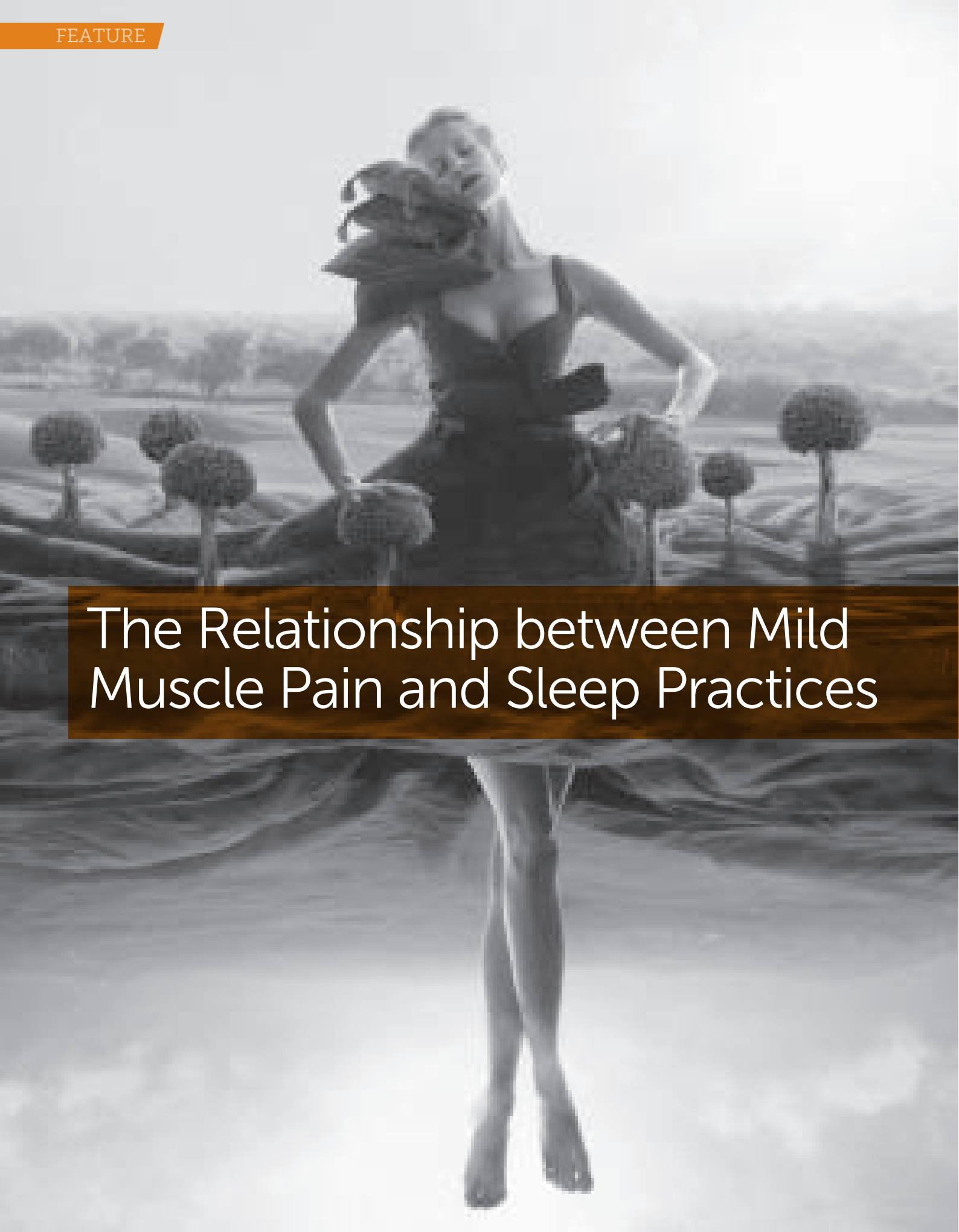


The Relationship between Mild Muscle Pain and Sleep Practices

Sleep problems and pain are widely experienced in the general population. Research has shown a relationship between chronic pain and poor sleep and between no pain and sleep. The AAMT *Massage Therapists Journal* is proud to bring you new research by Susan Davis which investigates the relationship of mild pain and sleep problems. The study was approved by Southern Cross University Human Research Ethics Committee, Lismore, New South Wales, Australia.

INTRODUCTION

Pain is a common experience, (Melzack, 1973) not only in severe and debilitating conditions, but also as a chronic disturbance that compromises quality of life. Sleep problems are also widely experienced (Gallup, 1995). The 2005 Sleep in America Poll conducted by the National Sleep Foundation (2005) found that 75 per cent of Americans reported at least one symptom of sleep disorder. Sleep disturbance is a prevalent complaint for persons with chronic pain disorders (Pilowsky, et al., 1985) and pain has been cited as the most common cause of secondary sleep disturbance (Moffitt, 1991). In addition, the National Sleep Foundation (2006) declares "…sleep loss may have harmful consequences for our immune and endocrine systems, as well as contribute to serious illness such as obesity, diabetes, and hypertension".

There are two principal reasons for research into the relationship between sleep and mild pain:

Firstly, there is growing interest in the role of sleep on pain processing. Individuals with sleep disturbances have demonstrated enhanced pain sensitivity, depression and increased risk of chronic disease (Lautenbacher, 2006; Tsuno, et al., 2005; Taylor, et al., 2007). Disruption and restriction of healthy sleep was shown to have a constellation of effects on metabolic and endocrine balance of the body; some of which could indirectly or possibly directly involve muscular pain and soft tissue disease (Alvarez, 2004; Lautenbacher, 2006). Raymond et al. (2001) conducted research with burn-injured in-patients and found that disrupted sleep was a strong indication of increased pain intensity on the following day. Advances in the neuroscience of pain (Craig, 2002; 2003), the mechanisms of the sleep-wake systems and its interactions are expanding the understanding of sleep and pain (Edwards, et al., 2009; Smith & Haythornthwaite, 2004). These studies show that sleep deprivation can cause increased pain response to normal painful stimuli (hyperalgesia) and pain responses to non-painful stimuli (allodynia) because of reduced suppression of pain by the brain.

Secondly, studies to date have investigated sleep and pain relationships using individuals with chronic, debilitating pain and individuals without pain at all. The gap in the literature appears between these two extremes. Epidemiological studies have found a strong correlation between insomnia and chronic pain (Ohayon, 2005 ; Taylor, et al., 2007). Influences of poor sleep and rheumatoid arthritis and pain sensitivity suggests that diffuse non-inflammatory pain may result from multi-directional and dynamic association of pain, sleep disturbance, muscle pain and possible diffuse peripheral or central pain sensitivity (Lee, et al.,2009). Results from clinical studies examining increasing next day pain and chronic pain also suggest a bi-directional relationship between sleep and pain (Edwards, et al., 2008; Smith & Haythornthwaite, 2004). No single study has asked people with mild pain about their sleep. While the exact mechanisms may well be complicated, pathways that link sleep disturbances and pain and an understanding of the progression of the relationship need further exploration.

The definition of mild pain requires explanation and is determined by exclusion.

Methods: Sixty seven patients from an established remedial massage centre completed questionnaires. The majority (79%) of the respondents were female. The questionnaire was a combination of three aspects: general demographics and alcohol consumption; an edited version of the Brief Pain Index; and the 12 question MOS Sleep Scale (revised). Sleep results were produced from the MOS software that compared the participants to the large population (mainly USA) recorded to date. Pain was reported as a 0-10 score (10 being the most pain). Those individuals scoring over seven were excluded from the survey. The age range was from 20-85 years. Correlational analyses were then made using Microsoft Excel, ANOVA.

Results: The overall results showed a small, but insignificant relationship, however, isolating the female results produced a significant relationship, with coincidental movements of pain experience and sleep problems. This outcome is in line with previous studies on chronic pain and serious sleep problems. In the female group ($n = 53$), 59% fell below the average of 50 set by the MOS Sleep Problem Index (below 50 indicating sleep problems); 41% showed mild pain experience. Correlational analysis showed that increases in pain coincided with decreases in sleep quality. Correlation was $r = 0.41$ with a p value < 0.05 indicating a statistically significant result.

Conclusions: Although only a small study with limited detail in the questionnaires, it is concluded that the results encourage the need for further research. This research shows that there may be a progressive line of pain before the development of chronic problems that could be detected through the inclusion of sleep assessment in mild pain patients and vice versa. This has important implications for the ongoing treatment of mild pain and the methods of practice for professions that deal with mild pain such as massage therapists.

Acute pain is related to an acute event requiring acute medical treatment. **Chronic pain** is recognised by literature and therapist as including moderate pain intensity over time and long-term psychosocial debilitating aspects (Cedraschi, et al., 1999). Therefore, **mild pain** is defined as being non-debilitating and non-specific (not from acute injury). Massage therapy is a health practice that is chosen for the management of back, neck/shoulder problems in the interest of wellbeing (Smith, et al., 2011) as a modern day treatment of muscle pain, tightness and stiffness (Vickers, et al. 1999).

In light of the before-mentioned gap in literature, a brief questionnaire was designed to illuminate the relationship between mild pain and sleep practices in a cohort seeking remedial massage therapy. The researcher hypothesises that sleep disturbances have a negative/indirect relationship with mild muscle pain.

METHODS

Design. A small-scale quantitative survey design was chosen to provide a snapshot of descriptive statistics as an initial examination of participants with mild pain and their sleep practices. Sixty seven (N=67) people, both male and female consented to participate in the research and returned their questionnaires. This study was approved by the Southern Cross University Human Research Ethics Committee, Lismore, NSW.

Participants. A quota of one hundred (100) clients were selected by convenience sampling over a two week appointment period from the Remedial Massage Therapy clinic, Davis Health Centre, Gordon NSW. Their selection was guided by the consultation history notes. Criteria for inclusion in the study was clients presenting with non-specific mild muscle pain and aged between twenty (20) and eighty five (85) years. The selection of clients was representative of the general population attending the clinic, 65 per cent female and 35 per cent male. The questionnaires were administered by post to invited respondents, with consent form, information and return envelope. Three weeks return period was allowed and sixty seven (N=67) respondents consented to participate.

Questionnaire. Self-reported questionnaires are commonly used instruments in quantitative research. Levels of pain and sleep habits have been shown to be reliably assessed by indirect measures in questionnaire instruments (Moffit, 1991). The questionnaire comprised three measures: demographics, 12-itemed Sleep Scale-MOS Sleep-Revised (Quality Metric, 2009) and five questions adapted from the Brief Pain Inventory (Cleeland, 1991).

Demographics. Questions included sex, age, medication and/or treatments and weekly alcohol consumption. Numerical values were assigned to represent categories. For example in question 7, weekly alcohol consumption, one to seven standard drinks per week = value 2.

Sleep Measure. The Medical Outcomes Sleep-Revised (MOS Sleep Scale) is a 12-item questionnaire (4-week recall) normed as part of a 2009 study that recruited a large, representative sample of the U.S. general population (Quality Metric Incorporated, 2010). MOS Sleep Scale is a self-administered highly reliable and validated sleep survey (Allen et al., 2009). Sleep Problems Index II Score, is derived from responses to nine of the items found in the 12-itemed version. The score has a strong reliability value (Cronbach's alpha) r = 0.95 (Hays and Stewart, 1992) and is the single score measure, representing each participant's sleep behaviour in the study. The MOS Sleep Scale has been used in many clinical trials, including studies of patients with spinal cord injury (Siddall et al., 2006) and fibromyalgia (Crofford et al., 2005). The MOS Sleep is scored such that higher scores indicate fewer problems. 12 – Item MOS Sleep requires two parts:

1. Assigning a point score to each response choice comprised of six subscales, each consisting of one to four items: sleep disturbance, snoring, shortness of breath or headache, sleep adequacy, sleep somnolence and sleep quality.
2. Summing the point value included in the given subscale and index. The MOS Sleep Problem index II score is then converted to a *T* score 0-100 with the mean = 50 and a standard deviation of 10.

Licensing of the psychometric instrument and analysis tool was supplied by Quality Metric Incorporated.

Pain measure. Many measures have been developed to measure different aspects of pain. The questionnaire, the Brief Pain Inventory (BPI) (Cleeland, 2009) is a widely used measurement tool for assessing clinical pain. The 5-item (4-week recall) measure comprises a "yes/no" answer to their immediate experience of pain, followed by four items to identify the severity of the pain. The BPI developers recommend the use of all four questions to fully assess "sensory" dimensions of pain (0-10, zero representing "No Pain" to ten for "pain as bad as you can imagine"). The "average" of the last four items gave an individual "Pain Index Score" – one (1) being least amount of pain severity to ten (10) being the most. It is predicted that a Pain Index Score <6 will represent mild pain. Microsoft Excel (2010) was used to analyse the "average" score.

Analysis. The relationship between sleep and pain is determined by correlation of the three domains within the questionnaire: demographic data; the score calculated by the MOS Sleep Problem Index Score II; and the Pain Index Score. The data was examined for descriptive associations using Microsoft Excel (2010). Descriptive statistics showing proportions and percentages using various measures of central tendency "averages" and dispersions "ranges" will give a creative exploration of each variable. Simple inter-relationship correlation between variables was explored with ANOVA.

RESULTS

Age and Sex

The total invited participants (N= 100) were sampled over a two week period, 65 per cent female and 35 per cent male aged between 20–85 years. The total respondent participants after a three week period was sixty seven (N= 67) all respondents were included in the study, comprising 79 per cent female (N= 53) and 21 per cent male (N=14) (Fig 1. & Fig 2.).

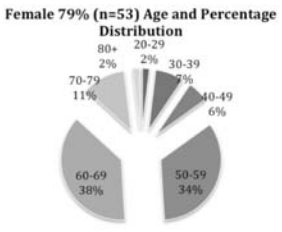


Figure 1. Age and percentage distribution of the respondent female participants (N=53).

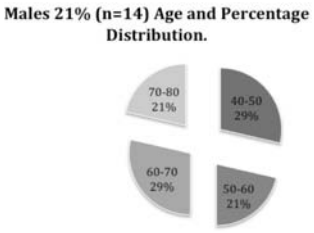


Figure 2. Age and percentage distribution of the 14 male respondent participants.

The age distribution of the female participants (N=53) (fig.1) indicates 72 per cent were aged between 49-69 years. The total male (N=14) distribution, even with the small number was evenly distributed between 40-80 years (fig.2). None of the younger men invited to participate did so. The domination of female participants is demonstrated in figure 3.

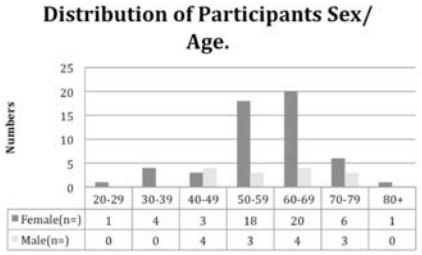


Figure 3. Male/Female participants (N=67) distribution across ages, dominance of the female respondents (N= 53) and the central distribution in the female participants between the ages of 49-69 years (N=38).

Alcohol Consumption

The results of the total participants' alcohol consumption (fig 4.) indicate 74 per cent didn't drink, or usually had less than seven standard alcoholic drinks (10gms) in a week.

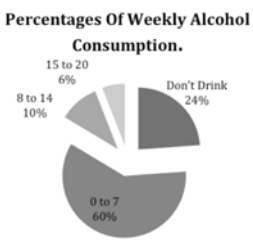


Figure 4. Total (N=67) percentages of weekly alcohol consumption, 74 per cent of participants indicated <7 standard drinks per week.

Alcohol Glass/week	Numbers
Nil	16
0 to 7	40
8 to 14	7
15 to 20	4
	N = 67

Medication/treatment

The scores for medication and/or treatment were answered inconsistently. Some of the participants included all the things they do to relieve their pain (exercise, swimming, physical therapy and over the counter medications) and others just included pharmaceutical medications.

Remedial massage, exercise and fish oil were the most consistent answer at eighty per cent. Forty per cent of the participants included band named non-steroidal anti-inflammatory medications. One of the men responded with information about his sleep and that he used a sleep apnea monitor every night.

MOS Sleep Problem Index II

Total participant (N=67) MOS Sleep Problem Index II scores (fig. 5) correlated with the normal population distribution, based on the study (Quality Metric, 2009) of the US population. The largest percentage, 49 per cent of our survey participants, scoring "average sleep" = 50 (mean "normal" sleep for the average US population) and above (fig.6).

The average score of our survey participants (mean=48.7) was lower than the average (mean=50) in the US sleep study. The standard deviation (Std Dev=6.5) was less than the recommended standard deviation for the MOS Sleep Index (Std Dev=10). In the scores of the combined sexes, 33 per cent of our survey participants were scored, below "normal" sleep (score <47) (fig.6). When studied individually, forty per cent of the female participants were scored below "normal" sleep (score < 47) (fig.7) seven per cent higher number than in the combined sexes score. Two male survey participants scored lower than the average (50) of "normal" sleep.

Figure 5. MOS Sleep Problem Index II scores, 50 < = "normal" sleep and above average sleep (US population Study, 2009).

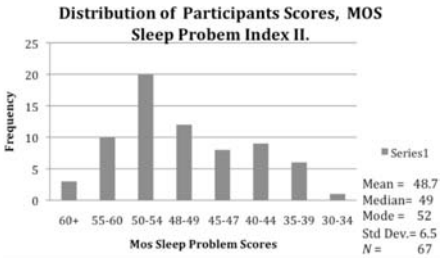


Figure 6. Percentage of participants MOS Sleep Problem index II score**. 49 per cent** scored normal or above average sleep compared with US general population study, 2009: 33 per cent scored below the normal average sleep.

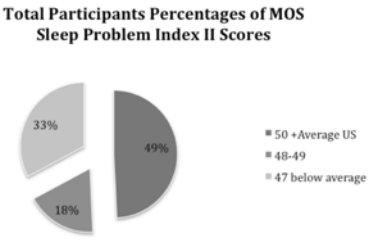
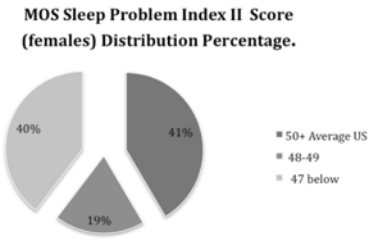


Figure 7. MOS Sleep Problem Index II scores for the female participants, 59 per cent below average sleep scores.



Pain Index Score

The participant's Pain Index Score is the individually averaged value score of questions 9,10,11,12. The Pain Index Score (*ps*) results fell between the minimum *ps*= '0' and a maximum value of *ps*='7' (least pain to worst pain respectively).

Total survey participants (N=67) (Table. 2) averaged Pain Score Index (Fig 8.), mean = *ps* 2.6 (Std. Dev. = 1.5 rounded). In the total participants, the pain score was skewed towards the lower scores, seventy per cent Pain Score Index scored in the range, *ps* = 1 – 3.9 (Fig 8). These scores fall between

one standard deviation of the mean (2.6). The greatest percentage, 27 per cent of participants (N=18) shown in the pie chart, Figure 9. scored *ps* = 1 – 1.9 and 22 per cent (N=15) of participants scoring *ps* = 3 – 3.9.

The findings indicate the greatest proportion of the participant's scored as "mild" pain. This is consistent with the expected pain level of clients surveyed.

Figure 8. Distribution of Pain Index Score (N=67), greatest proportion of the participants score below pain score = 3.9

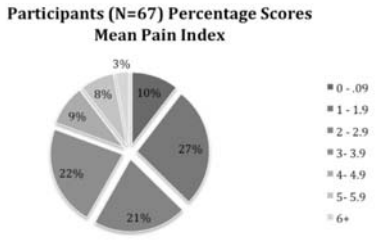


consistent with mild muscle pain.

Table 2: Participants Mean Pain Index.

Mean Pain Index (ps)	Total Number
0–0.9	7
1–1.9	18
2–2.9	14
3–3.9	15
4–4.9	6
5–5.9	5
6+	2
	67

Figure.9. Percentage distribution of participants Pain Score Index, demonstrating the largest percentage below a pain score of 3.9.



Sleep and Pain Scores

The total number of female participants (N=53), 59 per cent scored below average (<50) sleep problem score. This 59 per cent of females (N= 30) have been examined as a sub group.

Table 3 shows the percentages of female participants in the sleep problem sub group, 74 per cent (N=22) of the total reported a pain level above the average (mean = 2.6). Therefore, twenty two females of the possible fifty three females (N=53), reported both increased pain and below average nightly sleep practices (41 per cent of total female participants).

Table 3.

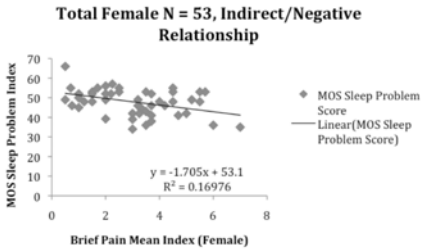
Percentage of Female Participants

Pain Index	0 – 2.9	3 -4.9	5+
N = <50 in MOS	8	17	5
%	26%	57%	17%

Simple Inter-Relationship Correlation

The correlation measure with the relationship variables of the MOS Sleep Problem Index II and Pain Index with the total population (N=67) (Pearson Product-Moment Correlation Coefficient, Excel 2010) showed no significant statistical interaction. However, the female participants (N=53) demonstrated a negative/ indirect correlational relationship (Fig.10) between sleep and subsequent pain. The relationship between the variables demonstrated moderately strong (correlation, r=0.41) association when the MOS Sleep problem Index II decreased (below average sleep than normal), the Pain Index increased (more pain was reported). This result scored a *p* value < 0.05 (*p* = .002), which indicates it is statistically significant (Appendix 5).

Figure 10. Female Participants (N=53) Indirect/Negative Relationship: as the x MOS Sleep Score decreases, y pain increases.



DISCUSSION

This research evaluated self-reported sleep behaviours and its relationship to mild pain in people who attended a remedial massage therapy clinic. The study contained both male and female participants examined by descriptive analysis. Only the female group demonstrated a medium strength negative correlational relationship: decrease in sleep problem index II scores (increased sleep problems) with a coinciding increase in pain index scores. While this doesn't establish causality, it does support our hypothesis and reflects the relationship established in previous studies examining chronic pain conditions.

The overall number of participants in the study contained a larger respondent sample of females than men. This is consistent with previous trends in studies, indicating more women than men seek treatment for muscle pain (Fillingim, 2000). The relationship between sleep disturbance and mild pain in the female participants was stronger in the group scoring below "average" sleep problems (mean=50). Seventy five per cent of this group also recorded a pain index equal to the mean of 2.6 or more. The study also demonstrated the largest percentages of females seeking treatment at the clinic were aged between 49 and 69 years. This is consistent with evidence in population and long-term women studies. Sleep problems during early menopause, through the transition and post menopause, has become a focus of increasing studies. A women's population study showed forty per cent of women in this age group suffered sleep disturbances rating sleep problems as the most bothersome and frequent symptom (Woods, 2010). Lower hormone levels during menopause and older age, hormonal influence, age and psychological problems have been found to be significant variables in pain studies (Moffit, 1991). Future studies containing hormone levels and menstrual phases would benefit from their examination. Interview or focus groups in a qualitative style of enquiry would help understanding in future research.

The size of this study is a factor in the evaluation of the scores. Trends especially in the male population may be proven to be significant with a larger sample size. Although the male sample (N=14) was evenly proportioned over the age range the sample was too small to be representative of the population. It is important to note, in relation to the sleep scale, the largest number of participants in the survey results were reflective of the US population sleep study (2009). This is an encouraging result as it indicates that despite the small numbers, these participants are a reasonable reflection of the real-world population.

The study shows that the majority of participants were upper-middle class, health conscious and well-being was important. They reported low alcohol consumption, chose remedial massage, exercise and healthy lifestyles to treat their pain. Despite being from limited social demographics and yet the results in their sleep disturbance and pain are in line with the larger population results of the MOS Sleep Scale (Quality Metric, 2009). Future research would benefit from examination of remedial massage clients from different demographics.

In recent studies, anxiety and other affective disorders have been found to be a significant factor contributing to sleep disturbance (Lee, 2009; Smith & Quartana, 2010). Though psychological disorders were not in this study it is important to mention their possible influence in the results. It has been a hypothesis for many years that chronic pain is sufficiently intensive, that it interrupts the onset of sleep and continues creating poor sleep throughout the night. It would be interesting to examine whether mild pain is considered to be intense enough to create such an influence on sleep or or the possibility that anxiety or other pathophysiogical processes related to depression could possibly develop in relation to pain, that is disruptive to the circadian sleep cycles.

Sleep disturbance in previous studies has indicated to play a part in the pathophysiology of sleep disturbance and chronic pain. This study supports the hypothesis that sleep problems have a relationship with mild pain. Potentially important implications may arise from the observation of early relationship with sleep disturbance and mild pain. Sleep disturbance may serve as an early marker identifying individuals at elevated risk for pain related outcomes. Treatment of sleep disturbance may be a non-pharmacological treatment to reduce pain and possibly for prevention of the development of ongoing chronic pain syndromes. Fully assessing a client's sleep problems in conjunction with pain assessment could prove to be shown as best practice. Treatment of mild pain, in relation to sleep problems, might include improving sleep hygiene or referral for further assessment.

There are a number of limitations in this study. First, the study utilised a small non-randomised, questionnaire descriptive design, which should prevent readers from drawing any causal conclusions. Second, the measure for pain is based on a single item of severity. Researchers using similar items have included multi-dimensional measures to include not only frequency, but position of pain, source and impact of pain. Third, the assessment of sleep and pain was based solely on self-report. Future studies in this area would benefit from including a qualitative interview and an evaluation of people's understanding of their pain. Objective measures to evaluate and confirm sleep patterns would improve validity.

Despite these limitations, the positive results in this study provide a framework and encouragement to pursue further research. Confirming these results with larger groups and over wider demographics may prove to have a transformative influence on the way the mild muscle pain is treated and in the way in which mild pain is considered in the process of preventative healthcare.

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