned the moderation analysis of trait conscientiousness on the relationship between pAP and total sedentary time. Here, pAP, and trait conscientiousness were set as fixed covariates and total sedentary time as the dependent variable. Overall, a p-value of $<.05$ was indicated as significant.

3. Results

3.1 Reliability

Split-half reliability was determined using the spearman's rho coefficient. For the sedentary time items mostly a moderate to strong correlation was found. However, three items showed weak to moderate correlation coefficient values and were statistically insignificant. For the pAP item a significant, moderate correlation was found. A detailed overview can be found in Tables A1 and A2). For the conscientiousness trait scale items cronbach's alpha was computed. A Cronbach's $\alpha = .67$ was calculated, which can be interpreted as a questionable reliability score (Tavakol & Dennick, 2011).

3.2 Dataset Characteristics

During the data cleaning process 52 participants have been excluded from the original data set of 84 participants. The decision was made because 19 participants joined after the starting date and did not receive the informed consent and baseline questionnaire, further two participants did not fill out the informed consent, 20 participants had a response rate < 70%, five filled out that they had a physical condition that affects their sedentary time, and six respondents had total sedentary times per day >24h (1440 minutes). Consequently, the total number of participants in the final dataset was 32.

Table 2

Overview of all relevant Constructs

<i>Variable</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Sedentary time in minutes (hours)	540.15min (9h)	183.47 (3.06h)	105.00 (1.75h)	1155.00 (19.25h)
Active Sedentary Time in minutes (hours)	323.24min (5.39h)	174.70 (2.91h)	.00 min (0h)	1005.00min (16.75h)
Perceived academic pressure (scale 0-4)	1.38	1.11	0	4
Trait Conscientiousness (scale 0-4)	2.44	0.659	1	4

3.2.1 Sedentary time

Overall sedentary time did not vary significantly across participants $F(31, 22.90) = 1.48, p = .169$. The estimated mean for this construct equals 9h ($SD = 3.06$; see Table 2). The highest amount of sedentary time observed was reported from participant 1 with an amount of 19.25h on a day and an estimated marginal mean of 12.62h. In general 21 participants indicated sedentary times >9 h (see Figure 3). Further, it can be said that the proportion of active and passive sedentary time is unequal (see Appendix B). Mostly active sedentary times were reported.

3.2.2 Perceived academic pressure

Due to a high observed variance for the pAP variable ($M = 1.38, SD = 1.11$) a closer look was taken at individual EMMs for each participant. PAP was experienced significantly different across participants $F(31, 24.13) = 3.70, p = .001$, while some seemed to experience no pAP at all over the course of this study like participant 13, others reported scores of three almost every day like participant 22. Further, the sample mean of 1.38 can be considered as rather low compared to what was possible on the five-point Likert scale (from 0 to 4). Further information can be found in Table 2.

Interestingly, a marginal decrease in pAP on the weekend and especially on Sunday can be observed, while a considerable increase on Monday and Tuesday, right after the weekend can be seen. Still, pAP does seem to be experienced by students on the weekend, even though this is expected to be free time. Sedentary time and pAP followed basically the same slope over time. Both concepts showed a decrease until the weekend and an increase from Monday on (see Figure 4).

3.2.3 Conscientiousness

The mean conscientiousness score of 2.44 can be identified as high compared to the values on the five-point-Likert scale (0-4). More information can be found in Table 2.

Figure 3

EMMs of Sedentary time and perceived academic pressure (pAP) over participants

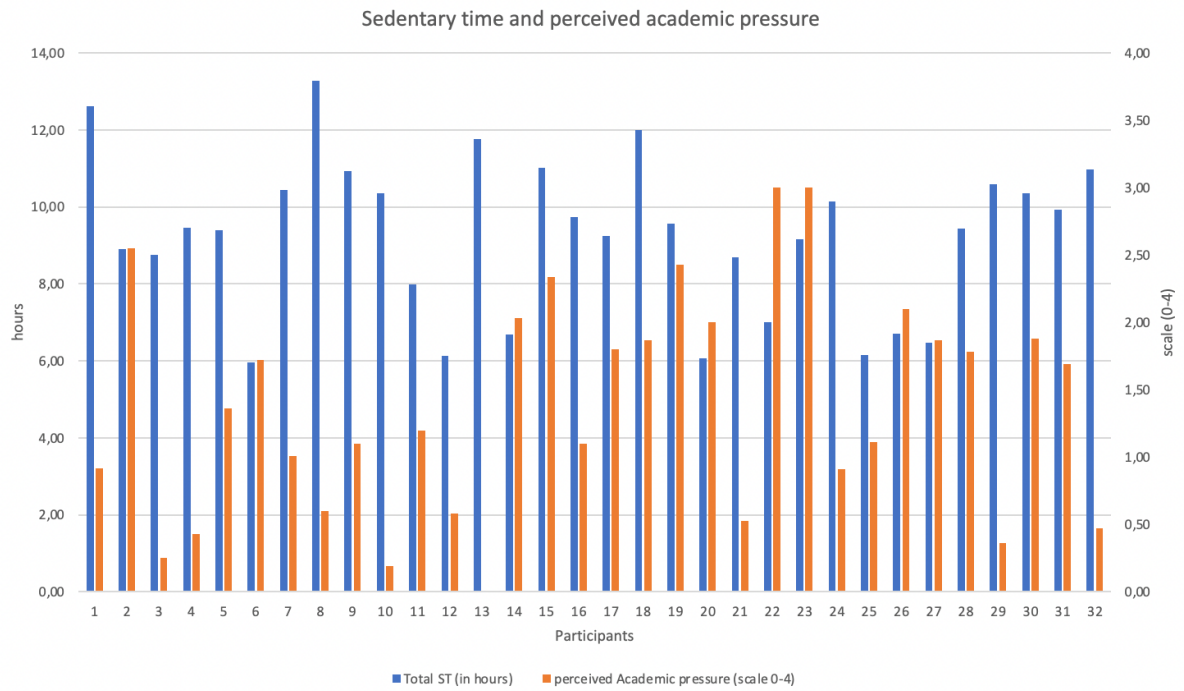
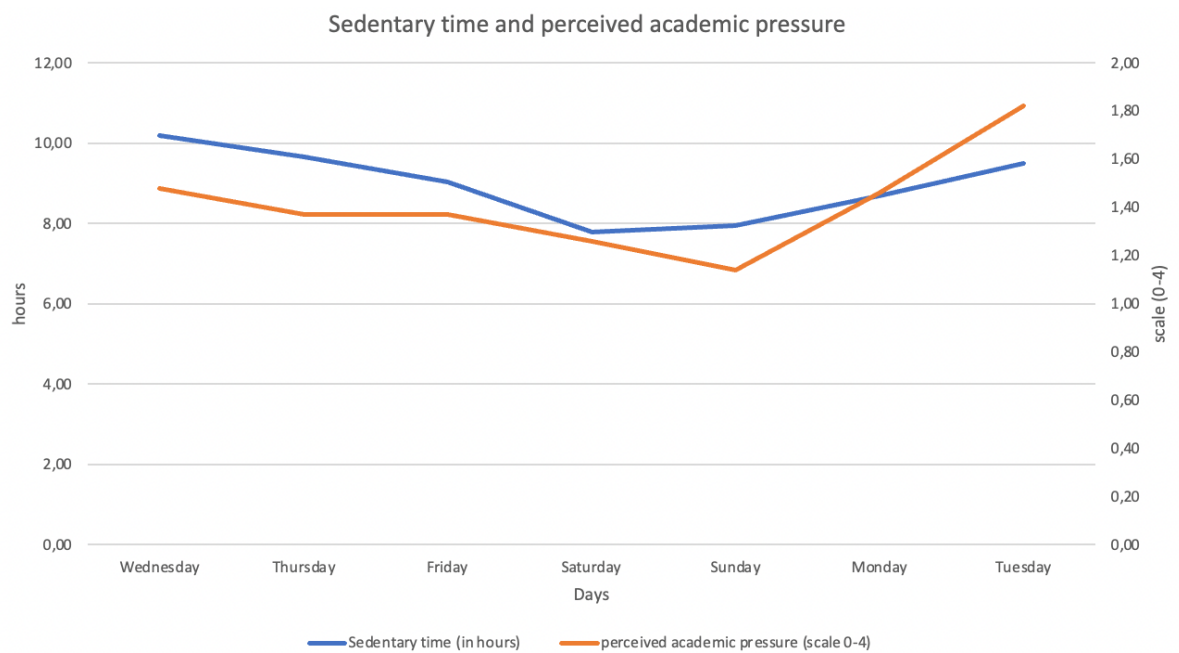


Figure 4

EMMs of Sedentary time and perceived academic pressure (pAP) over time



3.3 Hypothesis testing

3.3.1 Relationship between perceived academic pressure and total sedentary time (RQ 1)

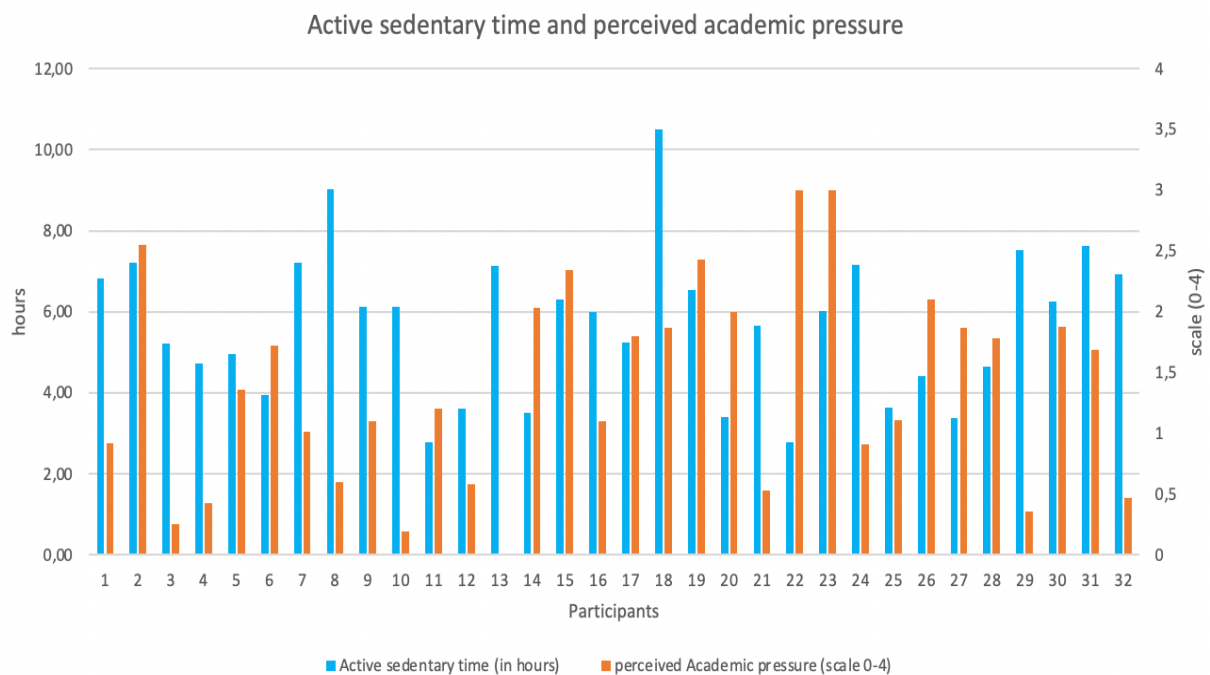
EMMs were calculated for total sedentary time and pAP for each participant over time and plotted together (Figure 3 & 4). From Figure 3 it can already be assumed that a student's sedentary time does not depend on pAP. While some students experience high amounts of sedentary time along with low amounts of pAP, like participant 13, others experience low amounts of sedentary time along with rather low amounts of pAP like participant 12 (Figure 3).

As expected, after the analysis of the EMMs of pAP and sedentary time, the estimated relationship between both concepts was statistically insignificant ($F(1,187.64) = 0.09, p = .76$). All statistics can be found in Table 3.

3.3.2 Relationship between perceived academic pressure and active sedentary time (RQ 2)

Figure 5

EMMs of active sedentary time and perceived academic pressure (pAP) over participants



In order to analyse the relationship of active sedentary time in relation to pAP, EMMs were computed. Figure 5 shows active sedentary time along with pAP for every participant. Again great variations between participants can be observed. Hence, active sedentary time does not seem to be influenced by pAP. The analyses by LMMs supported this. The relationships between pAP and active ST ($F(1,173.75) = 0.45, p = .50$) proved to be statistically insignificant (Table 3).

3.3.4 Moderating effect of trait conscientiousness (RQ 3)

The third hypothesis focuses on the moderation effect of trait conscientiousness on the relationship between total sedentary time and pAP. This moderation analysis showed insignificant results: $F(1,181.86) = .01, p = .93$. (Table 3).

3.4 Individual observations

Because scores in general varied a lot between participants, a closer look was taken at individual scores of participants. An example participant would be participant 23. This person reported very high scores of pAP along with relatively high scores of sedentary time. Interesting about this person is that a high amount of sedentary time spent on studying activities. Further, this person had a conscientiousness score of three, which is above average. This person might have spent a lot of time studying because of the high amounts pAP that was experienced. And, it might also be the case that the relatively high score of conscientiousness influenced this behaviour positively.

This example can be compared to participant 22. Although this person experienced a high amount of pAP, an engagement in active sedentary activities is relatively low. Especially scores of studying sedentary activities were really low. This relationship could have also been influenced by the low conscientiousness score of one.

Table 3*Hypothesis tests results*

Parameter	Estimate	Std. Error	df	F	<i>p</i>	95% CI	
						LB	UB
Total sedentary time							
Intercept	556.95	25.97	85.34	459.93	.000	505.31	608.58
Academic pressure	-3.70	12.16	187.64	.09	.761	-27.69	20.29
Active sedentary time							
Intercept	345.24	23.59	84.63	214.19	.000	298.33	392.14
Academic pressure	-7.93	11.82	173.75	.45	.503	-31.26	15.39
Moderation effect of trait conscientiousness							
Intercept	524.50	117.03	100.65	20.09	.000	292.33	756.68
Academic pressure	-8.01	52.28	182.07	.02	.878	-111.17	95.15
Conscientiousness	13.05	45.93	100.10	.08	.777	-78.07	104.16
Academic pressure* Conscientiousness	1.91	20.63	181.86	.01	.926	-38.80	42.62

Note: N = 32; dependent variable: sedentary time; *p*-value = .05

Legend: CI = Confidence Interval; LB = Lower Bound; UB = Upper Bound

4. Discussion

4.1 Findings

The aim of this study was to explore the relationship between academic pressure and sedentary time. Although based on previous findings a relationship between the two concepts can be expected, no significant influence of pAP on sedentary time was found in the current study. Further, pAP does not seem to influence mentally active sedentary time. Moreover, the moderation analysis of trait conscientiousness on academic pressure and sedentary time proved to be insignificant.

4.2 Evaluating the first research question: Relationship between perceived academic pressure and total sedentary time

Against expectations, results of the current study suggest that pAP does not significantly influence sedentary time in university students. The literature which led to this research questions indicated that sedentary time is a moderating factor within the relationship between determinants and sedentary behaviour (Deliens et al., 2015). The difference that pAP was analysed as a moderating factor, and not as an independent variable, might have led to the observed differences in results. A different paper suggested that workload in office workers leads to increases in sedentary time (Parry & Straker, 2013). Although workload in office workers is seen as a comparable construct to pAP they are not identical variables (Aihie & Ohanaka, 2019). The differences between the two constructs might explain why an influence on sedentary time was found for workload but not for pAP. Furthermore, the research question was based on the fact that stress is already known to influence sedentary time (Ashdown-Franks et al., 2018), and that stress is seen as a result of high amounts of pAP (Deb et al., 2015). However, in the current study mostly low amounts of pAP were observed. Consequently, stress as a result of pAP might not have been experienced by participants in this study. Therefore, pAP was not found to influence sedentary time.

Next the ESM study design was different in the present study compared to study designs of papers that have been used as a basis. Observed differences in results might have been due to advantages of the ESM design choice (Myin-Germeys et al., 2018).

4.3 Evaluating the second research question: Relationship between perceived academic pressure and active sedentary time

The relationship between pAP and mentally active sedentary time proved to be insignificant in the current study. Literature suggests that longer active sedentary times are a result of high amounts of pAP, since it is expected that students spend more time studying when university tasks are demanding (Moulin, 2016). Then, however, not all mentally active sedentary items measured studying activities in the current study. In fact, only one out of eight items concerned studying activities. It could therefore be that an association between pAP and mentally active sedentary time in general does not exist, but only an association between pAP and studying activities.

An additional possible explanation could be that student's reactions to pAP are more unique. Sedentary behaviour can be one possible reaction to pAP but does not seem to be the only one. In fact, it has been found that some students tend to increase physical activity to cope with pAP (Cruz et al., 2013). Therefore, although some students have increased sedentary times this does not seem to be generalizable for all students.

4.4 Evaluating the third research question: Moderation effect of conscientiousness on the relationship between perceived academic pressure and sedentary time

For the moderation analysis of conscientiousness on pAP and sedentary time no significant relationship was found. An explanation for this finding could be the fact that also no significant relationship between pAP and sedentary time was found. Hence, there was no significant relationship that could have been moderated. The most relevant paper for the assumption that conscientiousness might influence pAP and sedentary time stated that there is a relationship between trait conscientiousness and a persons' ability to manage stress (Bartley & Roesch, 2011). However, pAP was rather low in the current study. Consequently, perceived stress reactions of students may have been low as well. Therefore, the ability to measure the influence of trait conscientiousness might have been limited within the observed sample. Last, other constructs as moderators in this analysis might be more insightful. These moderating factors can be physical activity, obesity, and gender (Castro et al., 2018).

4.5 Limitations and Strengths

Several limitations and strengths of this study have been identified. One possible limitation of this study may be the sedentary time items. The items were not mutually exclusive. It is therefore possible that two sedentary behaviours were reported at the same time. For example, a participant can sit in a train while reading a book and report this sedentary time at the reading item as well as the travelling item. This makes the total sedentary times per person that were computed during the statistical analysis rather unreliable. Additionally, it could explain why some participants had very high sedentary time scores.

Also, EMMs of pAP have been lower than expected in the current study. At the University of Amsterdam pAP scores between 6.6 and 8.0 on a scale from 1-10 have been found (University of Amsterdam, 2021). However, the mean for pAP in the current study was only 1.38 on a scale from 0-4. Low pAP scores limit the insights in effects on sedentary time of the construct, because the crucial concept stress is only known to be triggered through high amounts of pAP (Deb et al., 2015).

Furthermore, socially desirable response biases can be a big issue in research with self-reporting measuring techniques. Especially, if critical items are involved which participants feel uncomfortable with (Van de Mortel, 2008). Hence, participants might lie to fulfil a preferred self-concept. This might have been the case for the conscientiousness items in the baseline questionnaire because the trait is known to be desirable among university students (Javaras et al., 2019). Further, sedentary time might be difficult to recognize and report accurately for some people.

A strength of this study was the fact that the descriptive statistics showed expected values for university students. The mean sedentary time of 9h every day matches the amount that was found in literature (Castro et al., 2020). Additionally, pAP was logically distributed over time. Decreased scores on Saturday and Sunday have been found, which was expected in previous literature (Ragsdale et al., 2011). Also mean conscientiousness was high in the present study. This finding is in line with the fact that trait conscientiousness is prevalent among university students (MacCann et al., 2009). Hence, it can be concluded that the general sample adequately described the group of interest.

Further, analysing the concept within an ESM study can be very insightful and has some major advantages compared to cross-sectional designs. Within ESM studies the concept of pAP and sedentary time can be analysed simultaneously and consequently compared easily (Myin-Germeys et al., 2018). Further, repeating similar surveys over a certain period makes results comparable over time and variations within days can be recognized better. Hence, a very

detailed understanding of a concept over time can be established. An advantage of ESM is the fact that recall biases are decreased (Myin-Germeys et al., 2018). The longer time periods of ESM studies are expected to give a more accurate understanding of the analysed concepts (Myin-Germeys et al., 2018). Papers that served as a basis for research questions of the current study used mainly cross-sectional study designs and might therefore show slightly different results compared to ESM studies.

The association between academic pressure and sedentary time has not been deeply explored before. Research only investigated comparable constructs. For example, was a correlation between physical activity and sedentary time in university students explored (Bhuiyan et al., 2020). But a direct association between pAP and sedentary time was not analysed. Therefore, the report adds to existing literature within this topic and might further increase the understanding of sedentary time in university students.

4.6 Recommendations for further research

Although no association between the analysed concepts in this study was found, further research within the broader context of sedentary behaviour of university students is recommended. Literature showed a connection between studying behaviours and sedentary times in university students (Moulin, 2016). Therefore, pAP in relation to studying behaviours is advised as a topic for further research. Next different moderating factors might be more accurate for the sample of university students. Physical activity, obesity and gender are advised as moderators for future studies (Castro et al., 2018). In addition, research at other times of a year are expected to give more insight. Especially because students in the current study did not experience high amounts of pAP in November. Weeks of interest for further research could be in March or December because peaks of academic pressure can be observed in these months. Often, exams are written at universities in these times of the year (University of Amsterdam, 2021).

4.7 Conclusion

No interaction between academic pressure and total sedentary time nor mentally active sedentary time was found in this study. Accordingly, the moderation analysis of trait conscientiousness turned out to be insignificant as well. Regarding the urge to decrease the high amount of sedentary time currently observed in university students, further research is recommended. Within the current study, concepts might have been wrong or too broadly defined. Therefore, a more detailed analysis is expected to be insightful. From this study it can be concluded that specifically sedentary activities in form of studying may be a crucial concept for further analysis.

References

- Aihie, O. N., & Ohanaka, B. I. (2019). Perceived academic stress among undergraduate students in a Nigerian University. *Journal of Educational and Social Research*, 9(2), 56-56.
- Akoglu, H. (2018). User's guide to correlation coefficients. *Turkish journal of emergency medicine*, 18(3), 91-93. <https://doi.org/10.1016/j.tjem.2018.08.001>
- Allen, M. S., Walter, E. E., & McDermott, M. S. (2017). Personality and sedentary behavior: A systematic review and meta-analysis. *Health Psychology*, 36(3), 255. <https://doi.org/10.1037/hea0000429>
- Antonovsky, A. (1987). The salutogenic perspective: Toward a new view of health and illness. *Advances*.
- Ashdown-Franks, G., Koyanagi, A., Vancampfort, D., Smith, L., Firth, J., Schuch, F., ... & Stubbs, B. (2018). Sedentary behavior and perceived stress among adults aged ≥ 50 years in six low-and middle-income countries. *Maturitas*, 116, 100-107. <https://doi.org/10.1016/j.maturitas.2018.08.005>
- Avison, W., & Gotlib, I. H. (Eds.). (1994). *Stress and mental health: Contemporary issues and prospects for the future*. Springer Science & Business Media.
- Bartley, C. E., & Roesch, S. C. (2011). Coping with daily stress: The role of conscientiousness. *Personality and individual differences*, 50(1), 79-83. <https://doi.org/10.1016/j.paid.2010.08.027>
- Becker, C. M., Glascoff, M. A., & Felts, W. M. (2010). Salutogenesis 30 Years Later: Where Do We Go from here?. *International Electronic Journal of Health Education*, 13, 25-32.
- Bhuiyan, N., Kang, J. H., Papalia, Z., Bopp, C. M., Bopp, M., & Mama, S. K. (2020). Assessing the stress-buffering effects of social support for exercise on physical activity, sitting time, and blood lipid profiles. *Journal of American College Health*, 1-7. <https://doi.org/10.1080/07448481.2020.1810055>
- Bolger, N., & Laurenceau, J. P. (2013). *Intensive longitudinal methods: An introduction to diary and experience sampling research*. Guilford Press.
- Castro, O., Bennie, J., Vergeer, I., Bosselut, G., & Biddle, S. J. (2018). Correlates of sedentary behaviour in university students: A systematic review. *Preventive medicine*, 116, 194-202. <https://doi.org/10.1016/j.ypmed.2018.09.016>
- Castro, O., Bennie, J., Vergeer, I., Bosselut, G., & Biddle, S. J. (2020). How sedentary are

- university students? A systematic review and meta-analysis. *Prevention Science*, 21(3), 332-343. <https://doi.org/10.1007/s11121-020-01093-8>
- Carbonell, X., Chamarro, A., Oberst, U., Rodrigo, B., & Prades, M. (2018). Problematic use of the internet and smartphones in university students: 2006–2017. *International journal of environmental research and public health*, 15(3), 475. <https://doi.org/10.3390/ijerph15030475>
- Clark, B. K., Pavey, T. G., Lim, R. F., Gomersall, S. R., & Brown, W. J. (2016). Past-day recall of sedentary time: validity of a self-reported measure of sedentary time in a university population. *Journal of science and medicine in sport*, 19(3), 237-241. <https://doi.org/10.1016/j.jsams.2015.02.001>
- Cruz, S. Y., Fabián, C., Pagán, I., Ríos, J. L., González, A. M., Betancourt, J., ... & Palacios, C. (2013). Physical activity and its associations with sociodemographic characteristics, dietary patterns, and perceived academic stress in students attending college in Puerto Rico. *Puerto Rico health sciences journal*, 32(1).
- Deb, S., Strodl, E., & Sun, H. (2015). Academic stress, parental pressure, anxiety and mental health among Indian high school students. *International Journal of Psychology and Behavioral Science*, 5(1), 26-34. 10.5923/j.ijpbs.20150501.04
- Deliens, T., Deforche, B., De Bourdeaudhuij, I., & Clarys, P. (2015). Determinants of physical activity and sedentary behaviour in university students: a qualitative study using focus group discussions. *BMC public health*, 15(1), 1-9.
- Fowler, G., Cope, C., Michalski, D., Christidis, P., Lin, L., & Conroy, J. (2018, December). Women outnumber men in psychology graduate programs. *Monitor on Psychology*, 49(11). <http://www.apa.org/monitor/2018/12/datapoint>
- Gardner, B., Smith, L., Lorencatto, F., Hamer, M., & Biddle, S. J. (2016). How to reduce sitting time? A review of behaviour change strategies used in sedentary behaviour reduction interventions among adults. *Health psychology review*, 10(1), 89-112. <https://doi.org/10.1080/17437199.2015.1082146>
- Gerlitz, J. Y., & Schupp, J. (2005). Zur Erhebung der Big-Five-basierten persönlichkeitsmerkmale im SOEP. *DIW Research Notes*, 4, 2005.
- GESIS (2021, november 9). Open Access Repository für Messinstrumente: Big Five Inventory-SOEP. (BFI-S) [https://zis.gesis.org/skala/Schupp-Gerlitz-Big-Five-Inventory-SOEP-\(BFI-S\)](https://zis.gesis.org/skala/Schupp-Gerlitz-Big-Five-Inventory-SOEP-(BFI-S))
- Hallgren, M., Dunstan, D. W., & Owen, N. (2020). Passive versus mentally active sedentary

- behaviors and depression. *Exercise and sport sciences reviews*, 48(1), 20-27.
10.1249/JES.0000000000000211
- Hamer, M., & Stamatakis, E. (2014). Prospective study of sedentary behavior, risk of depression, and cognitive impairment. *Medicine and science in sports and exercise*, 46(4), 718. 10.1249/MSS.0000000000000156
- Javaras, K. N., Williams, M., & Baskin-Sommers, A. R. (2019). Psychological interventions potentially useful for increasing conscientiousness. *Personality Disorders: Theory, Research, and Treatment*, 10(1), 13. <https://doi.org/10.1037/per0000267>
- Jetté, M., Sidney, K., & Blümchen, G. (1990). Metabolic equivalents (METs) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clinical cardiology*, 13(8), 555-565. <https://doi.org/10.1002/clc.4960130809>
- Katzmarzyk, P. T. (2010). Physical activity, sedentary behavior, and health: paradigm paralysis or paradigm shift?. *Diabetes*, 59(11), 2717-2725.
<https://doi.org/10.2337/db10-0822>
- Khan, M. J., Altaf, S., & Kausar, H. (2013). Effect of Perceived Academic Stress on Students' Performance. *FWU Journal of Social Sciences*, 7(2).
- Kumaraswamy, N. (2013). Academic stress, anxiety and depression among college students: A brief review. *International review of social sciences and humanities*, 5(1), 135-143.
- Lal, K. (2014). Academic stress among adolescent in relation to intelligence and demographic factors. *American International Journal of Research in Humanities, Arts and Social Sciences*, 5(1), 123-129.
- López-Valenciano, A., Mayo, X., Liguori, G., Copeland, R. J., Lamb, M., & Jimenez, A. (2020). Changes in sedentary behaviour in European Union adults between 2002 and 2017. *BMC Public Health*, 20(1), 1-10. <https://doi.org/10.1186/s12889-020-09293-1>
- MacCann, C., Duckworth, A. L., & Roberts, R. D. (2009). Empirical identification of the major facets of conscientiousness. *Learning and Individual Differences*, 19(4), 451-458. <https://doi.org/10.1016/j.lindif.2009.03.007>
- Moulin, M. S. (2016). An Assessment of Sedentary Time Among Undergraduate Students at an Urban Canadian University. <http://ir.lib.uwo.ca/etd/3568>
- Myin-Germeys, I., Kasanova, Z., Vaessen, T., Vachon, H., Kirtley, O., Viechtbauer, W., & Reininghaus, U. (2018). Experience sampling methodology in mental health research: new insights and technical developments. *World Psychiatry*, 17(2), 123-132.
- Owen, N., Healy, G. N., Matthews, C. E., & Dunstan, D. W. (2010). Too much sitting: the

- population-health science of sedentary behavior. *Exercise and sport sciences reviews*, 38(3), 105. 10.1097/JES.0b013e3181e373a2
- Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults' sedentary behavior: determinants and interventions. *American journal of preventive medicine*, 41(2), 189-196. <https://doi.org/10.1016/j.amepre.2011.05.013>
- Parry, S., & Straker, L. (2013). The contribution of office work to sedentary behaviour associated risk. *BMC public health*, 13(1), 1-10. <https://doi.org/10.1186/1471-2458-13-296>
- Ragsdale, J. M., Beehr, T. A., Grebner, S., & Han, K. (2011). An integrated model of weekday stress and weekend recovery of students. *International Journal of Stress Management*, 18(2), 153. <https://doi.org/10.1037/a0023190>
- Reddy, K. J., Menon, K. R., & Thattil, A. (2018). Academic stress and its sources among university students. *Biomedical and Pharmacology Journal*, 11(1), 531-537. <https://dx.doi.org/10.13005/bpj/1404>
- Resolving Vilification (2021, October 10). A scale for assessing academic stress - Laekev Academic Stress Response Scale (LASRS). *resolvingvilification*. [https://www.resolvingvilification.com/blog/4591988729/A-Scale-for-Assessing-Academic-Stress---Lakaev-Academic-Stress-Response-Scale-\(LASRS\)/10650702](https://www.resolvingvilification.com/blog/4591988729/A-Scale-for-Assessing-Academic-Stress---Lakaev-Academic-Stress-Response-Scale-(LASRS)/10650702)
- Rezende, L. F. M. D., Rodrigues Lopes, M., Rey-López, J. P., Matsudo, V. K. R., & Luiz, O. D. C. (2014). Sedentary behavior and health outcomes: an overview of systematic reviews. *PloS one*, 9(8), E105620. <https://doi.org/10.1371/journal.pone.0105620>
- Roberts, B. W., Jackson, J. J., Fayard, J. V., Edmonds, G., & Meints, J. (2009). Conscientiousness. In M. R. Leary & R. H. Hoyle (Eds.), *Handbook of individual differences in social behavior* (pp. 369–381). The Guilford Press.
- Silver, M. (1974). Procrastination. *Centerpoint*.
- Selye, H. (1956). What is stress. *Metabolism*, 5(5), 525-530.
- Speakman, J. R. (2020). An evolutionary perspective on sedentary behavior. *BioEssays*, 42(1). <https://doi.org/10.1002/bies.201900156>
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, 2, 53. 10.5116/ijme.4dfb.8dfd
- Tremblay, M. S., Aubert, S., Barnes, J. D., Saunders, T. J., Carson, V., Latimer-Cheung, A. E., ... & Chinapaw, M. J. (2017). Sedentary behavior research network

- (SBRN)–terminology consensus project process and outcome. *International journal of behavioral nutrition and physical activity*, 14(1), 1-17.
<https://doi.org/10.1186/s12966-017-0525-8>
- University of Amsterdam (2021, March 30) *UvA Crisis Monitoring update: Lots of Stress and high study/work pressure among students and staff*. UvA.
<https://www.uva.nl/en/content/news/news/2021/03/uva-crisis-monitor-update-lots-of-stress-and-high-study-work-pressure-among-students-and-staff.html>
- Van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The experience sampling method on mobile devices. *ACM Computing Surveys (CSUR)*, 50(6), 1-40.
<https://doi.org/10.1145/3123988>
- Van de Mortel, T. F. (2008). Faking it: social desirability response bias in self-report research. *Australian Journal of Advanced Nursing, The*, 25(4), 40-48.
- Van Wyk, L. (2006). *The relationship between procrastination and stress in the life of the high school teacher* (Doctoral dissertation, University of Pretoria).
<http://hdl.handle.net/2263/29333>
- West, B. T. (2009). Analyzing longitudinal data with the linear mixed models procedure in SPSS. *Evaluation & the health professions*, 32(3), 207-228. <https://doi.org/10.1177/0163278709338554>
- World Health Organization. (1995). Constitution of the world health organization.
- Wunsch, K., Kasten, N., & Fuchs, R. (2017). The effect of physical activity on sleep quality, well-being, and affect in academic stress periods. *Nature and science of sleep*, 9, 117. 10.2147/NSS.S132078
- Zhong, J., & Chu, Y. D. (2013). Preliminary Study on the Relationship between Procrastination and Physical Activity of College Students. *Journal of Beijing Sport University*, 20(8), 21-22.

Appendices

Appendix A

Table A1

Spearman's rho coefficients: Sedentary time items

Item	Correlation coefficient	Sig.
ST_studying	.718	<.001
ST_working	.718	<.001
ST_driving_active	.653	.001
ST_driving_passive	.452	.030
ST_TV	.563	.005
ST_videogames	.591	.003
ST_pc_active	.540	.008
ST_reading	.707	<.001
ST_eating	.263	.225
ST_socializing	.797	<.001
ST_creative	.846	<.001
ST_other	.505	.014

Note: N = 25

Table A2

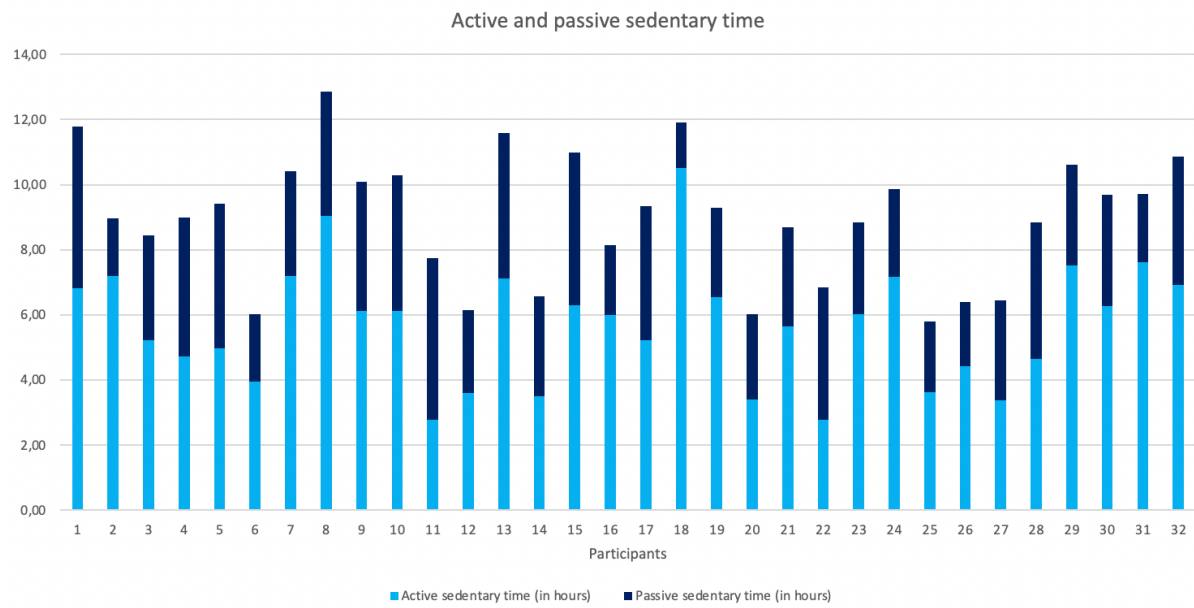
Spearman's rho coefficients: academic pressure item

Item	Correlation coefficient	Sig.
Academic pressure	.549	.008

Note: N = 24

Appendix B

Figure active and passive sedentary time



Appendix C

Survey C1

Informed consent

Thank you for participating in our study on sitting behaviour! Please read the following information thoroughly.

The goal of this research is to explore the relationship between sitting behaviour and mental health-related constructs. With your participation in this research, you will help us contribute to the scientific knowledge of sitting behaviour and its relationship to mental health.

You are eligible to participate in this study if you are at least 18 years old, proficient in English, and enrolled at a university or university of applied sciences.

The study will be conducted over a period of nine days. At the start of the study, you will be asked to fill out a baseline questionnaire with questions about demographics and personality traits. This questionnaire will take about ten minutes to fill out. After that, you will receive three short questionnaires daily via the Ethica App. Please make sure that the notifications on your device for Ethica are turned on.

Participation in this study is not expected to pose any risks. One possible consequence is an increased awareness of your daily mood, behaviour, academic pressure, and feelings. For this reason, please consider your participation in this study carefully if you are sensitive to these topics. This might be especially relevant for you if you are diagnosed with or suspected to have a mood and/or anxiety disorder.

Your participation in this study is entirely voluntary. If you wish to withdraw from this research, you can do so at any time without giving a reason. All your answers will be treated confidentially. That is, all personal data will be anonymized and will not be published and/or given to a third party. Hence, the data will be used for this study only. The study has been approved by the Ethics Committee of the University of Twente. If you have any questions or concerns before, during or after your participation, do not hesitate to contact the researchers:

Josie Vorhauer (j.vorhauer@student.utwente.nl)

Lina Skupin (l.a.skupin@student.utwente.nl)

Helena Zablotny (h.k.zablotny@student.utwente.nl)

Lina Rath (l.rath@student.utwente.nl)

(Supervisor) Gerko Schaap (g.schaap@utwente.nl)

I hereby declare that I have fully read and understand the text above and I am willing to participate in this study. By ticking 'Yes', I actively consent to participate in this study and the processing of my data.

Survey C2

Baseline questionnaire

- How old are you?

- Which gender do you identify with?
 - female
 - male
 - other

- What is your nationality?
 - dutch
 - german
 - other EU nationality
 - other non-EU nationality

- Which study program are you enrolled in?

- I see myself as someone who tends to be disorganized (-)

- I see myself as someone who tends to be lazy (-)

- I see myself as someone who does a thorough job (+)

- I see myself as someone who does everything efficiently (+)

- I see myself as someone who perseveres until the task is finished (+)

Survey C3

Morning survey

Sitting for study

ST 1. **How long** were you **sitting** while studying yesterday? (include the time at university, during lectures, tutorials, meetings, group discussions, self-study, study from home, etc.)

Sitting for work

ST 2. **How long** were you **sitting** at your workplace or working from home in a paid position yesterday? (Examples: babysitting, sitting at the reception, minding a stall/shop, data entry/administrative paper work, tutoring, etc.)

Sitting for Transport

ST 3a. Thinking again of yesterday, please estimate the **total** time that you spent **sitting** to travel from one place to another **driving yourself**. Please **include sitting and waiting** for transport. Do **not** include any time you were standing up while travelling or waiting.

ST 3b. Thinking again of yesterday, please estimate the **total** time that you spent **sitting** to travel from one place to another **not driving yourself/ using public transportation**. Please **include sitting and waiting** for transport. Do **not** include any time you were standing up while travelling or waiting.

Television Viewing

ST 4a. Please estimate the **total time** you spent sitting or lying down to watch TV or DVDs? This includes if you watch TV in bed. This does not include Video-on-Demand watching.

ST 4b. Please estimate the total you spent sitting or lying down to play games on the TV, such as PlayStation/Xbox yesterday? This includes if you watch TV in bed.

Computer, internet, and electronic games

ST 5a. Please estimate the total time yesterday that you spent sitting or lying down and using the computer actively. (For example, include time spent playing games, reading, online shopping on your smartphone/tablet/computer).

ST 5b. Please estimate the total time yesterday that you spent sitting or lying down and using the computer passively. (For example, including time spent watching Video On Demand (e.g. YouTube, Netflix, scrolling through social media)

Sitting for reading

ST 6. Please estimate the total time yesterday that you spent sitting or lying down while reading **during your leisure time**. Include reading in bed but do not include time spent reading for paid work or for study.

Sitting for eating

S7. Please estimate the total time yesterday that you spent sitting down for eating and drinking, including meals and snack breaks.

Sitting for socializing

ST8. Please estimate the total time yesterday that you spent sitting down to socialize with friends or family, regardless of location (at university, at home or in a public place). Include time spent on the **phone (e.g. calling, chatting, texting etc.)**

Sitting/lying for other purposes

ST 9. We are interested in any other sitting or lying down that you may have done that you have not already told us. For example this could include; hobbies such as doing art and craft, playing board games; listening to music or for religious purposes. **Please name only one main activity.**

ST 10. Again thinking of yesterday, please estimate the **total time** that you spent sitting or lying down **NOT** including time that you have told us about in the previous answers.

Academic pressure item:

- I am feeling overwhelmed by the demands of study
 - Not at all
 - slightly
 - moderately
 - much
 - very much