Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

THE EFFECT OF MASSAGE THERAPY ON THE SLEEP QUALITY IN HEALTHY ADULTS

Stela Ivanova [1,*]

[1] Faculty of Public Health, Health Care and Tourism, NSA "Vasil Levski",
1 Gurgulyat Street, 1000 Sofia, Bulgaria

Current Trends in Natural Sciences

Abstract
Previous studies indicated that massage relieves pain and fatigue, reduces blood pressure, decreases heart rate, decreases cortisol release and depression, and regulates sleep. Therefore, massage is a method that is frequently used to overcome sleep problems. But previous studies were mostly conducted in various pathological conditions and in infants. The aim of the current study is to determine the impact of the main parameters of the massage on the quality of sleep. ***Materials and methods:*** *An online self-report questionnaire was administered to clients of four massage therapists with more than 10 years of practice and to first-year students at the National Sports Academy, Sofia, Bulgaria, after practicing back and low back massage under the supervision of their instructor. The questionnaire contains 4 sections collecting personal information and information about massage parameters, sleep quality on non-massage days and sleep quality on the night following massage session. 74 healthy volunteers completed the questionnaire.* ***Results:*** *74 healthy volunteers completed the questionnaire. We excluded 2 participants younger than 18 years old. Statistical analysis showed a significant improved of quality of sleep based on the studied sleep parameters: time for transition to sleep (with - 6,16 min), sleep duration (with 39 min), need for more sleep (increasing "no" answers from 25 to 46 after massage) and self-reported sleep rate (with 1,42). We also find correlation between massage duration and falling asleep during massage and the time for transition to sleep, sleep duration, and sleep rate with better results for 60- and 90-min massage duration and drifting off during massage.* ***CONCLUSIONS:*** *Massage is a useful non-pharmacological method for improving the quality of sleep the night after especially 60- and 90-min massage duration and drifting off during massage. More studies are needed to evaluate the delayed effects of massage therapy on sleep parameters and quality of sleep as well as to establish the neurophysiological and biochemical mechanisms of this effects.*

Keywords: massage, sleep quality

1. INTRODUCTION

Nearly one-third of the general population experience symptoms of insomnia, defined as difficulties falling asleep and/or staying asleep (Scott et al., 2021). Impairment in sleep quality is characterized by the symptoms such as spending too much time for transition to sleep, shortening sleep duration, unrest during the night, continuous movement during sleep, and waking up without feeling rested. Low sleep quality causes fatigue, deterioration in concentration, learning disability, nervousness, increased sensitivity to pain, hallucinations, slowing of growth, weakening of the immune system, susceptibility to infections, delay in wound healing, decrease in quality of life, and increased risk of mortality and morbidity (Akpinar et al., 2022). Short sleep was significantly associated with the mortality outcome. Similar significant results were observed in diabetes mellitus, hypertension,

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

cardiovascular diseases, coronary heart diseases, and obesity (Itani et al., 2017). Increasing evidence also points to a bidirectional relationship between sleep and health; that is, sleep disturbances contribute to the development of or increase the severity of various medical and psychiatric disorders, and these same disorders result in poor sleep quality (Zee and Turek, 2006).

Improving sleep quality is in relation with better physical and mental health, better mood, and quality of life (Itani et al., 2017). There is a dose-response relationship between improvements in sleep quality and subsequent mental health, such as greater improvements in sleep led to greater improvements in mental health (Scott et al., 2021). Perception of sleep quality and daytime disfunction have consequences for the body's ability to respond to challenges (Bassett et al., 2015).

Based on these findings, Itani et al. declare necessity of future studies for examining the effectiveness of psychosocial interventions to improve sleep on reducing these health outcomes in general community settings (Itani et al., 2017).

There are several measures like massage therapy, music therapy, pharmacotherapy, bright light therapy, behaviour therapy and Yoga etc. to treat sleeplessness, of which the therapeutic massage is considered one of the effective methods used to induce sleep (Shinde and Anjum, 2014).

One of the non-pharmacological interventions proposed to improve sleep quality and facilitate sleep is applying the massage. Massage is a systematic touch to the body to reduce tension, provide relaxation, and stimulate and accelerate blood circulation. Massage decreases fatigue, exhaustion, tension, and pain by showing a sedative effect and improves the feeling of trust in individuals. Studies indicated that massage relieves pain and fatigue, reduces blood pressure, decreases heart rate, decreases cortisol release and depression, and regulates sleep. Therefore, massage is a method that is frequently used to overcome sleep problems. (Akpinar et al., 2022). In addition, touch accelerates blood circulation, helps the digestive system and its function, stimulates the lymphatic system, relieves stress, and reduces heart rate and blood pressure. On the other hand, by causing the secretion of endorphins, it reduces pain and provides relaxation for the patients and is very safe and effective method (Kashani & Kashani, 2014).

During systematic research of the literature, we found out that most of the studies investigate the effect of massage to the quality of sleep mainly in pathological conditions and in infants. Back massage for 10 minutes influenced sleep quality from the second day among intensive care unit (ICU) patients (Hsu et al., 2019). In other study 10 to 12 minutes of slow stroke back massage also is helpful in inducing sleep and improving the quality of sleep among ICU patients on 3 consecutive days (Shinde and Anjum, 2014). 6-minute back massage improved quality of sleep among critically ill older men (Richards, 1998). 45-minute standardized massage protocol included gentle effleurage, light petrissage and compression, and nerve stroke to target head, neck, back, and gluteus muscle, and the 4 extremities slightly improve sleep quality in patients with metastatic bone pain (Jane et al., 2011). Massge therapy showed statistically significant improvement in self-reported sleep questionnaires and objectively recorded long sleep episodes in cancer survivors (Samuel et al., 2021), and massage therapy, performed for 20 minutes, 3 times a week, for 4 weeks improves quality of sleep in breast cancer patients (Kashani and Kashani, 2014). Massage on neck, shoulder and back, consisting of light and hard compression on trigger points, manual kneading, friction, cervical traction, and mobilization in all planes improve sleep quality and decreases fatigue in patients during the recovery period following cardiopulmonary artery bypass graft surgery (Nerbass et al., 2010). Patients with fibromyalgia increases their number of sleep hours and decreases their sleep movements after massage therapy, provided for 30 minutes, two times a week for 5 weeks (Field et al., 2002). Massage on lower back and legs reduces sleep disturbances in a group of patients with chronic low

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

back pain. Massage sessions were 30 minutes long twice a week for 5 weeks (Field et al., 2007). Back massage application is an effective intervention in increasing the sleep quality of the patients and that this massage should be applied for at least 10 minutes late in the day (Akpinar et al., 2022). Foot reflexology and back massage, administered for 30 minutes two times a week for 4 weeks, were shown to improve the sleep quality and reduce the fatigue of haemodialysis patients (Unal and Akpinar, 2016).There was an effect of baby massage on the enhancement of sleep quality in infants aged 3-6 months old (Kusumastuti et al., 2016) and sleep duration, and effectively decreased the number of awakenings and the duration of awakening (15-min massaged by their mothers) (Hartanti et al., 2019). Massage for 4 weeks improves growth and post-massage sleep in 6±1 week of age infants (Agarwal et al., 2000). Healthy, low-risk preterm infants gained more weight and slept less with just 5 days of massage (body stroking/passive limb movement for 15-minutes periods per day) (Dieter, J. N., et al. 2003). 8-month-old infants with low birth weight (LBW) who received massage interventions for the last 6 months were less likely to snore during sleep, required less feeding on waking-up at night, and appeared more alert during the day (Kelmanson, I. A., & Adulas, E. I., 2006). Just a few studies explore the effect of massage on sleep quality in physiological conditions and in healthy people. A pilot study results show in a large group of women that after 1 and 2 months of a facial massage routine global sleep quality improved through changes in several different subscales (subjective sleep quality, sleep latency, sleep disturbances and daytime disfunction). Similarly, average daytime sleepiness decreased (Porcheron, A., et al., 2024). Back massage applied for 10 minutes before bedtime in older adults increased the quality of sleep in the contingent. Back massage resulted in significantly better sleep quality in the older people, as well as significantly better components of sleep quality: better perceived sleep quality, shorter sleep latency, greater sleep efficiency and less daytime dysfunction (Çinar and Eşer, 2012).
There is a lack of research related to different massage parameters and their impact on sleep quality. Therefore, the current study aims to determine the impact of the main parameters of the massage on the quality of sleep in healthy people with physiological conditions.

2. MATERIALS AND METHODS

An online self-report questionnaire was administered to clients of four massage therapists with more than 10 years of practice and to first-year students at the National Sports Academy, Sofia, Bulgaria, after practicing back and low back massage under the supervision of their instructor. The questionnaire contains 4 sections: ***Section 1*** collected personal information about age, gender and e-mail address; ***Section 2*** collected information about massage parameters: massaged body parts, duration of massage, subjective perception of the massage (was it tonifying, relaxing, lulling or none of the mentioned), and drifted off or falling asleep during massage; ***Section 3*** collected information about usual sleep quality on non-massage days including information about time for transition to sleep, time to get up in the morning, sleep duration, feeling a need for more sleep, and determining the rate of sleep quality by using 10 point scale (from 1 - “very bad” to 10 – “very good”); ***Section 4*** collected same information as section 3 but for the night following the massage session. The results were processed using SPSS software.

3. RESULTS AND DISCUSSIONS

74 healthy volunteers completed the questionnaire. We excluded 2 participants younger than 18 years old. The age range of the included subjects was from 19 to 67 years (mean age 35.74 years). 77% of the participants were female and the remaining 23% were male (Fig. 1). Most of them were massaged

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

for around an hour (48 participants), followed by an hour and a half (13 participants), half an hour (8 participants) and two hours (5 participants) (Fig. 2). 52 of the participants received a full body massage, 13 received massage on their back and lower back area, 7 – only on the back, and 2 – on the back, neck and shoulder gridle (Fig. 3).

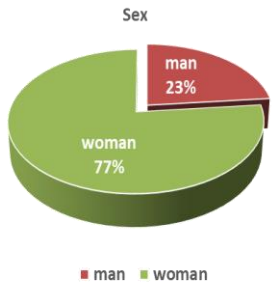

Figure 1. Distribution by gender

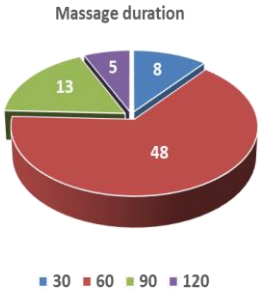

Figure 2. Distribution by duration of the massage

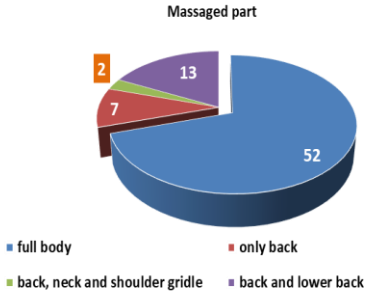

Figure 3. Distribution by massaged part

We compared the studied sleep parameters before and on the night after the massage using Paired Samples T Test. Statistical analysis showed a significant improved of the studied sleep parameters: *time for transition to sleep* decreased with 6.16 min, *sleep duration* increased with 39 min, "no" answers of *need for more sleep* increased from 25 to 46 after massage, and *self-reported sleep rate* increased with 1.39 points (Table 1).

Table 1. Improvement of basic sleep parameters

Studied sleep parameters	According to massage	Mean	Mean Difference
minutes to fall asleep	after	13.13	**-6.16**
	pre	19.29	
sleep duration	after	07:40	**00:39**
	pre	07:01	
sleep need "no"	after	46	**21**
	pre	25	
sleep rate	after	8.18	**1.39**
	pre	6.79	

The correlation analysis between massage duration and parametric sleep parameters showed significant greater improvement of *time for transition to sleep* after 90 minutes of massage (with 11.61 minutes less), followed by 120 minutes of massage (7 minutes less) and 60 minutes of massage (5,49 minutes less). *Sleep duartion* increased greatly after 120 minutes of massage (with 1 hour and 18 minutes), followed by 30 minutes of massage (with 49 minutes), and 60, and 90 minutes of massage (with 36 and 39 minutes respectively). *Self-reported sleep rate* improves with 1.8 points after 120 minutes of massage, with 1.77 points after 90 minutes of massge, with 1.33 points after 60 minutes of massage, and with 1.12 points after 30 minutes of massage (Table 2 and Figure 4).

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Table 2. Correlation between duration of massage and studied sleep parameters

Minutes			*Mean*	*Mean differences*
120	minutes to fall asleep	pre	17	**-7**
		after	10	
	sleep duration	pre	07:00:00	**01:18:00**
		after	08:18:00	
	sleep rate	pre	7.8	**1.8**
		after	9.6	
90	minutes to fall asleep	pre	26.38	**-11.61**
		after	14.77	
	sleep duration	pre	07:16:00	**00:39:00**
		after	07:55:00	
	sleep rate	pre	6.38	**1.77**
		after	8.15	
60	minutes to fall asleep	pre	16.23	**-5.49**
		after	10.74	
	sleep duration	pre	07:06:00	**00:36:00**
		after	07:42:00	
	sleep rate	pre	6.75	**1.33**
		after	8.08	
30	minutes to fall asleep	pre	27.86	**-0.72**
		after	27.14	
	sleep duration	pre	06:26:00	**00:49:00**
		after	07:15:00	
	sleep rate	pre	6.88	**1.12**
		after	8	

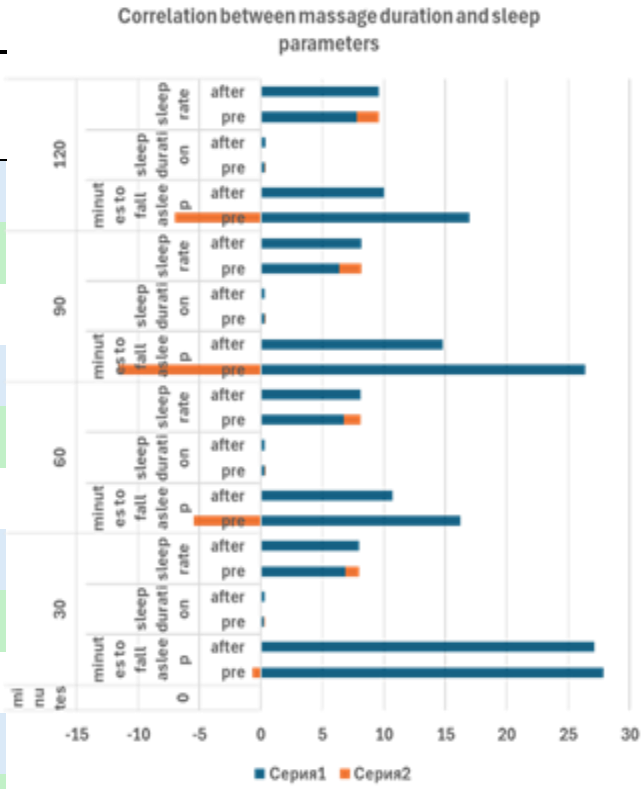

Figure 4. Correlation between massage duration and sleep parameters (time for transition to sleep, sleep duration and self-reported sleep rate)

The correlation analysis between falling or not asleep during massage and studied sleep parameters showed improved transition to sleep in all three options (fall asleep during massage – with 5.37 minutes, drifted off without falling asleep – with 7.81 minutes, and none of the above – with 2.5 minutes). Sleep duration increases almost the same (around 50 minutes) in the cases if the participants drifted off or fall asleep during massage, and only with 12 minutes if the participants didn't drift off, nor fall asleep during massage. Same is the correlation with self-reported sleep rate which improves with 2.23 if the participants fall asleep during massage, with 1.51 if only drifted off, and barely with 0.78 if the answer were "no, neither fall asleep, nor drifted off" (Table 3 and Figure 5).

Discussion

We couldn't find any significant difference in time for getting up in the morning probably because of the daily regime and waking up by alarm. It is likely that the increase in sleep duration in this case is due to falling asleep earlier and faster or is just subjective perception.

Decreasing of time for transition to sleep is explained currently through changes in brain electrical activity and serum vitamin D concentrations. An orchestrated series of changes which dynamically involved the different cortical areas and different EEG frequences during transition to sleep are taking places. Undoubtedly EEG synchronization is the most representative change of sleep onset (Marzano et al., 2013). A cross-sectional study shows that serum 25(OH)D concentrations were significantly associated with minutes to fall asleep, indicating that people with lower vitamin D levels tended to

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

have longer time to fall asleep (Shiue, 2013). Massage could affect both mechanisms. Our previous research shows that there are many studies proving that massage affects EEG activity of the brain (Ivanova and Alexiev, 2022), but studies on the effect of massage on vitamin D concentrations are lacking.

Table 3. The correlation analysis between falling or not asleep during massage and studied sleep parameters

Fall asleep during massage			*Mean*	*Mean differences*
yes, I fell asleep	minutes to fall asleep	pre	18.75	**-5.37**
		after	13.38	
	sleep duration	pre	06:40:00	**00:53:00**
		after	07:33:00	
	sleep rate	pre	6.44	**2.23**
		after	8.67	
I drifted off, but I didn't fall asleep	minutes to fall asleep	pre	20.43	**-7.81**
		after	12.62	
	sleep duration	pre	07:10:00	**00:49:00**
		after	07:59:00	
	sleep rate	pre	6.77	**1.51**
		after	8.28	
no, neither	minutes to fall asleep	pre	16.44	**-2.5**
		after	13.94	
	sleep duration	pre	06:56:00	**00:12:00**
		after	07:08:00	
	sleep rate	pre	6.94	**0.78**
		after	7.72	

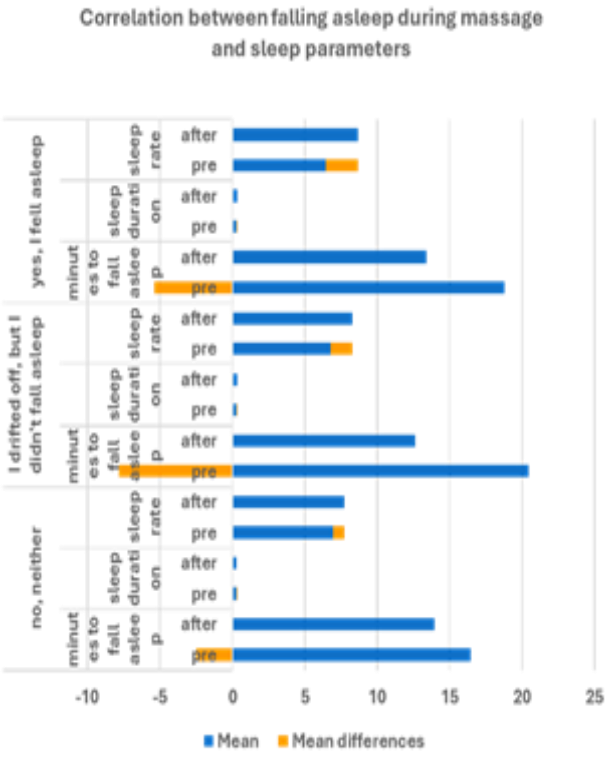

Figure 5. Correlation between falling or not asleep during massage and studied sleep parameters

Sleep duration per se is not related to better quality of sleep. According to Jean-Louis, greater quality of well-being was associated with greater sleep satisfaction, but increased sleep duration may not directly improve quality of life (Jean-Louis et al., 2000). Bassett says that sleep duration did not appear to affect cortisol stress responses, perceived sleep quality impacted cortisol stress responses in a gender-dependent manner (Bassett et al., 2015). Although available evidence suggests that a sleep duration of 7-8 h per day is the one most favourably associated with health among adults and older adults (Chaput et al., 2020). In the present study sleep duration by groups on the night after massage was in the same parameters (between 7 h and 8 min in "no, neither drifted off or falling asleep" group and 8 h and 18 minutes in "120 minutes massage" group).
Increased self-reported sleep rate and "no" answers to question about need for more sleep proves better self-perceived quality of sleep after massage.

4. CONCLUSIONS

Massage is a useful non-pharmacological method for improving the quality of sleep the night after especially 60- and 90-min massage duration and drifting off during massage. More studies are needed

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

to evaluate the delayed effects of massage therapy on sleep parameters and quality of sleep as well as to establish the neurophysiological and biochemical mechanisms of this effects.

5. ACKNOWLEDGEMENTS

Special thanks to my colleges, kinesitherapists: Tatyana Tomova, PhD, assistant professor in NSA, Katerina Simeonova, Kalin Neikov, a certificated teacher in Tai massage, Tatyana Kusheva and all the students which help me to gather the necessary information for this study.

6. REFERENCES

Agarwal, K. N., Gupta, A., Pushkarna, R., Bhargava, S. K., Faridi, M. M., & Prabhu, M. K. (2000). Effects of massage & use of oil on growth, blood flow & Sleep. *Indian J Med Res, 112*, 2.

Akpinar, R. B., Gülnur, A. K. I. N., & Emrah, A. Y. (2022). The Effect of Back Massage on Sleep Quality: A Systematic Review. *Kafkas Journal of Medical Sciences*, *12*(2), 179-184.

Bassett, S. M., Lupis, S. B., Gianferante, D., Rohleder, N., & Wolf, J. M. (2015). Sleep quality but not sleep quantity effects on cortisol responses to acute psychosocial stress. *Stress, 18*(6), 638-644.

Chaput, J. P., Dutil, C., Featherstone, R., Ross, R., Giangregorio, L., Saunders, T. J., ... & Carrier, J. (2020). Sleep duration and health in adults: an overview of systematic reviews. *Applied Physiology, Nutrition, and Metabolism*, *45*(10), S218-S231.

ÇINAR, Ş., & EŞER, İ. (2012). Effect on sleep quality of back massage in older adults in rest home.

Dieter, J. N., Field, T., Hernandez-Reif, M., Emory, E. K., & Redzepi, M. (2003). Stable preterm infants gain more weight and sleep less after five days of massage therapy. *Journal of pediatric psychology, 28*(6), 403-411.

Field, T., Diego, M., Cullen, C., Hernandez-Reif, M., Sunshine, W., & Douglas, S. (2002). Fibromyalgia pain and substance P decrease and sleep improves after massage therapy. JCR: *Journal of Clinical Rheumatology, 8*(2), 72-76.

Field, T., Hernandez-Reif, M., Diego, M., & Fraser, M. (2007). Lower back pain and sleep disturbance are reduced following massage therapy. *Journal of bodywork and movement therapies, 11*(2), 141-145.

Hartanti, A. T., Salimo, H., & Widyaningsih, V. (2019). Effectiveness of infant massage on strengthening bonding and improving sleep quality. *Indonesian Journal of Medicine, 4*(2), 165-175.

Hsu, W. C., Guo, S. E., & Chang, C. H. (2019). Back massage intervention for improving health and sleep quality among intensive care unit patients. *Nursing in critical care*, *24*(5), 313-319.

Itani, O., Jike, M., Watanabe, N., & Kaneita, Y. (2017). Short sleep duration and health outcomes: a systematic review, meta-analysis, and meta-regression. *Sleep medicine, 32*, 246-256.

Ivanova, S., & Alexiev, F. (2022). Possibilities of Eeg Diagnostics For Evaluation of The Massage Effects. *Proceeding Book*, 543.

Jane, S. W., Chen, S. L., Wilkie, D. J., Lin, Y. C., Foreman, S. W., Beaton, R. D., ... & Liao, M. N. (2011). Effects of massage on pain, mood status, relaxation, and sleep in Taiwanese patients with metastatic bone pain: a randomized clinical trial. *PAIN®, 152*(10), 2432-2442.

Jean-Louis, G., Kripke, D. F., & Ancoli-Israel, S. (2000). Sleep and quality of well-being. *SLEEP-NEW YORK-, 23*(8), 1115-1121.

Kashani, F., & Kashani, P. (2014). The effect of massage therapy on the quality of sleep in breast cancer patients. *Iranian Journal of Nursing and Midwifery Research, 19*(2), 113-118.

Kelmanson, I. A., & Adulas, E. I. (2006). Massage therapy and sleep behaviour in infants born with low birth weight. *Complementary Therapies in Clinical Practice, 12*(3), 200-205.

Kusumastuti, N. A., Tamtomo, D., & Salimo, H. (2016). Effect of massage on sleep quality and motor development in infant aged 3-6 months. *Journal of maternal and child health, 1*(3), 161-169.

Marzano, C., Moroni, F., Gorgoni, M., Nobili, L., Ferrara, M., & De Gennaro, L. (2013). How we fall asleep: regional and temporal differences in electroencephalographic synchronization at sleep onset. *Sleep medicine*, *14*(11), 1112-1122.

Nerbass, F. B., Feltrim, M. I. Z., de Souza, S. A., Ykeda, D. S., & Lorenzi-Filho, G. (2010). Effects of massage therapy on sleep quality after coronary artery bypass graft surgery. *Clinics, 65*(11), 1105-1110.

Porcheron, A., Latreille, J., Sauvet, F., & Bardel, M. H. (2024). Evaluation of a daily facial massage on perceived sleep quality and well-being: A pilot study. *International Journal of Cosmetic Science*.

*Corresponding author, E-mail address: stela_kalinova@abv.bg

Current Trends in Natural Sciences
Vol. 13, Issue 26, pp. 160-167, 2024
https://doi.org/10.47068/ctns.2024.v13i26.017
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

Richards, K. C. (1998). Effect of a back massage and relaxation intervention on sleep in critically ill patients. *American journal of critical care, 7*(4), 288.

Samuel, S. R., Gururaj, R., Kumar, K. V., Vira, P., Saxena, P. P., & Keogh, J. W. L. (2021). Randomized control trial evidence for the benefits of massage and relaxation therapy on sleep in cancer survivors—a systematic review. *Journal of Cancer Survivorship, 15*, 799-810.

Scott, A. J., Webb, T. L., Martyn-St James, M., Rowse, G., & Weich, S. (2021). Improving sleep quality leads to better mental health: A meta-analysis of randomised controlled trials. *Sleep medicine reviews*, *60*, 101556.

Shinde, M. B., & Anjum, S. (2014). Effectiveness of slow back massage on quality of sleep among ICU patent's. *IJSR, 3*(3), 292-298.

Shiue, I. (2013). Low vitamin D levels in adults with longer time to fall asleep: US NHANES, 2005–2006. *International journal of cardiology*, *168*(5), 5074-5075.

Unal, K. S., & Akpinar, R. B. (2016). The effect of foot reflexology and back massage on hemodialysis patients' fatigue and sleep quality. *Complementary therapies in clinical practice, 24*, 139-144.

Zee, P. C., & Turek, F. W. (2006). Sleep and health: everywhere and in both directions. *Archives of internal medicine, 166*(16), 1686-1688.

*Corresponding author, E-mail address: stela_kalinova@abv.bg