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Subjective and Objective Sleep Difficulties in Women with Fibromyalgia Syndrome

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Fibromyalgia Syndrome (FMS) is a chronic condition that is defined primarily as a syndrome characterized by widespread musculoskeletal pain and multiple tender points on clinical examination (Wolfe, 1989; Korzun, Young, Engleberg, Brucksch, Greden & Crofford, 2002). FMS is a common condition reportedly affecting as may as 5 million Americans, with a peak incidence in the 20 to 60 year old age group (Lawrence et al., 2008; Smith, 1998; Wolfe, Ross, Anderson, Russell & Herbert, 1995). FMS is six to eight times more commonly diagnosed in women than men, and women with FMS report significantly more tender points, pain and fatigue than men (Bennett, 1995; Yunus, Inanici, Aldag & Mangold, 2000). FMS is essentially a diagnosis of exclusion based on the diagnostic criteria of the American College of Rheumatology (Wolfe, et al., 1990); the diagnosis requires a history of at least 3 months of widespread pain and the presence of pain on palpation in at least 11 of 18 designated tender points.

In addition to pain, persons with FMS report a variety of other troubling symptoms including sleep disturbances, fatigue, depression, anxiety, irritable bowel syndrome, paresthesias and stiffness (Wilke, 1996). Although not included in the standard diagnostic criteria, sleep disturbances such as difficulty falling asleep, frequent awakening during the night, and early awakening with difficulty returning to sleep are very commonly reported by persons with FMS. Rutledge, Jones and Jones (2007) found that the majority of the 2,580 persons with FMS in their descriptive online survey reported moderate or greater difficulty with non restorative sleep (60%) and not being able to stay asleep (51.2%). In addition, 45.3% of the participants reported moderate or greater difficulty falling asleep. Shaver and colleagues (2006) found that women with FMS (N=442) reported taking more than twice as long to fall asleep then controls without FMS (N=205) and twice as many nighttime awakenings.

It has been suggested that symptom severity for those with FMS may be modulated by the interaction of sleep disturbance and daytime pain and distress (Edinger, Wohlgemuth, Krystal, & Rice, 2005). This interaction of symptoms may contribute to a cyclic symptom experience of pain, poor sleep, fatigue, increased pain, poor sleep and fatigue (Shaver et al., 1997). Depression, which occurs in approximately 27% of those with FMS, may also

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contribute to sleep difficulties (Offenbaecher, Glatzeder & Ackenheil, 1998). Using actigraphy to objectively measure sleep difficulty, Korzun and colleagues (2002) found that persons with FMS and comorbid depression had significantly lower sleep efficiency than persons with FMS only or a group of healthy controls. Thus, poor sleep quality might explain greater fatigue, depression and impairments in everyday functioning (Landis, Frey, Lentz, Rothermel, Buchwald & Shaver, 2003; Korzun et al., 2002).

Despite the fact that almost every article describing FMS symptoms refers to sleep disturbances, the vast majority of studies have relied on self-reports of sleep difficulties (Shaver et al., 2006). The reliance on self-report is problematic given existing evidence that subjective sleep complaints do not correlate strongly with objective evidence of actual deficits (Edinger, Fins, Glen, Sullivan, Bastian, Marsh et al., 2000). Interestingly, Landis and colleagues (2003) found that while women with FMS reported significantly poorer sleep quality compared to controls, objective sleep indicators from actigraphy were not significantly different between the two groups. Similarly, Lavie and colleagues (1992) found that self-reported sleep quality did not correlate with actigraphic measures of sleep for a sample of persons with chronic rheumatological pain.

Considered together, existing literature indicates that some, but not all, of those with FMS with subjective sleep complaints have objective evidence of sleep deficits. Given the serious consequences of insomnia on health (e.g. compromised cognitive and motor abilities and weakened immune systems) it is important for primary care providers to correctly identify and treat these problems in women with fibromyalgia (Henry, McClellen, Rosenthal, Dedrick & Gosdin, 2008). Edinger and colleagues (2000) stress that identifying factors that predict actual sleep deficits is a necessary first step in designing successful treatments for those experiencing insomnia. Thus, the purpose of this study was to compare two groups of women with FMS - those with objective sleep disturbances based on actigraphy and those who do not have objective sleep deficits. Specifically we compared the two groups of women with FMS to address the following questions:

1. Do women with objective sleep deficits differ significantly from women without objective sleep deficits with regard to age, length of diagnosis and BMI?
2. Do women with objective sleep deficits report greater pain on the tender point exam than women without objective sleep deficits?
3. Do women with objective sleep deficits report poorer perceived sleep quality than women without objective sleep deficits?
4. Do women with objective sleep deficits report more depressive symptoms than women without objective sleep deficits?
5. Do women with objective sleep deficits report greater fibromyalgia impact on functioning than women without objective sleep deficits?

Since primary care providers typically depend on patient statements about their energy, sleepiness, fatigue and functioning to make decisions about additional testing and assessment, we also examined women's written descriptions of their energy, sleepiness,

fatigue, mood and functioning in their 3-day sleep log to explore variations between the groups of women with and without objective sleep deficits.

METHODS

Procedures

Following approval by our IRB, women with FMS were recruited through notices in local newspapers and fliers in physician offices and community sites. Potential participants contacted staff by telephone to indicate their interest in the study. The study was explained to those who contacted research staff and screening for study eligibility (being female, having physician-diagnosed FMS for at least 6 months, and being 20 to 75 years of age) was completed by phone.

Participants in the study described here are a subsample (n=104) of a larger group of women completing baseline data collection for a randomized clinical trial of a wellness intervention. Other women in the larger study did not complete the same actigraphy protocol or experienced an equipment failure on one or more of the days. After completing the phone screening and verbal consent, participants scheduled an appointment for their baseline assessment. A family nurse practitioner (FNP) that was part of the research team conducted this baseline visit for all participants in a community clinic setting. At this visit, the FNP once again explained the study and obtained the written informed consent. In order to calculate BMI, weight was obtained using a portable strain gauge scale (checked for calibration prior to each use) and height was assessed with a portable free-standing stadiometer. The FNP assessed for the tender points (see instruments) and then instructed participants in the use of the actigraph and completion of the activity/sleep log. Women were asked to record daily activities, bed times and rising times as well as any removal of the actigraph in the sleep log. Participants were allowed to continue with their routine medication use during the assessment and were asked to record medications on the sleep log.

Each participant was asked to wear an actigraph and complete a sleep/activity log for 3 days (72 hours). Participants were given a questionnaire booklet to complete during this same time period with the self-report instruments described below. They were asked to return the survey and actigraph (in person or by postage paid mail) after they completed the 72 hours of data collection. Participants received $25 for this baseline data collection.

Instruments

A Background Information Sheet (BIS) was used to collect information on a variety of demographic and disease characteristics that were used to describe the sample. Age, ethnicity, educational status, economic status, and employment status and length of illness were determined from subjects' self reports on the BIS.

Pain was measured by the FNP at the baseline visit using the Tender Point Index (TPI) (Buckelew et al., 1998). The TPI is a behavioral response measuring a subject's reaction to the tender point exam. All of the 18 tender points are palpated using a standard amount of pressure and subject reactions are rated on a 5-point scale (0=no pain to 4=patient

untouchable/ withdrawal without palpation). Scores for the individual points were summed for a total TPI score.

The Center for Epidemiologic Studies -Depression Scale (CES-D) was used to measure depressive symptoms (Radloff, 1977). The CES-D appears to be a valid measure of depressive symptoms among individuals with arthritic conditions and has demonstrated high internal consistency (alpha of .91 in this study) and good discriminant validity (Blalock, DeVellis, Brown & Wallston, 1989; Orme, Reis, & Herz, 1986). Higher scores on this 20-item summated rating scale indicate more depressive symptoms during the past week.

The Fibromyalgia Impact Questionnaire (FIQ) was used to assess the functioning of women with FMS. The FIQ is a self-administered scale designed to quantify the impact of FMS over multiple dimensions. Respondents are asked to rate how often they were able to participate in 10 aspects of daily living on a 4 point likert scale (0=always to 3= never due to FMS). Scores for the items answered are averaged to obtain an overall score for physical functioning. The FIQ also contains 100 mm visual analog scales (scored 0 to 10) measuring work interference, depression, anxiety, sleep, pain, stiffness, fatigue and overall well-being – low scores indicate no effect and 10 equals severe effect. Test-retest reliability of individual FIQ items ranged from .56 to .95 (Burckhardt et al., 1991) and 2- month test-retest reliability of total scores was .67 in preliminary work conducted by the first author. FIQ scores are significantly correlated with scores on the quality of well-being scale and measures of self-rated health (Kaplan et al., 2000). Due to the overlap between the items on the second part of the FIQ (sleep, depression, pain) and other measures in the study, in the analyses described here we used only the average item score for the first 10 items to quantify whether the impact of FMS on functioning differed between the two groups of women. Higher average item scores indicate that FMS has a greater impact on functioning.

In addition to the data from the self-report surveys described above, data for this study were also obtained from the actigraphs and related sleep logs. Actigraphs were used to assess the nature and amount of daily sleep. Actigraphs are wrist-worn digital devices that are capable of monitoring the frequency and duration of movement over time (Leidy, Abbott & Redenko, 1997). The Actigraph, manufactured by Ambulatory Monitoring Inc, was selected because it is a sensitive, non-invasive, easily applied and widely used instrument. The Actigraph is a small, lightweight, portable accelerometer. It has the capability to detect both quantity and intensity of movement. Movement is sampled 10 times per second and stored in an internal memory in investigator-determined epochs ranging from 1 to 5 minutes (I minute in this study). The internal memory allows for continuous data accumulation for up to 11 days.

Actigraphy is unique in that the device is attached to the wrist of an individual for prolonged periods of time and provides continuous activity data with few limitations imposed on the participant. In this study, activity and sleep data were recorded continuously for a 72-hour period. The Actigraph interfaces with an IBM compatible computer for programming and for downloading of data. Using a computer program, the mean number of movements per minute and the standard deviation of overall minutes were derived separately for wake and sleep periods. For sleep, the data include sleep onset latency (time to sleep after ‘lights out’),

total sleep time duration (total minutes of sleep during nighttime), and efficiency (percentage of time asleep while in bed). It should be noted that actigraphy cannot reliably differentiate between rapid-eye-movement sleep stages and nonrapid-eye-movement sleep stages. Test-retest correlations of Actigraph readings for individual subjects range from 0.97 to 0.99. (Patterson et al. (1993). There was a strong correlation between polysomnography (PSG) data and the actigraph's calculation of total sleep time (r=.68), sleep onset latency (r=.87) and sleep efficiency (r=.67) (Edinger et al., 2004).

The daily sleep logs provided essential information for editing the actigraphic data (placement, removal, possible artifacts, etc.) in addition to recording the participants' subjective sleep-related experiences. On the sleep log each participant rated the perceived quality of each night's sleep (1 very good to 5 very bad) for the 3 days that they wore the actigraph. These ratings were averaged to obtain a measure of subjective sleep quality during the time period that the actigraph was recording. Participants were also asked to "briefly describe your energy level, sleepiness, fatigue, mood and ability to get work done" on each day of the sleep log. These brief descriptions were entered in as free text in the data file for analysis.

Data Analyses

Descriptive data analyses were conducted using SPSS for Windows. Frequency distributions, means, and standard deviations (SDs) were calculated for the demographic and FMS-related variables. Data from the actigraph were used to categorize women into one of the two groups – women with objective sleep deficits and those without using criteria reported by Edinger and colleagues (2000). Previous research (Bonnet, 1994) indicates that subjective sleep complaints become apparent when average nighttime sleep is experimentally lowered below 6.5 hours (390 minutes) per night and objective performance deficits are evident after average nighttime sleep is below 6 hours (360 minutes) per night. Thus, following the Edinger et al. (2000) protocol, we initially considered those with less than a 3-night average duration of 6 hours of sleep as having sleep deficits; those with a 3-night average of more than 6.5 hours were considered to have no sleep deficits. Six participants had 3-night average sleep times that fell between 6 and 6.5 hours. Given that subjective sleep quality and performance of daytime activities both suffer as sleep becomes more broken (less efficient), these 6 participants were classified as with or without deficits based on their average sleep efficiency. Those with sleep efficiency less than 85% were classified as "with deficits" (n=1, 361 minutes of sleep; 79% sleep efficiency) and the remaining 5 participants were classified as "no objective deficits" as their sleep efficiency ranged from 85 to 94% (average sleep minutes ranged from 367-385). Following this classification there were 22 women with FMS in the group with objective sleep deficits and 82 women in the group without objective sleep deficits. Independent sample *t* tests were used to assess for significant differences in the quantitative measures between the two groups of women. Due to the large difference in group size, the assumption of homogeneity of variance was checked prior to each comparison. If the assumption was violated, the t for unequal variances is reported and interpreted.

The qualitative data from the sleep log was initially entered as free text in the data file. A matrix listing each participant's description of their "energy level, sleepiness, fatigue, mood, and ability to get your work done" for each of the three days following a night of actigraphy was printed, read and coded by 2 independent raters. The 2 raters were blind to the group assignment (sleep deficits/no deficits) of the participant. The coding scheme included seven possible variables: energy, sleepiness, fatigue, mood, function, pain and other symptoms. Each response was coded on a 4 point scale with 0 =no problem, 1 = mild problem, 2 = moderate problem, 4 = severe problem. The two coders and the first author independently coded and then reviewed the first 21 descriptions and concurred on a list of adjectives that would indicate each of the categories (e.g., I had a good day and was very productive = '0' on functioning). A score was assigned to the variable only if the participant mentioned it in their statement for that particular day. Valid responses across the 3 days were examined and the percentage of women reporting moderate to severe problems in each area was calculated for each day. The percentage of women reporting moderate to severe problems in each area was then compared for women in the sleep deficits and no deficits groups.

RESULTS

A total of 104 women completed the 3 days of monitoring with the AMI actigraph at baseline. The women ranged in age from 24 to 74 years (mean ± SD, 53.40±10.13y) and included 83 whites, 3 African Americans, 2 American Indians and 15 who chose "other" or more than one racial category. Eighteen participants (17%) described their ethnicity as Hispanic. The majority were married (n=65, 62.5%) and not employed (n=67, 64%). The sample was well educated, with 32% (n=33) having completed high school and an additional 64% (n=66) having completed an associate or bachelors degree. The length of time since diagnosis with FMS ranged from 2 to 32 years (mean, 9.23±5.56y). Demographic characteristics for the overall sample and the two subgroups can be seen in Table 1.

Actigraphy data regarding sleep duration, latency, and sleep efficiency were averaged across the 3 days for each woman. Overall, the average number of sleep minutes per night for the entire sample was 426 ± 107.36 minutes. Thus, actigraphy data indicated that on average women in the sample were sleeping for just over 7 hours per night; the shortest sleep time recorded was 102.67 minutes (just less than 2 hours) and the maximum sleep duration was 618.33 minutes – over 10 hours per night. Average sleep onset latency was 35.21 minutes ± 41.36 and sleep efficiency averaged 88.78% ± 13.61%. On the first night of actigraphy, almost half (44%) of the women rated their subjective sleep quality as fairly bad or very bad in their sleep logs.

Table 2 provides the means and SDs on the sleep variables and all other major study variables for the 22 women with objective sleep deficits and the 82 women without objective sleep deficits. Women with objective sleep deficits did not differ significantly from women without deficits on age, length of diagnosis or BMI. As expected, those in the sleep deficits group had significantly lower sleep efficiency ($t=-4.82$, $p<.001$), significantly longer sleep onset latency ($t=2.81$, $p<.01$) and significantly shorter nighttime sleep times ($t=10.92$, $p<.001$) than those in the 'no deficits' group. Compared to women without sleep deficits, women with objective sleep deficits did have significantly higher scores on the tender point

index (t=3.3, p<.01) obtained through patient exam. Women with objective sleep deficits also perceived their sleep (average subjective ratings over three days) as significantly worse (t = 2.53, p<.01), reported significantly more depressive symptoms (t=2.88, p<.01) and reported a greater negative impact on functioning (t=−2.53, p=.013) than those without objective deficits.

A total of 312 text segments (3 for each participant) were coded using the scheme previously described. Table 3 provides the percentage of women in the total group and the groups of women with and without objective sleep deficits that had responses that were coded as moderate or severe problems on one or more of the three days. Overall, the greatest percentage of problems were reported with energy (31.8%), fatigue (25.9%) and functioning (22.1%). As seen in Table 3, there were clear differences in the coded responses of the statements provided by women with and without objective sleep deficits. For example, 54% of the women with sleep deficits reported moderate to severe problems with fatigue compared to 18 % of the women without sleep deficits.

The descriptions were brief and typically addressed the symptoms in the stem of the questions. Responses often linked poor sleep, low energy, high fatigue and poor daytime functioning. While the results of the coding revealed clear group differences, the statements of specific individuals were less clearly differentiated. For example, one woman with objective sleep deficits wrote “Energy level down. Last night was rough so I feel tired and sleepy and fatigued. Mood is agitated because I stayed up late last night to work but still couldn’t finish my work project.”. Another wrote, “ Today my energy level was low because I didn’t sleep well last night. I was sleepy and fatigued and didn’t get anything done.” However, it is important to note that some women without objective sleep deficits also described problems such as “Low energy – everything took greater effort. Fatigued, not sleepy, mood down. Hard time getting things done – spilled stuff, dropped items I was working with; made silly mistakes”.

DISCUSSION

Sleep deficits are an important clinical problem for the population of women with FMS, not only due to the general impact of insomnia on health (Henry et al., 2008) but also because sleep difficulties may interact and perpetuate other symptoms associated with FMS. Our results concur with those of Bigatti, Hernandez, Cronan and Rand (2008) who found that baseline sleep quality predicted 1-year pain in their sample of 492 patients with FMS. Findings from this study and others (Korzum, et al., 2002) suggest that health care providers should be particularly aware of the possibility of sleep problems among those with FMS who are experiencing co-morbid depressive symptoms, greater pain and more disrupted functioning. Other symptoms of fibromyalgia (e.g. pain, depression) may trigger sleep deficits which then perpetuate problems with these symptoms as well as overall functioning. Qualitative data from the sleep logs suggest the reciprocal effects of sleep problems, fatigue, and mood disorders. It is important to consider how these symptoms may contribute to each other and that treating only one symptom may not resolve the problems in the other symptoms.

Although a large number of the women in this study complained of poor sleep quality, a much smaller number had evidence of objective sleep deficits in night time sleep duration or sleep efficiency. While there were clear differences between the groups of women with and without objective sleep deficits (greater depression, greater pain, poorer functioning), clinicians must make decisions about specific individuals. Data from this study may help providers as they seek to identify the overlap among women with subjective complaints of sleep difficulties and the smaller number of women with objective data documenting these deficits.

In this sample, objective sleep deficits were not associated with easily measured clinical variables such as age, length of diagnosis and BMI. However, subjective sleep complaints were greater in those with objective sleep deficits. Thus, careful assessment for sleep difficulties is imperative. As a first step, providers should ask persons with FMS specific questions about their sleep including:

- How much sleep do you usually get each night?
- How many times do you wake up during an average night?
- How long does it take you to fall asleep once you go to bed and turn out the lights?
- In a 7 day period, how many nights would you say are ‘good sleep’ nights?
- Do you notice a difference in your pain on the days following a good or poor night’s sleep?

Those experiencing difficulty based on these initial questions, should be asked to keep a simple sleep log for one week as part of the assessment. On this log, patients can indicate what time they went to bed and woke up, nighttime awakenings and reasons if known (e.g., had to get up to go to the bathroom), naps taken during the day, simple ratings of other symptoms (e.g., pain, depression), caffeine and medication use and activities during the day. Using the information gained from such an assessment, the patient could be referred to well-known behavioral techniques as a way to improve their sleep.

Moldofsky (2002) suggests that management of sleep disturbances in persons with fibromyalgia requires regularizing both the person’s behavioral and physiologic functions. Common cognitive behavioral methods are useful to improve the circadian sleep-wake cycle. Patients should be encouraged to go to bed and get out of bed at regular times of night and day and avoid daytime naps to stabilize sleep patterns and assure adequate time for rest. Setting a regular schedule for sleep should be combined with healthy eating patterns, including limiting all forms of caffeine, and engaging is gentle physical activity. Women should schedule physical activity early in the day (to avoid the stimulating effects of exercise) and take care to avoid exercise that exacerbates pain. In addition, efforts should be made to reduce disruptions in the sleep environment controlling noise and assuring a comfortable temperature to sleep. The bed should be used only for sleep and women should be advised to engage in engage in relaxing activities (e.g. reading) before going to bed and avoid stressful or anxiety producing activities. Patients can be asked to keep a second sleep log documenting use of prescribed techniques and evaluating their sleep. If these behavioral

techniques are not successful at improving insomnia complaints then the patient should be referred for a sleep study.

Alternatively, patients receptive to structured physical activity may be encouraged to begin muscle strengthening, aerobic training, or aquatic therapy programs. A recently updated meta-analysis provided gold-level evidence for the benefit of aerobic exercise on FMS symptoms in general (Busch et al., 2008). A randomized controlled trial of women with FMS comparing 16 weeks of exercise therapy in a chest-high warm water pool to control found that not only did most symptoms, including subjective sleep quality, improve, but roughly two-thirds of the exercise group maintained the exercise program 12 months later (Munguía-Izquierdo & Legaz-Arrese, 2008). Similarly, a Turkish study found that subjective sleep quality improved for 26 women who completed either an 8-week muscle-strengthening or aerobic exercise program (Bircan, Karasel, Akgün, El, & Alper, 2008). Finally, while either hydrotherapy or conventional physiotherapy may increase total sleep time, women with FMS engaging in hydrotherapy enjoyed the greatest benefit (de Melo Vitorino, de Carvalho, & do Prado, 2006),

It should be noted that there are several limitations to the study reported here. The sample is a convenience sample recruited from only one geographic area and has limited minority representation. We relied on actigraphs, rather than the gold standard of polysomnography for assessing sleep deficits to allow us to assess sleep in the natural setting. However, it is possible that some women had sleep disorders not accurately assessed by the actigraph movement sensors. Nevertheless, sleep difficulties are an important clinical problem for many of those diagnosed with fibromyalgia syndrome. A more thorough understanding of the patient's sleep experience and difficulties might help explain variation in the response to clinical treatment of other symptoms (e.g, effectiveness of pain medications). Strategies to improve sleep can enhance overall treatment of fibromyalgia and enhance the general health of women with this chronic condition.

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Table 1

Sample Demographics (N=104)

Characteristic	Categories	Overall Sample (N=104)	Sleep Deficits Group (n=22) n(%)*	No Deficits Group (n=82) n(%)*
Age	20-35 years	9 (9%)	3 (14%)	6 (7%)
	36-50 years	31 (30%)	5 (23%)	26 (32%)
	51-65 years	51 (49%)	12 (54.5%)	39 (48%)
	66 and over	13 (12.5%)	2 (9%)	11 (13%)
Education	Less than HS	4 (4%)	1 (5%)	3 (4%)
	High School Grad	33 (32%)	9 (43%)	24 (29%)
	Associate Degree	11 (11%)	1 (5%)	10 (12%)
	Bachelors Degree	30 (29%)	5 (24%)	25 (30.5%)
	Graduate Degree	25 (24%)	5 (24%)	20 (24%)
Race/Ethnicity	White/Caucasian	83 (81%)	17 (77%)	66 (81.5%)
	African –American	3 (3%)	0 (0%)	3 (4%)
	Other	17 (16.5%)	5 (23%)	12 (15%)
Marital Status	Married	65 (63%)	11 (50%)	54 (66%)
	Un-Married	39 (37.5%)	11 (50%)	28 (34%)
Employment Status	Full Time	25 (24%)	1 (4.5%)	24 (29%)
	Part Time	17 (16%)	3 (14%)	14 (17%)
	Un-Employed	62 (60%)	18 (82%)	44 (54%)

*Percentage totals may not add to 100% due to rounding.

Table 2

Comparison of Scores for Women with Fibromyalgia With and Without Objective Sleep Deficits (n=104)

	Sleep Deficits Group (n=22) Mean/SD	No Deficits Group (n=84) Mean/SD	t	df	p
Age	52.73±9.9	53.59±10.2	−.351	102	.726
Years Diagnosed	10.00±6.6	9.03±5.3	.708	99	.481
BMI	30.58±7.8	29.50±6.7	.647	102	.519
Pain – TPI	46.73±11.5	38.37±10.2	3.30	102	<.001
Perceived Sleep Quality	3.43±0.51	3.01±0.69	2.52	91	.013
Depressive Symptoms	28.33±12.5	20.43±11.1	2.88	102	.005
FIQ Functioning	1.66±.71	1.24±.66	−2.53	102	.013
Sleep Duration	259.99±85.6	470.75±56.9	10.92*	102	<.001
Sleep Latency	69.58±72.0	25.99±20.6	2.81*	102	.01
Sleep Efficiency	72.16±20.3	93.25±5.8	−4.82*	102	<.001

* Equal variances not assumed

Table 3

Percentage of women reporting moderate to severe problems on one or more days

	Total Group (N=104)	Women with Sleep Deficits (n=22)	Women without Sleep Deficits (n=82)	X^2
Energy	31.8%	50.0%	26.8%	4.29 *
Sleepiness	10.6%	27.2%	6.1%	8.22 **
Fatigue	25.9%	54.5%	18.3%	11.86 ***
Pain	17.3%	31.8%	13.4%	4.10 *
Functioning	22.1%	45.5%	15.85%	8.82 **
Mood	16.3%	22.7%	15.85%	0.57
Other Symptoms	8.6%	18.2%	6.1%	3.20

Significant X^2 indicated with *

* p<.05;

** p<.01;

*** p<.001