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Bachelor's thesis in Psychology
Supervisor: Wei Wang
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Kunnskap for en bedre verden

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Preface

This thesis marks the ending of my three-years bachelor program in psychology at NTNU Trondheim. The aim of this thesis was to get a greater understanding for the relationship between mood and dreaming, and how this relationship can differ between men and women. The research question investigated if there was a gender difference in mood, and if low mood were associated with a greater prevalence of nightmares and bad dreams. The process of writing this bachelor has been very educational, and I have gained greater understanding of both the field of dreaming and the foundation of research processes in general. I´m thankful for getting the opportunity to contribute to a field that still lack knowledge and research. I would like to thank my supervisors Wei Wang and Torhild Anita Sørengaard for the guidance during this project. Torhild Anita Sørengaard in particular has been very helpful, engaged and always up for a good discussion, as well as caring for the whole group throughout this project. She has been an excellent motivator, which has been important during a period of uncertainty and confusion. I also want to thank my research assistants Tiffany Lussier and Eline Eyde Lüder-Larsen for their guidance and help throughout this project, and especially for all the work that has been done for getting this project possible to fulfill. The data collection for this project has been done together with my bachelor group, and we have collaborated throughout the semester and supported each other by giving feedback, good inputs and encouragement. Therefore, I will also thank my bachelor group for the good collaboration and support.

Abstract

This study investigates the associations between mood, gender and the prevalence of nightmares and bad dreams. Several types of research have displayed some connections between emotions and nightmares, but there is still not a robust and unilateral agreement on this connection. Since previous literature has not given a homogeneous framework regarding the link between dreaming and emotional processes, and there are many unanswered questions within the field of dreaming, it is important to apply some more research and obtain robust data to the field. Eighty-seven participants filled out an online dream diary questionnaire for a four-week period with information about their demographical variables, experienced dreaming and mood during this period. The result showed a significant negative correlation between mood before bedtime and total nightmares and bad dreams. The hierarchal regression analysis showed that age, gender and mood before bedtime could explain 22% of the variance in total nightmares and bad dreams, with mood before bedtime as the only significant predictor. There were no significant gender differences in the mood before bedtime and the total nightmares and bad dreams. The results demonstrate that more longitudinal research is needed on this area, with a substantially larger sample size to strengthen the results and contribute to a greater amount of data within the area of dreaming. Through enhanced knowledge within the domain, one can contribute to more homogeneous theories, and for people to gain more knowledge about a big part of their life and what it might mean for their psychological state.

Keywords: dreams, nightmares, bad dreams, mood, continuity hypothesis, emotion-dream interaction, gender differences

We spend a considerable part of our life sleeping, and most people actually dream every night (Sikka, 2020). Dreaming is a well-known phenomenon for the human species in general, but our understanding of dreams remains incomplete. Our lacking knowledge on dreaming indicates that we know too little about a topic that is a big part of our life as humans. There has been insufficient research on dreaming regarding its appearance, both its consciousness and unconsciousness. There is quite a lot of important, but yet undone research remaining on this topic. Nevertheless, it is an increasing field with growing empirical literature, but several research findings on dreams are inconsistent and even contain contradicting results.

Dreaming is a broad term and has been defined in several ways. As to dreams many interpretations, there is a prevailing consensus about dreaming as a subjective experience where we are able to create a new, "hallucinatory world" disconnected from external stimuli and the environment (Sikka, 2020). Some studies suggest that brain activity during sleep contributes to the consolidation of important information (Scarpelli et al., 2019; Schoch et al., 2019). Furthermore, other studies have found some kind of relationship between emotional state and dream affect, although it is unclear and somehow inconsistent findings (Barbeau et al., 2022; Conte et al., 2020; Gilchrist et al., 2007; Levin et al., 2011; Pesant & Zadra, 2006; Yu, 2007). Some even suggest that dreams can reflect our experiences in waking life (Conte et al., 2020). Whereas other studies, such as St-Onge et al. (2005), have not found any significant relationship between waking-life experience, like the subjective feeling of life satisfaction, and dreaming affect. This shows only some of the controversies within the dreaming field.

The fact that several research findings have found an emotion-dream interaction, suggests that dreams might have a relationship with the mood experienced the previous day before a subsequent dream. Therefore, this thesis will include a further study on how mood before bedtime might have an impact on dreams and perhaps why. The possible relationship will be studied through a digital self-report dreaming record questionnaire where the participants will report their dreaming activity for four weeks. The thesis will primarily focus on nightmares and bad dreams associations with low mood, and how this might differ in men and women.

Sleep and dreaming

We distinguish between two types of sleep – rapid eye movement sleep (REM-sleep), which dominates the late-night sleep, and non REM-sleep (NREM-sleep), which dominates the

early-night sleep (Malinowski & Horton, 2021; Scarpelli et al., 2019). NREM-sleep seems to be more implicated in episodic memory consolidation and be more reflective of our awakening experiences, whilst REM-sleep seems to be more involved in emotional consolidation (Malinowski & Horton, 2021). REM-sleep is found to be more related to emotional and bizarre dream content than NREM-sleep, which is more likely to picture episodic memories and therefore contains dream content that is more likely to resemble wakefulness (Malinowski & Horton, 2021). Dreams that occur in NREM are often more realistic and related to current concerns than REM-dreams, and this might be due to NREMs early-night sleep which is close to waking-life (Malinowski & Horton, 2021).

Compared to awakening and NREM-sleep, neuroimaging has shown increased brain activity during REM-sleep. This finding revealed that the brain-processes that regulate dreaming and emotional appearance in dreaming experiences share similar neural substrates with substrates that control emotions during awakening (Scarpelli et al., 2019). During REM-sleep, most of the regions involved in emotional memory and consolidation are highly activated, which may explain why some studies suggest that dreaming contributes to a consolidation process (Scarpelli et al., 2019; Schoch et al., 2019).

Dreams occur in different sleep phases, but REM-sleep is usually the phase in which we dream the most and the phase where we remember our dreams best. This may be due to the late-night phase of sleep, which is close to awakening (Malinowski & Horton, 2021). A study by Vandekerckhove and Wang (2018) indicates that dreaming during REM-sleep is processing our emotions experienced the previous day, which might point to a possible correlation between emotions and different types of dreams. This is further supported by findings indicating that the amygdala is highly activated during REM-sleep and dreaming during this phase, and especially since the amygdala is known to play an imperative role in emotion regulation (Scarpelli et al., 2019).

Nightmares

We can experience several types of dreams, both ordinary dreams, bad dreams, sexual dreams, and nightmares (Schredl et al., 2004). A nightmare can be defined as occurrences of dreams that are vivid and highly emotional, with experienced emotions such as fear, panic, and anger resulting in immediate awakening (Chen et al., 2014; Levin & Nielsen, 2009). Nightmares are rated significantly more intense than regular bad dreams, and often tend to emerge more frequently among young adults and women (Chen et al., 2014). What

distinguishes a nightmare from a general bad dream, is that a nightmare needs to contain enough negative emotions to awaken the sleeper to be defined as a nightmare. If not, the dream is defined as a regular bad dream (Zadra et al., 2006). Additionally, night terror distinguishes from both nightmares and bad dreams by occurring during NREM (Schredl & Reinhard, 2010), and is technically a sudden reaction of fear that occurs during the transition from one sleep stage to another, and is not exactly defined as dreaming (Boyden et al., 2018).

In a study of 1451 Chinese University Students, 923 reported having nightmares annually and 68 students were diagnosed with a nightmare disorder. The majority of the participants diagnosed with a nightmare disorder were women (Wang et al., 2021). Nightmare disorder patients often experience frequent episodes of dysphoric dreams (Shao et al., 2020). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), frequencies of nightmares are associated with a clinical ailment or weakening in social and other functional areas (SNL, 2020; Wang et al., 2021). Frequent nightmares are furthermore associated with impaired well-being in general and often come with a feeling of being anxious and depressive (Shao et al., 2020). When experiencing frequent nightmares, it is normal to experience a decrease in life satisfaction. Furthermore, it is stated that nightmare disorder patients score significantly higher on the Plutchik-van Praag Depression Inventory scale (PVP) compared to healthy people, which is a scale that measures depressive tendencies (Shao et al., 2020; Wang et al., 2021). This can add support to a possible theory indicating that emotions associated with depression and anxiety, such as decreased life-satisfaction and mood, can trigger nightmares and affect our brains to induce dreams with content that is similar to a nightmare.

Nightmares, emotional state and mood

Emotions can affect sleep in several ways, for instance, our dream content and sleep pattern, but the exact role of emotions in dreams remains unclear (Vandekerckhove & Wang, 2018). Emotions can be defined as a short and specific psychological and physiological response to a stimulus, with several primary and distinct feelings like anger, sadness and happiness. An emotional state refers to a temporary way of being, thinking and feeling. In contrast, a specific mood can last for several hours and even days (Larsen & Buss, 2017). The brain regions that control emotions during awakening share some similar neural substrates with processes that regulate the emotional salience in dreaming (Scarpelli et al., 2019). Important connections in emotion regulation processes, like the integrity of the prefrontal cortex-amygdala, are repaired

in healthy sleep which seems to be crucial for having a healthy emotionality and mental life (Conte et al., 2020; Vandekerckhove & Wang, 2018). A night of sound and healthy sleep is indicated to be necessary for the adaptive function of the amygdala, which plays an important role in emotion processing (Conte et al., 2020).

Previous research shows how important and crucial sleep and sleep quality are for both our mental and physical health (Conte et al., 2020). Therefore, it is reasonable to think that having frequent nightmares, which is defined as awakening during the night and perhaps can decrease our sleep quality, can affect our emotional state and further influence our psychological state. If nightmares have a mutual relationship with our emotion regulation the previous day, this can again affect our quality of sleep the same night, which can create a vicious cycle (Vandekerckhove & Wang, 2018).

Through different theories, it is assumed that there is a close relationship between emotions experienced in awakening and those during dreams (Conte et al., 2020). Lower levels of psychological well-being correlated with more negative emotions in dreams in a study by Pesant and Zadra (2006). Gilchrist et al. (2007) found positive correlations between the corresponding wake- and dream emotions. Additionally, having nightmares seem to be frequently associated with lower levels of psychological well-being the next day, however, it can be found contradictory results in which lower levels of mood predict a lower threshold for a nightmare to appear (Stocks et al., 2020). Several previous research state that nightmares actually are related to experiencing negative emotions the next day, and in general, this has been found more in women. However, it is important to mark that most studies are among students, and also that several studies investigate in clinical populations with some kind of mental issues (Wang et al., 2021).

Gender differences in nightmares

Gender seems to affect the frequency of dreams and dream content (Schredl et al., 2004). The prevalence of nightmares is shown to be higher in women than in men, and a majority of those diagnosed with a nightmare disorder are women (Chen et al., 2014; Wang et al., 2021). A study by Levin (1994) on 3433 college students found that women were about 50% more likely to report frequent nightmares (once a month or more), than men. This study collected the participants´ dreaming activity for over four years (Levin & Nielsen, 2007). A study by Schredl and Reinhard (2010) has further supported this by conducting a meta-analysis with 111 independent studies on gender differences in dreaming, demonstrating that women

reported having more nightmares than men. However, this gender difference was not found in children and older persons.

Nightmares lead to a deregulation of emotions in awakening, and this is especially shown in women (Chen et al., 2014). Women are also found to score significantly higher on negative emotions and meaning interpretation of dreams than men, and they often tend to seek out the meaning of a nightmare, trying to figure out why they had a nightmare and if the specific components of the dream are of matter (Chen et al., 2014). Also, among men and women who experienced nightmares, women showed more depressive and anxious emotions the day after.

Furthermore, the content of dreams seem to differ in gender and findings show that women more often dream about failing an examination and a person alive being dead, which in turn can be characterized as a nightmare. Schredl et al. (2004) explain this by pointing out how women often are more worried and thoughtful than men, thus causing similar thoughts and content to be more prominent in dreams as well. The differences in women´s and men´s dreaming can also be due to women's menstrual cycle, pregnancy and differences in both sex-role orientation and working roles (Dale et al., 2015). Biological differences in emotional brain processes might also cause these differences, making women more emotionally reactive. This can in turn explain why women have a higher prevalence of depression than men (Campbell et al., 2016; Nolen-Hoeksema et al., 1999; Schredl & Reinhard, 2010). All these various aspects that can affect men´s and women´s differences seem to be reflected in waking life and into dreaming. These various aspects seem to have an effect on dreaming and can contribute to gender differences both in content, recall and frequencies of dreams.

Theories within dreaming

Within the field of dreaming, different theories have been postulated. *The continuity hypothesis* (CH) promotes an explanation of a possible correlation between waking-life events and dreams, and is a supported hypothesis within the field (Barbeau et al., 2022). The theory provides evidence of continuity between waking life and dream content, and especially between waking negative experiences and subsequent dream content (Barbeau et al., 2022). The CH states that waking-life experiences and concerns are reflected in dreams (Pesant & Zadra, 2006). In a study by Dale et al. (2015) differences in dream content for women of different age span were examined, and the results lent support for the CH. As age increased, women´s dream content reflected better emotional regulation, smaller social networks and

less hostility (Dale et al., 2015), which is also the case in general for waking-life in aging. These findings are consistent with the CH and provide further support for the theory.

Another theory, somewhat similar to the continuity hypothesis, is the *Threat Simulation Theory* (TST) which postulates that dreams serve as an evolutionary biological function, where waking-life threats continue in dreams, functioning as mechanisms in order to further consolidate survival skills (Barbeau et al., 2022). Both the CH and the TST postulate theories of continuity between waking life and dreams, but to some different extent.

The CH and the TST is contradictory to Jung´s idea that dreams serves a compensatory function where neglected emotions of waking life are represented in the dreams (Pesant & Zadra, 2006). This adds support for theories suggesting that the content of dreaming is what your mind is unconsciously thinking about, such as the *compensatory hypothesis* (Mathes & Pietrowsky, 2022). For instance, if someone suppresses their negative emotions throughout the day, these suppressed negative emotions can come to the surface in their subsequent dream for not being processed in awakening. This is stated as the *compensatory hypothesis* where the brain can process our emotions in a therapeutic way during sleep, for emotions that are not processed in awakening (Malinowski et al., 2019; Mathes & Pietrowsky, 2022). This effect was found more pronounced for unpleasant suppressed thoughts than pleasant thoughts. Another finding contradicting the CH is that many dreams are known as bizarre, and have no direct foundation in a person's daily life, for instance dreaming about flying or killing someone (Schredl et al., 2004). This type of dream content can undermine the CH because many people have dreams that have no direct connection to their waking lives.

Aim of the current study

Within the field of dreaming, there are many unanswered questions. Previous literature has not given a homogeneous framework on the link between dreaming and emotional processes. The research presents various theories and models, though with a lack of robust and consistent results. The differences in findings suggest that it is important to do further research on the possible emotion-dream interaction. Additionally, research on nightmares experiences and nightmare frequency, and dreams in general, has mostly been focused on a specific group or type of people, for instance, specific groups of age or a group of university students, – which can affect the nightmare frequency due to influencing factors such as new and stressful life events as a student (Chen et al., 2014). Other studies focused more on

psychiatric patients, and not so much on the healthy population in general. These are factors that may have an impact on the results from the previous studies and do not necessarily apply to the general population. How different life events, affections, and daily activity can affect dreaming in a healthy population is not yet answered, but important research. Therefore, the aim of the study is to investigate if we can see some associations between mood, gender and the prevalence of nightmares and bad dreams in a more general population. The study´s purpose is to contribute to a better understanding of dreaming and its possible relationship to our mood. A better understanding of the relationship between mood and dreams can contribute to enhance further research and operate as a supplement to the already existing literature on dreaming.

Research question and hypotheses

Due to the inconsistent results from studies examining the relationship between emotions and dream affect, the goal of the current study is to find out more about this relationship. The research question for this thesis is as follows:

> "*Is there a gender difference in the mood before bedtime, and is mood before bedtime associated with the prevalence of nightmares and bad dreams?*"

Hypothesis 1: Low mood among the participants is associated with a greater frequency of nightmares and bad dreams.
Hypothesis 2: There is a higher frequency of low mood in women than in men.

Previous research has found that the PVP-scores are significantly higher in those with nightmare disorders than in healthy volunteers (Wang et al., 2021). Therefore, the first hypothesis is that low mood among participants is associated with a greater frequency of nightmares and bad dreams. The second hypothesis is that we will discover a higher frequency of low mood in women compared to men. Based on previous research, it was expected to find higher levels and frequencies of nightmares and bad dreams in those who reported low moods, and that low mood emerges more often for women in comparison to men (Chen et al., 2014).

Methods

Sample

A total of 87 Norwegian adults participated in the study. Of these, 47 were women (54%) and 40 were men (46%). The mean age of the respondents was 29.27 years (SD = 12.75, range = 20-78). The majority of the participants were aged between 20 and 25 years old (66%), and one of the participants was 78 years, which is an outlier in regard to the average age, nevertheless, the participant was counted in the results. There was no significant age difference between the two gender groups, and two of the participants failed to report their age.

Design and procedure

The participants were chosen through a convenience selection. Each person in the bachelor thesis group asked their friends, family, and people on Facebook if they would join the study. The participants were volunteers and did not receive anything to join the study. All the participants had to be over 18 years old to participate. Participants were recruited between January and February 2022. They needed to give written informed consent in form of writing their e-mail address in a section on a link they received, which in turn led to an e-mail with further information about the study. They could choose not to answer the e-mail containing the surveys, or to withdraw from the study at any time throughout the period of data collection. The respondents´ e-mail address was only used for recruiting, and they had to create their own username when filling out the surveys, which made the study completely anonymous. The whole selected sample (n = 87) participated in the first part of the study with the baseline survey, and 17 of the participants did not continue with the second survey (20%), which results in a final total of 70 participants (81%). The response rate was 42%, with a total of 1034 collected surveys.

Of relevance for the thesis hypothesis, 21 of the participants failed to report their mood before bedtime (24%), which means that data from 66 participants measures their average mood throughout the period, and that data from 21 of the participants is missing on this specific variable.

The project was presented as a study on "Dreaming activity during a 4-week period" and potential participants were encouraged to contribute to gain knowledge into what factors influenced the dreaming experience, and how these experiences in turn can influence the respondents. The data collection consisted of a four-week period, mid-March to mid-April, in

which they reported all their daily dreams in an online dream diary questionnaire. On the first day they obtained a baseline survey (survey 1) with some demographic questions only being filled out once. This was for instance questions like "*What is your gender?*" and "*How old are you?*". After filling out the baseline, participants filled out the main survey (survey 2) daily for four weeks. This survey contained among other things questions that needed to be daily updated, such as questions about hours of sleep, what type of dream they had dreamt, and how the participants´ moods was before going to bed. This survey was supposed to be filled out online every morning, and took approximately two-ten minutes, dependent on the participants´ dreams, and if they even dreamt. If they reported having a sexual dream or a nightmare, they had to fill out additional questionnaires as well – *Sexual Dream Experience Questionnaire* (SDEQ) when having a sexual dream and *Nightmare Experience Questionnaire* (NEQ) when experiencing a nightmare. These questionnaires are not used in further analyses in this project.

Ethics

The study was approved by the Norwegian Centre of Research Data (NSD) in March 2022 (09.03.2022), notification form 637636. We reported the completion of the data collection to NSD 25.04.2022. The respondents provided informed consent to their participation in the study electronically.

Measurements

There have been some changes in the translation of the questionnaire since the questionnaires were originally in Chinese. The questionnaires were first translated into English and then to Norwegian and transferred back to English again. This was done for the questionnaires to be as precise as possible, to assure validity, and for both versions in English and Norwegian to be as similar as possible. The respondents could choose whether to fill out the Norwegian or the English version of the questionnaire. There were also some changes in the verb tenses since our respondents needed to fill out the surveys every day and some of the questions in the original questionnaire were about their experience with nightmares in general, which were not of matter in this study.

To conduct the participants´ dreaming activity, they were asked "*Did you dream last night?*", with alternative yes and no. To identify which type of dream the participants might have had, they needed to answer "*What type of dream was it? Check all that apply*" with

alternatives (1= Ordinary dream, 2= Nightmare, 3= Sexual dream, 4 = Bad dream and 5= Other). The other question of interest in the survey was the participants´ subjective feelings of mood before bedtime. "*Which option best describes your mood before going to bed?*". Respondents were asked to check the one that applied the best of mood from low to high (1= low mood, 2 = neutral, 3 = good mood). Since the participants did not receive any definition of nightmares and bad dreams, it was subjectively up to each participant what they defined as a nightmare and as a bad dream. Therefore, we chose to merge those two variables, nightmares and bad dreams, into one variable as negative dreams. The variable was transformed into a sum score with the total amount of negative dreams reported during the entire data collection period.

Statistical Analyses

The analyses were performed in the 26th version of IBM SPSS. Hypothesis 1 was investigated using bivariate correlation analysis to investigate a possible correlation between mood and total nightmares and bad dreams. Further, a hierarchical regression analysis was used to see how much the variable age, gender and mood before bedtime could explain the variance of total nightmares and bad dreams among the participants. The dependent variable for this hypothesis was the total amount of nightmares and bad dreams. In model 1 age and gender were checked upon the total amount of nightmares and bad dreams, and in the second model the variable mood before bedtime was added to the analysis. Hypothesis 2 was investigated using an independent *t*-test that evaluated the between-group differences between men and women in age, the mood before bedtime and the total nightmares and bad dreams.

To perform a multiple regression analysis some prerequisites must be met (Field, 2018). One of these prerequisites was not met in this analysis, which means that the results must be carefully interpreted. Prerequisites for independence, multicollinearity, homoscedasticity and normal distribution were fulfilled, while the criteria for linearity were not. The prerequisite of not having multicollinearity as a problem in a multiple regression analysis was examined by checking all of the variable's correlations using the results from the bivariate correlation analysis. It was further checked by the variance inflation factor (*VIF*). The value of *VIF* should not be over 10, and preferably around 1(Field, 2018). Additionally, a Durbin-Watson value of 1.72 further strengthened this prerequisite. Further, a scattered plot indicated that the prerequisites of homoscedasticity were also fulfilled, due to its scattered dots. The scattered dots indicate that data meet the assumptions of the errors being normally

distributed and that the variance of the residuals is constant (Field, 2018). Since most of the prerequisites are met, the hierarchal regression analysis could be implemented.

Results

Table 1 displays means, standard deviation and correlations for the variables age, gender, mood before bedtime and, nightmares and bad dreams. The average score on the mood before bedtime was, $M = 2.26$, $SD = .39$, with a total of 66 reports. Nightmares and bad dreams, $M = 1.74$, $SD = 1.96$, had a total of 69 reported occurrences. Consistent with the first hypothesis, mood before bedtime showed a significant negative correlation with nightmares and bad dreams, $r(85) = -.32$, $p < .01$, with a moderate effect. No significant correlations were found between the other variables.

Table 1

Descriptive statistics and correlations between mood before bedtime and frequency of nightmares and bad dreams (N = 87)

Variable	M	SD	Correlations			
			1	2	3	4
1. Age	29.97	12.75	-			
2. Gender [a]	.46	.50	.09	-		
3. Mood before bedtime [b]	2.26	.39	-.07	-.06	-	
4. Nightmares and bad dreams	1.74	1.96	-.09	-.16	-.32**	-

[a] 0 = Woman, 1 = Man.

[b] 1 = Bad mood, 2 = Neutral mood and 3 = Good mood

**$p < .01$

Table 2 shows the results from a hierarchical multiple regression analysis with two models. Model 1 included variables age and gender, and in model 2 the mood before bedtime was included. Model 1 explained 4% of the variance in total nightmares and bad dreams, $R^2 = .04$, $F(2, 61) = 1.31$, $p = .279$. This model was not significant. In the second model the variable mood before bedtime was added, which increased the explanation percentage to 22%, $\Delta R^2 = .18$, $p < .001$, $R^2 = .22$, F(3, 60) = 5.62, $p = .002$. Model 1 was not significant, which indicates no significant connections between the total amount of nightmares and bad dreams with the variables age and gender. In Model 2 the mood before bedtime was the strongest and

only significant predictor, with a negative effect on the total of nightmares, β = -0.42, *p* <
.001. Model 2 indicates that mood before bedtime, together with age and gender, stands for
22% of the explanation in the total amount of nightmares and bad dreams with a moderate
effect size.

The correlation observed in Table 1 does not indicate multicollinearity. To fulfill the
criteria of multicollinearity the correlations should be .80 or above. The strongest correlation
found, and for instance, the only significant correlation, was between mood before bedtime
and nightmares and bad dreams, *r* = -.32, *p* < .01, which do not indicate multicollinearity. *VIF*
was lower than 4 for both Model 1, *VIF* = 1.00, and Model 2, *VIF* = 1.01. Therefore, the
criteria for multicollinearity were fulfilled both for high correlations and *VIF*-values.

Table 2

Hierarchical Regression Analysis Summary for Predicting Nightmares and Bad Dreams (N = 64)

		Nightmares and bad dreams				
	Variable	*b*	*SE b*	β	R^2	ΔR^2
Model 1					.04	.04
	Age	-0.02	0.02	-0.12		
	Gender	-0.60	0.48	-0.16		
Model 2					.22***	.18***
	Age	-0.02	0.02	-0.15		
	Gender	-0.68	0.43	-0.18		
	Mood before bedtime	-2.08	0.56	-0.42***		

***p < .001

An independent *t*-test found no significant gender difference between women, *M* =
28.2, *SD* = 11.52, and men *M* = 30.48, *SD* = 14.06, in age, *t*(75.58) = -.81, *p* = .421, where
woman was slightly younger, Δ*M* = -2.28. There was no significant difference in women, *M* =
2.28, *SD* = .37, and men, *M* = 2.23, *SD* = .42, in mood before bedtime, *t*(61.72) = .51, *p* =
.612. Just a small effect was found, *d* = 0.13. There were also no significant differences in
women, *M* = 2.03, *SD* = 2.10, and men, *M* = 1.42, *SD* = 1.77, in total amount of nightmares
and bad dreams, *t*(66.52) = 1.29, *p* = .200. Women reported more nightmares and bad dreams
than men, Δ*M* = .60, and the effect size, *d* = 0.31, was found to be slightly smaller than
Cohens convention for a moderate effect (Field, 2018).

Discussion

The aim of the study was to investigate if mood before bedtime affects the prevalence of nightmares and bad dreams and if there were any significant differences between men and women on this effect. A bivariate correlation analysis showed a significant correlation between the frequency of nightmares and bad dreams, and different types of moods. The result showed that the total nightmares and bad dreams had a negative correlation with the variable mood before bedtime, indicating that mood before bedtime increases when the total nightmares and bad dreams decreases, and vice versa. The results from the correlation analysis support the first hypothesis, with a moderate effect. This may indicate that a low mood predicts a higher risk of having a nightmare or a bad dream, than if one reports having a good mood the same day. Nonetheless, we cannot preclude a bidirectional direction. We can tell by the results that there is a relationship between these two variables, but no direction is concluded. Total nightmares and bad dreams can as well be the variable predicting a decrease in mood, likewise as a decrease in mood can be the one predicting a nightmare or a bad dream.

To further investigate more about the relationship and the direction on the correlation analysis a hierarchical regression analysis was performed to interpret how much the variable mood before bedtime could explain the variance in total nightmares and bad dreams. Results from this analysis indicate that mood before bedtime, together with age and gender, can explain 22% of the variance in total nightmares and bad dreams. The third analysis, a *t*-test, did not support the second hypothesis about women having a higher average of low mood than men, with men reporting a slightly lower mood than women, with a very small and not significant effect. Additionally, results from the *t*-test also showed that women reported a higher total of nightmares and bad dreams than men, however, this was also a non-significant result.

Relationship between low mood and negative dreams

The first hypothesis assumed that low mood among the participants was associated with a significantly higher frequency of nightmares and bad dreams. The results supported this hypothesis and were in accordance with studies finding that emotions related to depression and anxiety are associated with a higher possibility for experiencing nightmares (Wang et al., 2021). Results from the correlation analysis added support to this hypothesis, by finding a significant negative correlation between mood before bedtime and total nightmares and bad

dreams among the participants. This correlation had a moderate effect. Additionally, in a regression analysis, age, gender and mood before bedtime could explain 22% of the variance in total nightmares and bad dreams, with mood before bedtime as the strongest and only significant predictor, $\beta = -0.42$, $p < .001$. The result tells us that if the variable mood before bedtime increases by one standard deviation, a decrease of 0.42 will be found in the total nightmares and bad dreams. The results from the correlation- and regression analysis together give a relatively robust foundation to state that there is a relationship between low mood and negative dream content.

The results can provide some support for the CH and the TST. By presenting that mood before bedtime has a negative correlation with the total amount of nightmares and bad dreams, this can give some support for the CH considering researchers´ findings that people often experience a negative emotional state before having a nightmare (Shao et al., 2020). One possible way is that the participants´ low mood has an impact on whether they did have a nightmare or bad dream the same night. Results from Dale et al. (2015) presented evidence for the CH even in dreams of nonclinical populations, as well as findings by Barbeau et al. (2022) who found an association between negative emotions before sleep and the prevalence of threats in dreams. This gives support that both low mood before bedtime can predict a higher possibility of experiencing a nightmare or a bad dream the same night, as well as experiencing a greater possibility of having a lower mood the day after experiencing a negative dream. Our correlation analysis can give support for both outcomes since we do not know anything about which variable is predicting who.

Previous research indicates that nightmare disorder patients often score higher on the PVP-scale relative to a nonclinical population, which can give some support to an assumption of depressive symptoms, for instance, a low mood, predicting a higher frequency of nightmares (Shao et al., 2020). Our results, where low mood shows an effect on total negative dreams, provide further evidence for this. Although our surveys did not include a PVP-scale, there are some similarities between depressive symptoms and low mood, where both may involve sadness, helplessness, anger, etc. (Campbell et al., 2016). Therefore, findings on nightmare disorder patients higher PVP-score can contribute to support our results where low mood predicts a higher prevalence of negative dreams. Similarly, changes in psychological well-being are shown to be correlated with similar changes in emotional dream content (Barbeau et al., 2022). This can give further support to our results which show a moderate

effect of a negative correlation between mood before bedtime and the total amount of negative dreams.

Symptoms of anxiety were also related to negative dream affect (Sikka et al., 2018). This can provide support that negative emotions in daytime can lead to negative emotions in dreams, and salient negative emotions in dreams often lead to occurrences of nightmares or bad dreams. Additionally, this adds support for the continuity hypothesis, but also for the threat simulation theory, where perceived waking threats can lead to increased threat simulation in dreams, and further salience of negative emotions in dreams (Barbeau et al., 2022; Sikka et al., 2018). Looking from a nightmare disorder perspective, the TST can explain why nightmare disorder patients who often experience emotions related to anxiety and depression both before and after having a nightmare, often experience these emotions in their dreams as well (Chen et al., 2014). Transferring this over to a nonclinical population, there is support for indicating that this continuity-relationship is valid for the general population as well, with either the CH explaining the similarities between waking- and dream emotions, or the TST explaining why there is a relationship between waking- and dream threats, which in turn can result in experiencing a negative salience of those dreams.

In a study by Barbeau et al. (2022) it was found that our brain prioritizes emotional waking-life experiences when our cognitive capacity is achieved, and this with a negative bias. This can be due to negative emotions more intensely appearance than positive emotions. This phenomenon is broadly known as what Baumeister et al. (2001) call "Bad is stronger than good", which can create a bias where we do remember negative emotions easier due to their higher intensity and recognizability (Conte et al., 2020). More positive emotions are necessary for overtaking the appearance of bad ones, since negative emotions produce stronger emotions with a longer-lasting effect on the self, compared to events perceived as positive. This can give a general human biased effect, where people think they are experiencing more negative emotions and incidents, when in fact our brain needs more positive input than negative to overdue the negative ones (Baumeister et al., 2001). This bias can affect our results, where the participants can overreport both a lower mood and the total of negative dreams, and this bias is unfortunately tough to avoid. Additionally, an earlier morning REM-dream is indicated as more negatively emotional than dreams occurring earlier during sleep (Conte et al., 2020), which can lead to more participants reporting having a bad dream or a nightmare, even if the dream consisted of a majority of regular and positive incidents compared to negative content.

The *compensatory hypothesis* suggests that emotional processing occurs during dreaming for emotions that have not been processed in awakening (Malinowski et al., 2019; Mathes & Pietrowsky, 2022). One theory is that negative emotions, both conscious and unconscious, which are excluded, can come to the surface in dreams for one to process these emotions (Conte et al., 2020). This can be another possible reason for why negative emotions often are more represented and experienced during dreams. This theory is further supported by findings from REM-sleeping. During REM-sleep, several areas of the brain are attenuated, which can lead to a rebound of suppressed emotions in dream content (Malinowski et al., 2019). The brain can lead us to dream about waking-life emotions, and especially this effect is shown for negative, suppressed emotions, which can lend support to both the continuity hypothesis and the compensatory hypothesis.

Together, there is broad support for a relationship and continuity between waking emotions and emotions salient in dreams, but previous research has not found any direct relationship between wake- and dream emotions that further can affect the prevalence of nightmares and bad dreams. As literature has shown, there is broad support for the CH, and the results from this project give additional support for this theory. However, there is not yet a clear and unilateral support for the relationship between awakening- and dream emotions, due to the lack of existing, good and robust data. The CH and the compensatory hypothesis may seem to be the opposite, yet, they can also act compatible with each other (Mathes & Pietrowsky, 2022). The CH does not state all dreams and dream content to be identical to awakening, and the compensatory hypothesis can be due to a lack of something one can have thought about while being awake, which in turn can lead them both to have some kind of dream-awakening-relation. Both these hypotheses can yield some confounding thoughts since both hypotheses work as open hypotheses which are hard to falsify and are easy to find some kind of relation to.

Gender differences in mood and emotional state

The second hypothesis assumed that there was a higher frequency of low mood in women compared to men. Our results were not in accordance with this hypothesis. Results from a *t*-test showed a slight difference in the mood before bedtime in men and women, where men reported an average lower mood before bedtime over the four weeks, compared to women. However, this was not a significant result and with such a small effect that there is no reason to state it as a difference. Since the result did not give any predication for a gender difference

in mood, this result does not support previous research indicating that women often tend to report a higher level of negative emotions and depressive symptoms than men (Chen et al., 2014; Nolen-Hoeksema et al., 1999; Thayer et al., 2003). Since our results presented a tiny majority of men experiencing a lower mood than women, this contradicts previous research finding women to be more emotionally reactive than men. A study by Schredl et al. (1998) found higher reports of psychical violence in dreams for men, in comparison to women. This can yield an explanation for why our results found men reporting a slightly lower mood than women, as aggression can be interpreted as having a lower mood. Additionally, the study adds further support to the CH, since men often are more aggressive compared to women and this also seem to be followed in content of dreams.

There is an assumption of a significantly more anxious and less stable mental condition following a nightmare in comparison to a night without (Köthe & Pietrowsky, 2001; Li et al., 2010). This is shown to be more pronounced in people scoring high on neuroticism, but in general, healthy people report more presence of neurotic symptoms such as guilt, fear and anxiety when experiencing a nightmare as well (Köthe & Pietrowsky, 2001). Results from a study by Li et al. (2010) showed that participants with frequent nightmares scored significantly higher on symptoms of anxiety than those who did not experience a frequency of nightmares. Women´s general higher score on neuroticism can be one of the explanations for why it is often reported a higher number of nightmares and bad dreams among women than for men. There are also gender-related differences in cerebral processing of emotions, which can explain some of the reasons for women experiencing more emotions during dreaming (Chen et al., 2014).

Gender differences in frequency of nightmares and bad dreams

Additionally, the results from the *t*-test showed that women reported higher numbers of nightmares and bad dreams during the data collection compared to men, but the results from the *t*-test were not significant. The results are following previous research finding that women have higher frequencies of nightmares than men (Chen et al., 2014; Dale et al., 2015; Wang et al., 2021), but the results was not significant. According to Chen et al. (2014) women both experienced several nightmares and scored higher on neuroticism, which is related to experiencing more negative thoughts and moods. A study by Schredl and Reinhard (2010), found that the effect on nightmare frequency for women did not change when an adjustment of the definition of nightmares was done or when using different types of data collection

methods, which underlines the robustness of previous research finding gender differences in frequency of nightmares, where women tend to have more nightmares and bad dreams than men. Women´s tendency to have more nightmares than men, which is found in several studies, is in accordance with the results of the *t*-test.

There can be several reasons why our study does not support previous research that indicates a gender difference in general mood and why our results were not significant when examining the frequency of nightmares. This can be due to limitations of the sample, for instance, the small sample size, which can make it difficult to generalize the results and find large effect sizes (Field, 2018). Our result contradicting several previous research findings regarding gender differences can also be due to how the data collection is performed. Sikka (2020) emphasizes the important difference between sleep laboratory awakenings and home dream diaries, in addition to the difference between external rating (ER) and self-ratings (SR). In SR studies, the affective conditions are often higher in contrast to ER studies. For this study, where self-assessment is utilized in a home dream diary, the deviation can arise due to the negative bias effect. This effect can create a tendency for humans to overreport negative emotions and underreport positive ones. Such self-report biases are especially prevalent in women who are more likely to report distressing experiences and are more emotionally reactive to negative stimuli (Schredl & Reinhard, 2010). Results from a study by Sikka (2020) found significantly more dreams considered negative with SR, compared to studies containing ER. This can lead to an even considerable effect when our sample size is as limited as it is.

The use of SR can possibly affect our results with recall bias, where some participants could forget to fill out the survey in the morning. Therefore, there is a small risk for the participants to either forget the dream or at least some contents of it which in turn can affect the results. There was no requirement to report the dream immediately after awakening, and therefore the recall process can be biased. Besides, the recall bias could be affected by the fact that humans are more likely to recall the last dream they had, rather than other dreams during the night. The gender differences in total nightmares can be due to women being more able to recall their dreams, and furthermore, dream recall is stated to be closely related to nightmare frequency (Schredl & Reinhard, 2010). If the participants were woken up in the middle of the night, perhaps in a sleep laboratory study, we might get more knowledge from NREM dreams as well as possibly avoid biases with recall that could affect our results.

In addition, our variable mood before bedtime is a relatively weak indicator of mood, consisting of only three alternatives. Inconsistent results with previous research on gender

differences may be due to how we operationalized this variable. For enhancing this, the variable should have been operationalized as a continuous variable or we could have applied the Positive and Negative Affect Scale (PANAS) that provide a solid measure of mood (Watson et al., 1988).

Strengths and limitations

The study contained both strengths and limitations, of which some limitations restrict our possibility to interpret our results fully. One limitation is the sample size of the study and the period of data collection. With respect to the sample, implementation of several participants would be counted as positive, as 87 participants are considered a small sample and makes it difficult to trust the results and further generalize the findings of the study to the population as a whole (Field, 2018). Though 87 participants already were a small sample, only 70 continued filling out surveys after baseline, and 21 of the participants failed to report their mood before bedtime. Our data is therefore missing some data regarding variables such as mood before bedtime, containing data from 66 of the totals of 87 participants. This might also affect the data, and thus considered a limitation. The sample also contained one outlier in age, where one of the participants reported being 78 years old. Age seems to affect our dreams, where it is shown a tendency where young adults report having several nightmares compared to older adults, in addition to the adolescents´ more emotional reactiveness decreasing with age (Barbeau et al., 2022). This can be an implication for further studies investigating the associations between mood or emotions and frequencies of nightmares, taking age into account. Additionally, the period of data collection should have been longer than four weeks, and preferably for a whole year. As this particular study requires participants to report their dreams every day, it requires a lot of work from the participants. If the participants do not receive any incentives for participating in a study (e.g. money etc.) it might also cause a lack of motivation where the completion of surveys might come to risk. A possible solution to motivate people in a longer study could be to give something in return to each participant or announce that one of the participants can win a bigger prize.

Another limitation can be due to the selection method used when the collection of participants took place. Because friends and family were asked, there may have been a dependency relationship (Hem et al., 2019). Because of this dependency relationship, participants may feel obligated to participate in the study, and as a result, they may lack

motivation for completing surveys throughout the entire period since they did not volunteer to participate but were asked by a familiar person to join the study.

Because a dream journal was completed at home by our participants, and after awakening in the morning, the collected dream reports likely originated from late-night dreams in the REM phase. Dream reports from late REM are more abstract, less self-referential and more loosely associated with waking concerns of the previous day and incorporate more elements from the distant past than reports from the early REM period (Pesant & Zadra, 2006). A proposition can be to do further research on data collected from both early- and late-night REM periods and additionally from NREM-dreams. This can be done in sleeping laboratory experiments and give a more robust result stating an emotion-dream relationship as NREM-dreams are more likely to resemble wakefulness (Malinowski & Horton, 2021). Additionally, differences in personality traits would have been interesting to investigate, where one could go in-depth on the associations between mood, emotional state and dream content.

Due to ethical reasons, the project could not include questions about clinical research. For that reason, the PVP-scale, a measuring instrument that measures individuals' depressive tendencies, was not included in the thesis (Wang et al., 2021). This has caused a small limitation for the thesis and moreover for the research question, which could not include a measure of emotional state. Nevertheless, several external studies can support the link between mood and more specific emotional states. Hence, there will not be a direct pathway from this project to clinical psychology. However, several previous pieces of research have given us a reasonable opportunity to draw lines between emotional states as we measure the participant´s mood.

Due to the length of the survey, the threshold for reporting having a nightmare could be high because of the additional questionnaire they had to fill out if they reported experiencing a nightmare. Possible vague numbers of nightmares and bad dreams can also be a result of the operationalization of the concepts. Some of the participants can both experience a nightmare they did not report as a nightmare, or not fulfill the "requirements" for having a nightmare or a bad dream but still report as if it was a negative dream due to a lack of a common definition for all participants of what a nightmare or a bad dream should contain to be reported as one. Additionally, the operationalization of mood before bedtime can be a limitation of the results. This variable was not a continuously variable, which would be optimal for a closer detection of the participants´ moods. Instead, our survey asked for ratings

from low to good mood, which can give a bit vague result considering humans may experience being in between low and neutral mood, or between neutral and good mood. A broader measure of the mood variable, such as PANAS, would have strengthened the results (Watson et al., 1988).

Nevertheless, a strength of the study is that there was a relatively even distribution between both age and gender, with 47 women and 40 men and with only one outlier in age for the one respondent being 78 years old. Another strength is that a study with a dream diary report has never been done on a Norwegian population before and the study has used some measure scales that have not been used before in Norwegian research studies. The NEQ is a relatively new instrument, which has not been validated in a Norwegian sample before. Another big strength is that this study has investigated and elucidated a subject that is not quite well known yet and can contribute to a field that needs a lot of further research. This study can contribute as a supplement to a field with missing data and research, which is considered a big strength of this study. Even though self-report can be a limitation, it can also contribute as a strength where we can obtain unique and unobservable information about the participants. Moreover, being anonymous likely contributed to a reduced risk of participants reporting or acting after social desirability (Tourangeau & Yan, 2007). This has given the opportunity to obtain extraordinary information that would not be given access to in projects without self-reports, and thus seen as a considerable strength. Additionally, the results for the first hypothesis are in accordance with previous research, which can predict good reliability of the study. Another strength is that our study collected data from a normal, nonclinical population, while other studies on dreaming often are investigated in small, specific niches and clinical populations, which is not generalizable for the normal population.

Implications

The study aimed to examine the associations between mood, gender and the prevalence of nightmares and bad dreams. In general, there is not much research within the field of dreams, relative to other subjects in psychology. Due to significant results on the first hypothesis, this study can be used as a support for already existing theories stating a relationship between emotional state and content of dreams and give further support for the continuity hypothesis.

As mentioned, there is a general lack of knowledge in the field of dreaming with no homogenous definition or origin. The field of dreaming yield some challenges, since it

heavily rely on humans´ subjective thoughts, cognitive heuristics like memory and recall, and further their reports of dreaming (Kahan & LaBerge, 2011).

When conducting similar studies, a greater sample size and a longer period of conducting data through a dream diary would be recommended. Sufficient sample size in research is important to avoid biases and errors like Type I- and Type II-errors, as well as strengthen the power of the results (Langdridge, 2006). Refining our sample size by recruiting and conducting a greater number of respondents would have contributed to greater generalizability for the Scandinavian population. This is preferably rather than having a small sample size, as well as a sample where the majority of the participants share some kind of a relation to the project group investigating the data. Additionally, a longitudinal study would strengthen our results, but it is difficult to recruit participants to daily report their dreams for a long period, since it demands a lot of work and time from the participants. As well as an extension of the project and greater sample size, inclusion of variables measuring a better operationalization of emotions and additionally factors that could cover recent life events and different personality traits would have strengthened the study. A longer period for investigation and running of more complex analyses could have strengthened the study and given a more robust possibility to interpret the results with more certainty.

In the regression analysis, where age, gender and mood before bedtime could explain 22% of the variance in total nightmares and bad dreams, there remains an explanation from other uncontrolled variables. Other uncontrolled variables can explain the rest of the variance or affect the explained 22%. Variables better operationalized for mood, a measure of personality trait, in addition to a more substantial sample size, would advantageously contribute to a better understanding of the research question and be more specific for the regression analysis. A hypothesis that may be interesting to investigate is that emotions during awakening can alter dreams with a few days lag (Conte et al., 2020). This could not be tested in our study but is an intriguing idea to study further. In the conduct of research to come, it would be recommended to look at the difference in dreams content between dream diary reports and sleep laboratory experiments, where we can control for REM-dreams and NREM-dreams and investigate if it could contribute to a difference in the results.

Due to the study´s limitations and based on the different results, the findings are most suitable as background literature and as building blocks for further research and development of the dreaming field.

Conclusion

The study aimed to investigate the associations between mood, gender and the prevalence of nightmares and bad dreams. The results showed a significant negative correlation between mood before bedtime and total nightmares and bad dreams. This indicates a relationship between mood and the frequency of nightmares and bad dreams, where a low mood can predict a higher possibility of experiencing negative dreams, and where a negative dream can lead to a higher possibility of experiencing a lower mood the next day. There was no significant difference between men and women in the average mood before bedtime or the total nightmares and bad dreams during the period of reported dreams. The results were compared and discussed upon existing literature, with previous research both in accordance and in contrast to our findings. The results presented further support for the broadly known continuity hypothesis, as well as other theories implementing an emotion-dreaming interaction. For the indicated gender difference in average mood, there were contradicting results from previous research finding women to have a higher prevalence of lower mood states. However, our results were in accordance with women having a greater frequency of nightmares and bad dreams than men, though the results were not significant. This may be due to several reasons, but methodical errors like a small sample size and the operationalization of some of the variables within the survey are probably a part of these inconsistent results. Therefore, it is encouraged to do further research on the relationship between one´s mood and dream content since dreaming still lacks proper knowledge and reliable findings. To reach a better understanding of this relationship, further research remains.

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