

# The Relation of Sleep, Distress, and Coping Strategies—What Male and Female Students Can Learn from Each Other?

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## Abstract

Sleep quality, distress, and coping strategies differ between male and female students. However, effects of gender on their relation have not been evaluated. Therefore, the primary aim of this study was to confirm gender differences on sleep quality, chronic distress, and various coping strategies, as well as to examine gender differences in their relation to each other. A cross-sectional online study including several sleep-related self-report measures was completed by 6379 German students. After excluding all cases with missing data on the variables gender, psychiatric disorder, and medication, the final sample consisted of 5889 students with a mean age of 23.10 years (SD = 2.67) for men and 22.64 years (SD = 2.56) for women. Data from the Pittsburgh Sleep Quality Index, the Trier Inventory for Chronic Stress, and the Proactive Coping Inventory were analyzed. Results showed that women reported to have a poorer sleep quality, a higher level of chronic distress, and use social support more often than men. The hypothesized model revealed gender differences on the model level. However, these differences only occurred between avoidance coping and distress, as well as between various coping strategies. The biological gender influenced each of those three variables, but barely their relation to each other. Participants' gender role might explain gender differences in coping strategies and their impact on distress. Furthermore, the type of stressor and subjective or objective measured sleep parameters might show more gender differences on this relation. Conclusively, gender-specific trainings or interventions are not necessary, however, gender differences should be considered during the implementation process.

## Keywords

Gender Differences, Sleep Quality, Chronic Distress, Coping, University Students

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## 1. Introduction

Poor sleep quality and insomnia are very common health problems in adults [1] and especially in a student population due to their inadequate sleep habits and patterns like insufficient sleep, irregular bedtimes on weekdays, and weekends [2] [3]. Prevalence rates vary between 9.4% in US college students [4] and 14.9% in German students [5], whereby women are at higher risk than men [5] [6]. The ratio for men and women developing insomnia symptoms is increasing with age [7]. According to Kabrita *et al.* [8] and Tsai *et al.* [9], women reported significant earlier bedtime and rise time, longer sleep-onset latency, more awakenings, and poorer sleep quality based on subjective sleep measures (sleep log), whereas objective sleep measures (polysomnography) showed a better sleep quality, longer sleep duration, shorter sleep-onset latency, and higher sleep efficiency in women compared with men [10]. Research also stated that sleep is essential for an efficient consolidation of knowledge and skills [11]. Therefore, sleep problems and insomnia can be detrimental for students' cognitive functioning and behavioral performance regardless of their gender. Enhancing these sleep habits might improve different areas of life like academic performance [11] [12], cognitive functioning [13] [14], physiological and psychological health [3] [5] [15]. More precisely, poor sleep quality reduced neurobehavioral functions, e.g., attention, memory, executive functions. Thereby, sleep in men and women, seems to be necessary for learning and memory [11], and a good night sleep benefits procedural as well as declarative memory [14]. As especially academic performance is an important part of students' life and is significantly associated with earlier bedtimes and waking times in the morning [8]. In order to improve sleep quality and diminish its related consequences, it is necessary to detect the causes and influencing factors concerning poor sleep quality.

One of the most researched factors which affect sleep quality is the perceived stress level defined as the reaction towards a critical stimulus [16]. Shaikh and colleagues [17] found that male and female students experienced severe symptoms of stress over a four-week period reporting low moods (82%), problems with concentration (71%), and change in sleep patterns (61%), whereby a higher stress level is associated with more sleep problems, e.g., shorter sleep time, poorer sleep quality, and a higher level of daytime sleepiness for both male and female students [18] [19]. Women (13.9%) are again significantly more affected than men (8.2%) [20]. Particularly psychosocial stress is associated with overall poor sleep quality and higher sleep latency, but only in women [21], who also scored higher on scales for chronic distress and minor daily stressors [22]. However, these differences are not attributed to the amount of stressful life events, rather to the rating of those [22]. Women perceive various scenarios as more stressful, negative, and uncontrollable [22] [23].

Besides the direct influence of stress on sleep, one has to keep in mind that other factors like coping strategies affect different sleep indices indirectly via distress. Responding to stressful situations, people can either increase their activity, which is incompatible with sleep, or decrease activity to preserve energy, which is compatible with extended sleep. However, active as well as passive coping reduces stress, which in turn

enhances sleep quality and other sleep parameters [24], though the type of coping strategy is important in order to reduce stress. Emotion-focused and avoidant coping correlated positively with perceived stress [25]-[27], whereby task-oriented and problem-solving coping was negatively associated with perceived stress [28]. In general, women use coping strategies more often than men [23] [27] [29]. Women are more likely using emotional-focused strategies like seeking social support, rumination, but also avoidant coping [22] [26] [29], whereas men prefer problem- and task-oriented coping [23] [26]. Beyond, the type of stressor determined the selected coping strategy [29]. Men are more likely avoiding and venting relationship stressors, whereby women overall use more coping strategies with health stressors. However, effect sizes of these gender differences are quite small [29].

Previous research showed that gender influenced various sleep parameters, the stress level, as well as the type of coping strategy used. Furthermore, sleep is affected by distress and indirectly by coping. Therefore, the primary aim of this study was to confirm gender differences on those three variables, as well as to examine gender differences for the relation of sleep, stress, and coping to consider them in preventions, trainings, and interventions.

## 2. Method and Materials

### 2.1. Sample and Procedure

This study was a cross-sectional online study including several sleep-related self-report measures and was completed by 6379 students from German universities. Only students between 18 and 30 years were included ( $n = 6029$ ). Exclusion criteria were missing data on the grouping variable gender, as well as on the control variables psychiatric disorder and medication. The final sample consisted of 5889 students (4212 female, 1677 male) with a mean age of 23.10 years ( $SD = 2.67$ ) for men and 22.64 years ( $SD = 2.56$ ) for women (see **Table 1**). Prior to testing, all students were informed about content and goal of the study. They gave their informed consent and were adequately informed that they could end the study at every time without any consequences. The study was accomplished by the ethics committee of the Bielefeld University.

### 2.2. Materials

*Pittsburgh Sleep Quality Index (PSQI)*. Subjective sleep quality was measured with the

**Table 1.** Socio-demographic characteristics for students.

Variables	Female	Male	Total
N	4212 (71.52%)	1677 (28.48%)	5889
Mean Age	22.64 (SD = 2.56)	23.10 (SD = 2.67)	22.77 (SD = 2.60)
Psychiatric disorder	295 (79.09%)	78 (20.91%)	373
Medication	112 (78.87%)	30 (21.13%)	142

Note. SD = Standard Deviation.

German version of the PSQI [30] an international established screening instrument, which gathers sleep quality retrospectively over a period of four weeks and consists of 18 items which are classified to the following seven components: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and day time dysfunction. The total score which can be generated by adding all scores of the components could range from 0 to 21, whereby a score between five and ten indicates impaired sleep quality and a score above ten a chronic sleep problem. The instrument has demonstrated acceptable overall reliability coefficients between 0.77 and 0.83 [31] [32], as well as a high specificity and sensitivity in identifying patients with sleep disorders (above 80%) [33] [34].

*Trier Inventory for Chronic Stress (TICS)*. The third edition of the TICS [35] is composed of 57 items where participants rate their subjectively perceived stress level on a five-point scale from “never” to “very often” retrospectively over a period of three months. Items can be summarized to nine subscales: work overload, social overload, pressure to perform, work discontent, excessive demands at work, lack of social recognition, social tension, social isolation, and chronic worrying, whereby higher scores indicate a higher level of distress. Additionally, a screening scale including 12 items can be generated to a global score for chronic stress which will be used for multi-group path analysis. Studies showed good internal consistencies between 0.81 and 0.91 [35] [36], and a negative relation between stress types and sleep quality [35].

*Proactive Coping Inventory (PCI)*. This inventory consists of 55 items that were attributed to seven subscales: proactive coping, reflective coping, strategic planning, preventive coping, instrumental support seeking, emotional support seeking, and avoidance [37]. Higher scores indicate a higher level of reactive coping strategies, except for the subscale avoidance coping. Greenglass *et al.* [37] reported a seven-factor model with good construct validity and acceptable reliabilities. Due to significant correlations between the subscales, Roesch, Aldridge, Huff, Langner, Villodas and Bradshaw [38] conducted a confirmatory factorial analysis (CFA) in a large multiethnic sample. Results showed that a three-factor model fits as well as a seven-factor model, including the factors logical analysis/problem solving, social support, and avoidance. Those three factors are consistent with dimensions of other instruments, e.g. Coping Strategies Indicator (CSI). A CFA using data from this study revealed a better fit for these three factors and therefore, will be used for statistical analysis.

### 2.3. Statistical Analysis

Calculations for descriptive statistics and group comparisons were carried out with IBM SPSS Statistics 22. T-tests for independent samples were used to compare mean differences between male and female participants if the data was normal distributed and Mann-Whitney-Tests for non-normal distributed data. The effect size Cohen's *d* will be reported for normal and non-normal distributed data, due to the large discrepancy of the group sample sizes. The software IBM SPSS AMOS 22 was used to conduct multi-group analysis for the hypothesized path model with a test for critical ratios. This

method estimates the male and female model simultaneously and includes a difference test for regressions weights and covariances. For the multi-group analysis, the chi-squared/degrees of freedom test ( $\chi^2/df$ ), the Comparative Fit Index (CFI), and the root mean square error of approximation (RMSEA) were used as goodness-of-fit indices. The p-value for all calculations was set to  $p < 0.01$  due to the large sample size. A screening for missing values revealed at least one missing value on 17 items. In order to replace those missing values using the hot deck imputation method [39], the Little's missing completely at random test with EM estimation was used and revealed an insignificant chi-square statistic ( $\chi^2 = 7238.16, df = 7212, p = 0.412$ ). During the imputation process each missing value was replaced with an equivalent value of another participant which was computed based on various selected variables.

### 3. Results

Only few differences between male and female students were found regarding the study variables (Table 2). For both groups poorer sleep quality was associated with a higher level of chronic distress, less use of problem solving, and social support as coping strategies. Furthermore, chronic distress was positively correlated with avoidance and negatively with problem solving and social support. The coping strategy avoidance was neither significantly correlated with chronic distress nor social support. Only the relations between chronic distress and avoidance, as well as problem solving and social support were different for both groups, with being greater for men.

#### 3.1. Group Differences

Comparing male and female students' mean reported levels of sleep quality, chronic distress, and various coping strategies, significant gender differences did not emerge on all variables (Table 3). In terms of sleep quality, female students reported a significantly poorer sleep quality, a significantly higher level of perceived chronic distress, and significantly more use of social support as a coping strategy. No significant differences were obtained between male and female students for the coping strategies problem solving and avoidance. Although male and female students differed on various vari-

**Table 2.** Correlations between stress and sleep for men (above diagonal) and women (below diagonal).

Variable	1	2	3	4	5
1. Sleep Quality	-	0.427**	-0.111**	0.015	-0.116**
2. Chronic Distress	0.416**	-	-0.124**	0.115**	-0.161**
3. Problem Solving	-0.082**	-0.074**	-	-0.171**	0.283**
4. Avoidance	-0.005	0.045*	-0.096**	-	0.005
5. Social Support	-0.165**	-0.169**	0.208**	-0.010	-

Note. Higher scores indicate worse sleep quality, more chronic distress, better reactive coping strategies (problem solving, social support), more negative coping strategies (avoidance), \* $p < 0.01$ , \*\* $p < 0.001$ .

**Table 3.** Group comparisons on stress and sleep.

Variable	Women (n = 4212)	Men (n = 1677)	Gender differences	Cohen's d
Sleep Quality mR	3003.76	2797.42	<b>U = 3,285,262**</b>	0.15
Chronic Distress M (SD)	19.08 (8.88)	15.66 (8.61)	<b>t(5887) = 13.63**</b>	0.39
Problem Solving M (SD)	118.87 (13.45)	119.46 (14.73)	t(2849.27) = -1.42	-
Avoidance M (SD)	7.10 (1.88)	6.99 (1.88)	t(5887) = 2.07	-
Social Support mR	3156.42	2413.99	<b>U=2,641,259.5**</b>	0.44

*Note.* Group differences were analyzed using t-tests for normal distributed data and Mann-Whitney-Tests for not normal distributed data, mR = mean rank, M = mean score, SD = standard deviation, U = test-statistic for Mann-Whitney-Test, Cohen's d=effect size, \*p < 0.01, \*\*p < 0.001.

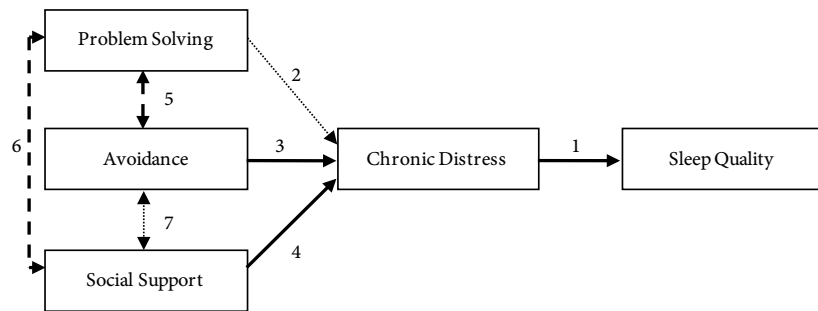
ables, effect sizes were quite small for sleep quality, problem solving, and avoidance, and medium by tendency for chronic distress and social support.

### 3.2. Multi-Group Analysis

The multi-group path analysis was computed to assess gender differences on the relation of sleep quality, chronic distress, and coping strategies. **Figure 1** illustrates the path model tested. Good fit statistics were obtained for the unconstrained model ( $\chi^2/df = 8.80$ , CFI = 0.97, RMSEA = 0.04) indicating that a common model could be assumed across groups. Assuming that both groups differ, analyses from a fully unconstrained to a fully constrained model were conducted. A  $\chi^2$ -difference-test comparing a model with no restrictions (fully unconstrained) and a model with most restrictions (fully constrained) revealed no invariance ( $\Delta\chi^2 = 36.31$ ,  $p < 0.001$ ), indicating that male and female students differ on the model level. Subsequently, the critical ratios of the males and females path coefficients and covariances were assessed to determine which one differed across groups. Standardized coefficients and covariances are shown in **Table 4**. Except for the paths problem solving and distress (path 2), and avoidance and social support (path 7), all paths were significant ( $p < 0.01$ ). Sleep quality was significantly predicted by the level of chronic distress (path 1), which was again influenced by avoidance and social support (path 3 and 4). According to the critical ratios, only the covariances between problem solving and avoidance (path 5), as well as problem solving and social support (path 6) differed significantly for male and female students, with the effects being stronger for males. The path between chronic distress and avoidance showed marginal significance, with the effect being stronger for males again. No relationship emerged between problem solving and chronic distress, as well as between social support and avoidance in both groups.

## 4. Discussion

The primary aim of this study was to examine gender differences for the relation of



**Figure 1.** Tested path model for the relation of sleep quality, chronic distress, and coping strategies. —= significant effect, - - - - = gender differences, ····· = not significant.

**Table 4.** Standardized path coefficients and covariances for women and men.

	Women	Men	Critical ratio
Path coefficient			
1 Sleep Quality ← Distress	<b>0.397**</b>	<b>0.405**</b>	0.73
2 Distress ← Problem Solving	-0.026	-0.056	0.88
3 Distress ← Avoidance	<b>0.043*</b>	<b>0.092**</b>	<b>-1.69†</b>
4 Distress ← Social Support	<b>-0.138**</b>	<b>-0.114**</b>	-0.98
Covariances			
5 Problem Solving ↔ Avoidance	<b>-0.096**</b>	<b>-0.171**</b>	<b>2.91*</b>
6 Problem Solving ↔ Social Support	<b>0.208**</b>	<b>0.283**</b>	<b>-3.20*</b>
7 Avoidance ↔ Social Support	-0.010	0.005	-0.49

Note. †p < 0.05, \*p < 0.01, \*\*p < 0.001.

subjective sleep quality, chronic distress, and various coping strategies, since differences between male and female students in sleep quality [8]-[10], distress [18] [20] [22], and coping strategies [26] [27] [29] are well approved. Therefore, data from a large sample of German students who suffered from disturbed sleep was evaluated.

First, subjective sleep quality differed between male and female students whereby women reported a poorer sleep quality. The effect of gender differences in sleep quality, however, was quite small. Besides sleep quality, Tsai *et al.* [9] investigated gender differences in university students for various sleep parameters and found earlier bedtime and rise time, higher sleep latency, and more awakenings during the night in women. Nevertheless, effect sizes were not reported. Perhaps effect sizes will increase when using other subjective sleep parameters, e.g., sleep-onset latency, sleep efficiency, rise time or time in bed, which are positively correlated with subjective sleep quality, and objective measures in future research [9]. On the other hand, the effect of gender differences could be attributed to gender differences on other variables like anxiety and depression which in turn influence sleep [40]. A higher level of anxiety and depressive symptoms is associated with a shorter sleep duration and reduced sleep quality [41] [42]. Women,

thereby, tend to be more affected in developing a depression throughout their adolescent and adult life [43].

Second, a medium effect of gender difference was found regarding students' subjective distress level. Thus, women reported a higher level of perceived chronic distress compared to men. Consistent with previous research, this study showed that distress and sleep quality were highly associated [18] [19]. A higher level of perceived distress led to a poorer sleep quality in men and women. However, discriminating between different types of distress, e.g., psychosocial, work-related, might cause gender differences in the relation of distress and sleep quality. Especially increased psychosocial distress in women is associated with more sleep problems [21]. Furthermore, the individual rating of stressful events should be taken into account as women perceive them as more stressful, negative, and uncontrollable [22] [23].

Third, a comparison of male and female students regarding their coping strategies in problem solving, social support, and avoidance, revealed differences only concerning social support. Women used more social support when experiencing stressful events. Effect size was medium in contrast to reported small effects by Tamres *et al.* [29], whereby a wider spectrum of age groups was considered in the review of 2002. The present study focused on university students and their life style might have resulted in a greater use of social support. Problem solving and avoidance, however, was used equally by both men and women. In contrast to previous research by Beasley *et al.* [26] and Eaton *et al.* [23], where problem solving as coping was used more often by men and avoidant coping by women. Nevertheless, this non-significant gender difference in problem solving and avoidance might be explained by participants' gender role instead of their biological gender. Dyson *et al.* [44] found that masculinity is positively correlated with problem-focused and emotion-focused coping, and femininity with emotion-focused and avoidant coping. Consequently, gender role might lead to differences on coping style and its influence on distress.

Although the results of the hypothesized model indicated a difference between male and female students, significant gender differences could only be found for problem solving and avoidance, problem solving and social support, as well as avoidance and chronic distress by tendency. The latter relation was stronger for men, which seems counter-intuitive to previous research, where women use more avoidant coping and therefore, distress should be more affected by avoidance in women [22]. This might be determined by the type of stressor. Men use avoiding and venting more often when they are exposed to relationship stressors [29].

This cross-sectional study was based on self-report measures gathering information about students' sleep quality, chronic distress, and coping strategies whereby those measures referred to different periods of time. So far, research investigated gender differences in sleep, distress, and coping in student populations [8] [9] [17] as well as the general population [10] [22]. Due to the specific group of university students examined in this study generalizing the present results to patients or other age-groups is not fully possible. Therefore, future research should consider a wider range of groups, a longitu-



dinal design, and more sleep parameters including subjective (sleep logs) as well as objective measurements (actigraphy, polysomnography). This might lead to more valid statements about gender differences in the relation between sleep quality, chronic distress, and coping.

## 5. Conclusion

As expected, female students reported poorer sleep quality, a higher subjective stress level, and an increased level of social support as a coping strategy. Although, the relationship between sleep quality, chronic distress, and coping strategies was barely affected by participants' biological gender given the significant gender differences on each variable, coping might be influenced by participants' perception of femininity and masculinity. Future studies might incorporate various types of stressors and more sleep parameters, while developing gender-specific programs for sleep disturbances are not required, though it should be considered during the implementation process.

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## Conflict of Interest

J. Faber and A. Schlarb state that there are no conflicts of interest. All studies on humans described in the present manuscript were carried out with the approval of the responsible ethics committee and in accordance with national law and the Helsinki Declaration of 1975 (in its current, revised form).

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