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Infatuation and Lovesickness on Sleep Quality and Dreams in Adolescence

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Abstract

Background: Infatuation and lovesickness are widespread and significant experiences in adolescence. Less is known about the connection between infatuation/lovesickness and sleep. The few studies, examining the link between infatuation and sleep quality show inconsistent results. The link between lovesickness and sleep as well as the link between infatuation/lovesickness and dreams has not been investigated yet. The aim of this study was to examine whether infatuation and lovesickness are linked to sleep quality and dreams in adolescents. **Methods:** A self-assessment online questionnaire was constructed to assess adolescents' infatuation, lovesickness, sleep quality and dreams. In total, data of 630 adolescents and young adults (150 males, 480 females; aged 16 - 21) were analyzed in this study. **Results:** Infatuation did not relate to overall sleep quality and dreams. Sleep disturbances, as a component of overall sleep quality, were more frequent in infatuated adolescents. Adolescents currently suffering from lovesickness reported a significantly lower sleep quality, more negative dreams and nightmares. Furthermore, nightmares influenced them more strongly the next day. **Conclusions:** The associations between infatuation/lovesickness and sleep provide evidence for the far reaching effects of infatuation and lovesickness in adolescents' lives. The fact that lovesickness leads to lower sleep quality and more negative dreams should be integrated in new approaches of insomnia treatment.

Keywords

Infatuation, Lovesickness, Sleep Quality, Dreams, Adolescence, Nightmares

1. Introduction

Infatuation is described as a strong and passionate feeling [1]. The state of infatuation is connected to changes on the domains: psychological, behavioral, and

physiological level. Psychological effects are among others focused attention on the beloved, obsessive, intrusive, persistent thinking of him or her, and euphoria [2]. On the behavioral level, infatuated individuals show more goal directed behavior as, for example, changing their habits to impress or remain in contact with the beloved [3] [4]. Observable physiological effects are sweaty palms, a pounding heart and increased energy. Additionally, the hormonal system changes: cortisol levels increase in both sexes, testosterone levels decrease in men and increase in women [5]. This supports the assumption that attachment and social contacts are associated to a moderate level of stress in both humans and animals [6] [7] [8] [9]. Moreover, reward and motivation systems in the human brain are involved in infatuation [4]. Additionally, Fisher *et al.* supposed that infatuation is not a specific emotion but mainly a motivation system which is connected to various emotions [3]. Various research projects have shown that the stage of infatuation is comparable to symptoms of the "bright" side of hypomania with increased activity, enhanced mood and increased self-confidence [2] [10] [11].

The few investigations on the impact of infatuation on sleep patterns show diverse outcomes. In one study, infatuated participants reported fewer hours of sleep, increased subjective sleep quality, decreased daytime sleepiness, and increased concentration during the day compared to the non-infatuated [2]. In two other studies, no impact of infatuation on sleep quality could be detected [10] [11]. Astonishingly and to the best of our knowledge, no studies investigating the connection between infatuation and dreams exist although the continuity hypothesis of dreaming has long been established postulating that dreams reflect on waking life experiences [12] [13] [14] and, hence, infatuation as a strong experience should influence dream contents.

Apart from infatuation, lovesickness is another widespread experience of adolescents associated with romantic love. In a representative study, 33% - 53% of adolescents reported problems with lovesickness within the last two years and lovesickness was the most frequent problem of adolescents of all subcultures [15]. Furthermore, in another study 82% of the adolescents reported to have already experienced lovesickness [16]. These findings lead to the assumption that lovesickness is a similarly universal experience in adolescence just like infatuation. However, scientific research concerning lovesickness is surprisingly rare considering the possible fatal consequences of this mental state. Analyzing farewell letters and police reports, lovesickness was discovered as the most frequent reason for adolescent suicide [17] [18]. Other findings show that romantic relationship breakup is a predictor for the first but not for recurrent episodes of a major depressive disorder in adolescents [19]. An indication for a possible connection between lovesickness and sleep has been found in the study of Senger, who stated that 80% - 83% (female-male) of the interviewed lovesick individuals suffered from sleep disturbances [20]. Furthermore, sleep disturbance has been mentioned within a list of characteristics of lovesickness [21]. In addition to these findings, lovesickness can be conceived of a social stressor and as such should decrease the sleep quality [22]. Beyond that, Vandekerckhove *et al.* found that

negative pre-sleep emotions lead to deteriorated sleep quality [23]. Hence, negative emotions occurring while suffering from lovesickness should also negatively influence sleep quality. Yet, as all studies analyzed data from adult individuals it remains an open question if their findings generalize to adolescents.

To the best of our knowledge, no study exists examining the link between lovesickness and dream contents. In related fields, some studies show that affective disorders like depression lead to more negative dream contents [24] and, additionally, lovesickness can lead to depressive feelings [19] [25], hence, we assume that lovesickness leads to increased levels of negative dream contents.

In this study, we presume that the above mentioned findings generalize to adolescents. Hence, we hypothesize infatuated adolescents report 1) a better overall sleep quality, and 2) more positive dream contents. To the opposite we hypothesize that lovesick adolescents' report, 3) lower overall sleep quality, and 4) more negative dream contents and/or nightmares.

2. Procedure

In order to test these hypotheses, we recruited adolescents via internet strongly relying on social networks (e.g., Facebook, university groups). Before providing any information, adolescents were informed about the study content and that their participation was strictly voluntary, that they could resign from participation at any time, and that anonymity was granted by the study protocol. After agreeing to participate, adolescents filled in an online-survey assessing infatuation, lovesickness as well as sleep and dream quality. Multiple compilation could not be controlled in favor of anonymity, but no duplicates could be found based on demographic statistics.

3. Methods

Participants

Initially, 755 individuals being 16 to 21 years old participated in this study. Participants up to 21 were considered as adolescents according to German guidelines for children and adolescents psychotherapy. Due to the inclusion criteria (passing relevant cut-off values for being infatuated or being lovesick, respectively; not being infatuated and lovesick simultaneously) data from 630 adolescents (150 male and 480 female participants) were considered for statistical analyses. Overall, the average age was 20.07 (SD = 1.05) with female adolescents being older (20.12; SD = 1.01) compared to their male counterparts (19.90; SD = 1.17; t (223.91) = 2.07; p = 0.04). 439 adolescents indicated to be infatuated (89 males, 350 females) were assigned to the infatuation-group. 32 adolescents (6 males, 26 females) reported to suffer from lovesickness. 152 (53 males, 99 females) were neither infatuated nor lovesick, and served as control group. For analysis, data from 359 adolescents being in a romantic relationship (308 females, 51 males) as well as data from 271 singles (99 male, 172 females) were used. Mean duration of romantic relationship was 22.41 months (SD = 17.84).

4. Measurement Instruments

4.1. Demographics

Adolescents provided information about their age, gender, school or university degree, relationship status, and relationship duration (if applicable).

4.2. Infatuation

Adolescents had to indicate if they are infatuated (single item) and had to fill in three items of the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; [26]). The following items, validated by Brand *et al*. [2], were used: "*How much time do you think of the other person*?", "*While thinking of the other person, do you feel distracted*?", "*How well can you resist the need to think of the other person*?". Items were coded on a five-point Likert scale (0 - 4) with a maximum at 12 and a cut-off for being infatuated set at 6 points leading to the exclusion of 7 participants. Internal consistency (Cronbach's alpha) of this scale was $\alpha = 0.89$.

4.3. Lovesickness

The lovesickness questionnaire [25] assesses if participants currently feel lovesick, if so, participants have to indicate for how long they have been lovesick and why they feel lovesick. Moreover, participants have to answer a set of items assessing feelings that may be associated to their lovesickness. If the participants did not suffer from lovesickness at that time, they were requested to apply their answers to a former lovesickness. In the current study, only the first item was used to identify lovesick participants ("*Do you feel lovesick at the moment*?").

4.4. Sleep Quality

The Pittsburgh Sleep Quality Index (PSQI; German version [27]) is a retrospective self- and peer-rating questionnaire assessing the sleep quality and the sleeping behavior of the previous four weeks. It comprises 19 self-rating items and 5 peer-report items to be answered by the partner or roommate assessing 7 components of sleeping behavior/quality: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The total score of the PSQI has an internal consistency of $\alpha = 0.85$ [28].

4.5. Nightmares

The Nightmares Effects Questionnaire (NEQ, [29]) assesses the frequency of nightmares and their consequences on waking life regarding the last three months. For this study, the items "*How often have remembered dreams been positive*", "*During the past three months, how often did you have bad dreams without awakening*" and "*During the past three months, how often did you remember nightmares*?" serve to assess dream quality. Items were coded on a 7-point rating scale (0 = not at all, 1 = less than 4 times/year, 2 = once in 2 months, 3 = once a month, 4 = 2 - 3 times/month, 5 once a week, 6 = 2 - 3 times/week, 7 = every morning). Sum score ranges between 0 - 37 with higher scores indicating more nightmare effects. Internal consistency (Cronbach's alpha) of this scale was $\alpha = 0.76$.

5. Statistical Analysis

Based on their self-reports, adolescents were separated into three groups: 1) being infatuated, 2) being lovesick, and 3) being neither infatuated nor lovesick (control group). All hypotheses refer to differences in central tendencies, hence, either t-tests or Mann-Whitney U-tests (for comparisons including the lovesickness group) have to be calculated. In order to test the formulated hypotheses we adopt a Type-I error rate of 5% (one-sided).

6. Results

6.1. Descriptive Statistics

Table 1 provides the demographic descriptive statistics for the three groups (infatuated, lovesick, and control group). For the infatuated adolescents, we found differences with respect to age with female adolescents being roughly three month older on average than male adolescents ($t(437) = 2.05$; $p = 0.013$). Neither for the lovesick nor for the control group, we found a statistically significant difference for age (lovesick: $t(5.88) = 0.68$; $p = 0.52$; control: $t(150) = -0.34$; $p = 0.74$).

Out of the infatuated group, 344 adolescents (78.4%) reported to be in a romantic relationship. Mean duration of romantic relationship in months was 22.03 ($SD = 17.72$) (one year and 10 months). Relationship duration ranked from less than a month to 100 months, (eight years and four months) (see Table 1). See Table 2 for further sociodemographic characteristics.

Four adolescents (12.5%) suffering from lovesickness reported to be in a romantic relationship. Mean duration of romantic relationship in these four adolescents was 22.75 ($SD = 18.71$; 1 year and 10 month; range less than 1 month to 40 months). 18 (56.3%) adolescents reported a *romantic relationship breakup* as being the reason for their current lovesickness, 8 (25%) participants named a *one-sided love without reply* of the beloved and 3 of them (9.4%) reported of a *sexual affair which did not end up into a romantic relationship*. The majority of the control-group reported to be single (n = 146, 96%). Only six of them (3.9%) were in a romantic relationship (mean duration = 32.83 month; $SD = 18.74$; 2 years and 8 month; range from less than a month to 48 months).

Table 1. Age, relationship duration.

	Infatuation group n = 439		Lovesickness group n = 32		Control group n = 152	
	Mean	SD	Mean	SD	Mean	SD
Age woman	20.16	1.01	20.12	0.96	19.96	1.03
Age men	19.85	1.17	19.67	1.58	20.02	1.15
Age sum	20.10	1.05	20.04	1.08	19.98	1.07
Relationship duration	22.03	17.72	22.75	18.71	32.83	18.74

Notes: Due to exclusion of 7 participants being infatuated but scoring lower than 6 on the Y-BOCS sample size reduced to 623.

Table 2. Sociodemographic characteristics of the participants.

	Infatuation group n = 439		Lovesickness group n = 32		Control group n = 152	
	Women	Men	Women	Men	Women	Men
Secondary school certificate	4 (1.1%)	3 (3.3%)	1 (3.8%)	0 (0%)	1 (1%)	1 (1.9%)
Advanced school-leaving certificate	346 (98.9%)	86 (96.7%)	20 (96.2%)	6 (100%)	98 (99%)	52 (98.1%)
University students	324 (92.5%)	76 (85.3%)	21 (80.7%)	6 (100%)	85 (85.9%)	45 (84.9%)

Notes: Due to exclusion of 7 participants being infatuated but scoring lower than 6 on the Y-BOCS sample size reduced to 623.

6.2. Sleep and Sleep Disturbances

The mean PSQI sum score was 7.09 (SD = 3.37), see also Table 3. Overall, 57% of the participants scored than 5 higher on the PSQI. In detail, considering the score of 5 on the PSQI as cut-off for poor sleep quality, the sample consists of 51.1% poor sleepers (>5 and <10) and 5.9% of chronic insomnia symptoms patients (higher than 10). Women (7.28 ± 3.44) reported significantly higher PSQI sum scores than men (6.47 ± 3.05), ($t(628) = 2.59$; $p = 0.010$). Furthermore, women scored significantly higher in various components as *subjective sleep quality* ($t(628) = 2.75$; $p = 0.006$), *sleep disturbances* ($t(628) = 4.15$; $p < 0.001$), *use of sleep medication* ($t(479) = 4.10$; $p < 0.001$) and *daytime dysfunction* ($t(628) = 1.96$; $p = 0.050$).

6.3. Nightmares

The mean score for NEQ sum score was 5.46 (SD = 5.47). The higher the sum score of NEQ, the more did nightmares affect on the mental and health states of adolescents the next day. Mean score and standard deviation of NEQ sum score and all subscales are displayed in Table 4. Women (6.00 ± 5.78) reported of significantly more nightmare effects than men (3.73 ± 4.93), ($t(628) = 4.35$; $p < 0.001$). They scored higher in the subscales *anxiety and depression* ($t(310.15) = 6.20$; $p < 0.001$), *problems of concentration and attention* ($t(286.75) = 2.90$; $p = 0.004$) and *aggression* ($t(300.14) = 3.36$; $p = 0.001$). The mean score for the item, "*How often have remembered dreams been positive*" was 5.05 (SD = 1.84), mean score for "*During the past three months, how often did you have bad dreams without awakening*?" was 3.57 (SD = 2.01), and for "*During the past three months, how often did you remember nightmares*", it was 3.90 (SD = 2.07).

6.4. Infatuation and Sleep Quality

For overall sleep quality (PSQI total score), we did not find a statistically significant difference between the infatuated and control group ($t(589) = 0.18$; $p = 0.87$). However, concerning sleep disturbances according to the PSQI, the infa-

Table 3. Mean score and standard deviation of PSQI sum score and separated subscales.

	M	SD
PSQI sum score	7.09	3.37
Subjective sleep quality	1.04	0.64
Sleep latency	1.98	1.57
Sleep duration	0.23	0.55
Sleep efficiency	0.52	0.77
Sleep disturbances	1.07	0.38
Use of sleep medication	0.05	0.32
Daytime dysfunction	2.19	1.32

Notes: M = Mean Score; SD = Standard Deviation; PSQI = Pittsburgh Sleep Quality Index.

Table 4. Mean score and standard deviation of NEQ sum score and separated subscales.

	M	SD
NEQ sum score	5.46	5.67
Anxiety/depression	2.59	2.06
Problems of concentration and attention	1.33	1.72
Aggression	1.08	1.60
Antisocial behavior	0.25	0.63
Physical symptoms	0.22	0.56

Notes: M = Mean Score; SD = Standard Deviation; NEQ: Nightmares Effects Questionnaire.

tuated group reported to have more sleep disturbances ($t(266.64) = 2.84$; $p = 0.005$; $\alpha_{(\text{Bonferroni})} = 0.05/7 = 0.007$ for the multiple comparisons of the PSQI components). For all other components of the PSQI, we did not find any statistically significant difference (Table 5).

6.5. Infatuation and Dreams

No difference was found between the infatuated and control group regarding the frequency of positive dreams (Mann-Whitney: $z = -0.58$, $p = 0.56$).

6.6. Lovesickness and Sleep Quality

The t-test revealed that lovesick adolescents scored significantly higher (worse) in the PSQI sum score than adolescents of the control group ($t(128) = 3.06$; $p < 0.01$). Analyzing the separated components of the PSQI, we found that the lovesickness-group reported more sleep disturbances ($t(37.25) = 3.29$; $p = 0.002$) and more daytime dysfunction ($t(182) = 3.30$; $p = 0.001$) than the control-group. However, no significant differences have been found in the other components. The results of the group comparison concerning the PSQI are presented in Table 6.

6.7. Lovesickness and Dreams

With respect to the total score of the NEQ, adolescents of the lovesick group

Table 5. Results of the T-test comparing PSQI scores of the infatuation-group and the control-group.

	Mean (*SD*)		*T*	*df*	*p*
	Infatuation (n = 439)	**Control (n = 152)**			
PSQI sum score	7.02 (3.42)	6.96 (3.23)	0.18	589	0.856
Subjective sleep quality	1.04 (0.66)	1.01 (0.65)	0.52	589	0.603
Sleep latency	1.93 (1.52)	2.02 (1.68)	−0.54	589	0.590
Sleep duration	0.22 (0.56)	0.26 (0.54)	−0.75	587	0.452
Sleep efficiency	0.52 (0.76)	0.55 (0.77)	−0.45	586	0.655
Sleep disturbances	1.08 (0.37)	0.99 (0.36)	2.85	266.64	0.005*
Use of sleep medication	0.07 (0.37)	0.03 (0.20)	1.67	487.77	0.095
Daytime dysfunction	2.16 (1.32)	2.13 (1.24)	0.26	589	0.793

Notes: *p ≤ 0.05; Mean = Mean score; SD = Standard deviation; T = T-test value; df = Degrees of freedom; p = Two-tailed significance. Type-I error rate for all comparisons was set to 0.05/7 = 0.007. (Bonferroni corrected multiple comparisons of components of the PSQI; the test of the PSQI sum score is not corrected). Abbreviations: PSQI = Pittsburgh Sleep Quality Index; Infatuation = Infatuation-group; Control = Control-group; n = Number.

Table 6. Results of the T-test comparing PSQI scores of the lovesickness-group and the control-group.

	Mean (*SD*)				
	Lovesickness (n = 32)	**Control (n = 152)**	*T*	*df*	*p*
PSQI sum score	8.88 (3.18)	6.96 (3.23)	3.06	182	0.003*
Subjective sleep quality	1.21 (0.55)	1.01 (0.65)	1.73	182	0.086
Sleep latency	2.53 (1.68)	2.01 (1.68)	1.59	182	0.115
Sleep duration	0.31 (0.59)	0.26 (0.53)	0.51	181	0.610
Sleep efficiency	0.56 (0.76)	0.55 (0.77)	0.06	180	0.951
Sleep disturbances	1.31 (0.54)	0.99 (0.36)	3.29	37.25	0.002*
Use of sleep medication	0.00 (0.00)	0.03 (0.20)	−0.75	182	0.453
Daytime dysfunction	2.94 (1.41)	2.13 (1.24)	3.30	182	0.001***

Notes: *p ≤ 0.05; ***p ≤ 0.001; Mean = Mean score; SD = Standard deviation; T = the T-test statistic; df = Degrees of freedom; p = two-tailed significance. Type-I error rate for all comparisons was set to 0.05/7 = 0.007. (Bonferroni corrected multiple comparisons of components of the PSQI; the test of the PSQI sum score is not corrected). Abbreviations: PSQI = Pittsburgh Sleep Quality Index; Lovesickness = Lovesickness-group; Control = Control-group; n = Number.

showed more (negative) effects than the control group ($t(182) = 4.07$; $p < 0.001$). Especially the negative repercussions *anxiety/depression* ($t(182) = 4.23$; $p < 0.001$), *concentration and attention problems* ($t(182) = 2.66$; $p = 0.009$), *aggression* ($t(182) = 3.17$; $p = 0.002$) and *physical symptoms* ($t(33.60) = 2.15$; $p = 0.039$) occur more frequently in the lovesickness-group (see Table 7).

Additionally, lovesick adolescents reported of significantly more negative dreams without awakening ($U(32,152) = 1457$; $p < 0.001$)/($z = -3.62$; $p < 0.001$) and nightmares ($U(32,152) = 1579$; $p = 0.002$)/($z = -3.15$; $p = 0.002$).

Table 7. Results of the T-test comparing NEQ scores of the lovesickness-group and the control-group.

	Mean (*SD*)				
	Lovesickness (n = 32)	**Control (n = 152)**	***T***	***df***	***p***
NEQ sum score	9.12 (5.11)	4.72 (5.65)	4.07	182	<0.001***
Anxiety/depression	4.09 (2.96)	2.06 (2.36)	4.23	182	<0.001***
Concentration and attention problems	2.09 (1.55)	1.20 (1.75)	2.66	182	0.009*
Aggression	2.03 (1.69)	1.01 (1.64)	3.17	182	0.002*
Antisocial behavior	0.41 (0.71)	0.30 (0.70)	0.76	180	0.449
Physical symptoms	0.50 (0.92)	0.14 (0.41)	2.15	33.60	0.039*
			U	***Z***	***P***
Negative dreams without awaking	4.63 (1.88)	3.20 (1.99)	1457.00	−3.62	<0.001***
Nightmares	4.78 (2.04)	3.45 (2.11)	1579.00	−3.15	0.002

Notes: *p ≤ 0.05; ***p ≤ 0.001; Mean = Mean score; SD = Standard deviation; T = the T-test statistic; df = Degrees of freedom; U = the Mann-Whitney U test statistic; Z = the Mann-Whitney U test Z-score; p = two-tailed significance. Type-I error rate for all comparisons was set to 0.05/7 = 0.007. (Bonferroni corrected multiple comparisons of components of the PSQI; the test of the PSQI sum score is not corrected).

7. Discussion

The purpose of this study was to investigate if infatuation and lovesickness are related to sleep quality and dreams in adolescents. The transitions on physiological, psychological and behavioral levels [2] [3] [4] [17] [18] [19] [25] caused by infatuation and lovesickness suggest that there might also be influences on sleep quality and dreams. Previous research suggested impaired sleep quality due to circadian changes in adolescence also found in this sample [30].

Infatuated adolescents did not report a higher sleep quality and more positive dreams than adolescents in the control group. On the contrary, infatuated adolescents showed significantly more sleep disturbances like problems to fall asleep, nightly or early morning awakening, and breathing difficulties. However, we found that adolescents who suffer from lovesickness had a lower sleep quality than adolescents in the control group. Especially the PSQI-components "*sleep disturbances*" and "*daytime dysfunction*" were affected. Additionally, lovesickness was related to more negative dreams without awakening, a higher frequency of nightmares, and more daytime effects of nightmares. The findings of this study do not replicate the results of Brand and colleagues [2]. Brand and colleagues reported that infatuated adolescents report a higher subjective sleep quality, decreased daytime sleepiness, and increased concentration during the day. Yet, in their study, Brand and colleagues [2] included adolescents being in a much earlier stage of a romantic relationship (mean duration of romantic relationship = 5.3 months; *SD* = 6.78) compared to the sample in this study. However, in a follow-up analysis, we compared infatuated adolescents being in a relatively short relationship (no longer than 8 months) to those being in a longer re-

lationship and did not find any differences on our study variables. An additional alternative explanation could be that although infatuated adolescents scored relatively high in the Y-BOCS, it is conceivable that numerous adolescents of the infatuation group already passed the early and intense stage of infatuation and its (physiological) effects. Marazziti & Canale found that hormonal changes in infatuated individuals reverse after a few months [5]. Hormonal changes in infatuated adults being in early phases of their romantic relationship (no more than six months) have been found to level off 12 - 18 months later. With respect to the components of the PSQI, infatuated adolescents report more sleep disturbances. These findings could be attributed to the fact that infatuation is related to hormonal changes like increased cortisol levels [5] and that attachment and social contacts are supported by a moderate level of stress [6] [7] [8] [9] [31]. On the other hand, it is conceivable, that the beginning of a romantic relationship lead to cognitive arousal, brooding and focusing on the relationship, which causes stress [3] [4] [5]. Infatuation, although known as a positive life event [10], might be on the other hand a stressful experience which causes sleep disturbances. Coming back to our results concerning the relation of infatuation and overall sleep quality, our findings fit rather to the results of Bajoghli *et al*. [10] [11] who have shown that infatuation is not related to a higher sleep quality in Iranian adolescents. Unfortunately, the authors do not report about a restriction of relationship duration in their infatuation group. This supports the assumption that the connection between infatuation and sleep could be moderated by relationship duration. However, in a second follow-up analysis, we did not find a relation between sleep quality and infatuation moderated by relationship length. Bajoghli *et al*. explained their non-significant findings by taking into consideration cultural rules which possibly lead Iranian parents to supervise their children's behavior more thoroughly, especially regarding to sleep patterns [10]. To clarify, whether infatuation affects sleep pattern differently across cultures, further cross-cultural research is needed.

The connection between infatuation and dreams in adolescents has not been investigated before. Based up on the continuity-hypothesis [12] [13] [14], presuming that dreams reflect on waking life experiences, we hypothesized that the positive life event of being infatuated [10] should influence adolescents' dreams. Yet, our findings do not support this hypothesis. Again, due to the unrestricted relationship duration participants may have passed the intensive stage of infatuation [5] and, hence, the effects of infatuation leveled off.

The association between lovesickness and sleep quality is mainly unexplored. The outcomes of this study correspond to the statement of Senger [20], indicating that 83% of the male and 80% of the female interviewed participants suffered from sleep disturbances. Besides, sleep disturbances were mentioned as a typical characteristic of lovesickness by Maurer & Bred [21]. However, both articles did not focus on adolescents. Especially Maurer & Bred concentrated on lovesickness of married couples or within relationships lasting for years. In a broader sense, our findings also fit to previous studies where social stress [22] and nega-

tive pre-sleep emotions [23] have been identified as predictors for lower sleep quality. Including the reported reasons for lovesickness in our sample (*i.e.*, separation of the partner or a one-sided love without reply), it is obvious that lovesickness is a kind of social stress because it generates in interactions with a beloved person. In addition, the finding that there are negative effects of lovesickness on sleep quality in adolescents, is in line with previous studies focusing on the consequences of lovesickness and romantic relationship breakups on depressive feelings [19] [32] [33]. Furthermore, sleep is known to be affected by depressive disorders [34]. Therefore, the derivation of our presumption that lovesickness influences dreams just as depressive disorders is supported by our findings. All in all, the comparison of our outcomes with these few previous examinations underline that more research is needed to clarify how lovesickness is related to sleep patterns, particularly in adolescence.

Our findings concerning lovesickness and negative dreams can be explained by the continuity hypothesis [12] [13] [14]. The painful waking life experience of suffering from lovesickness might be reflected in adolescent's dreams and therefore lovesickness leads to more negative dreams and nightmares. However, the comparison of our results and the findings of these investigations should be drawn carefully as the mentioned previous investigations [24] [35] focused on adult patients, not on adolescent ones. Interpreting the finding that adolescents who suffer from lovesickness report more nightmare effects, it has to be considered that the nightmare effects might just display the consequences of suffering from lovesickness. Further longitudinal research has to clarify, how lovesickness predicts dreams and nightmares in adolescents. In addition, it has to be examined whether these effects are moderated by depressive symptoms.

Some limitations have to be taken in consideration. First of all, the sample is unbalanced for gender and therefore generalizability is limited. Furthermore, some participants reported to be infatuated and lovesick at the same time and the size of all groups was unbalanced. Multiple compilation and faked data entries could not be ruled out completely even though no duplicates were found. The measurement of sleep quality has only been a subjective self-report. Objective sleep related measurements like actigraphy could be reasonable [36]. In addition, it has to be mentioned that the NEQ was primarily drawn up to measure the effects of nightmares. For further research, it could be appropriate to use a daily dream diary to have more detailed information about different types of dreams (e.g., positive dreams related or unrelated to the beloved person, nightmares). In addition, the NEQ measures the effects of nightmares on daily mental and physiological states. It is doubtful whether these states can be seen as consequences of nightmares or just as a consequence of lovesickness itself. Finally, the different questionnaires refer to different periods of time: the PSQI refers back to the last four weeks, the NEQ refers to the last three months and the items of the Y-BOCS and lovesickness-questionnaire refer to the current state. Therefore, it is possible that assessing states before getting infatuated or lovesick adulterate the results, particularly in the examination of sleep quality.

8. Conclusion

To sum up, this study supports the assumption that lovesickness is related to lower sleep quality and more negative dreams. The postulated association between infatuation and higher sleep quality and between infatuation and positive dreams could not be found. To the contrary, infatuation seems to be related to sleep disturbances and low daytime functioning. Future studies, using improved measurement instruments and a balanced sample are needed to expand findings in this interesting field of research. Infatuation and lovesickness are known as widespread experiences in adolescents of all cultures. Especially, if the possible consequences with clinical relevance are taken into consideration, there remains no doubt that research in this field is not sufficient yet. The results hint to the notion that lovesickness should be integrated and dealt with in new approaches of insomnia treatment.

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Declaration

Ethics approval and consent to participate. The study was approved by the Ethics Committee of Bielefeld University (Number: EUB-2015-045). Participants gave their informed consent and were informed that participation was voluntary. The study follows the latest version of the Declaration of Helsinki.

Availability of Data and Materials

The datasets during and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

AS made substantial contributions to conception and design, interpretation of data and has been involved in drafting the manuscript and revising it critically. NB made substantial contributions to acquisition and analysis of data and has been involved in drafting the manuscript. FN made substantial contributions to analysis and interpretation of data. MC made substantial contributions to analysis and interpretation of data. All authors read and approved the final manuscript.

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List of Abbreviations

Y-BOCS, Yale-Brown Obsessive Compulsive Scale;
NEQ, Nightmare Effect Questionnaire;
PSQI, Pittsburgh Sleep Quality Index.