

Master thesis part 1:

The impact of massage therapy on pain perception in professional soccer players: A literature research

- **Massage therapy can alleviate pain symptoms of delayed onset of muscle soreness in test subjects**
- **Although massage therapy is a widely used therapy to aid elite athletes in their physical wellbeing, it is an under investigated treatment technique in this population, especially in soccer players**
- **Massage therapy can improve perceptual recovery in test subjects**

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RESEARCH FRAMEWORK

In part one of this two-part master thesis situated in sports rehabilitation, a study of the literature was performed. This master thesis is written in central format. It is a final product in study field physical therapy and rehabilitation science, faculty of healthcare and life sciences.

Roderick (2006) mentioned in his study, 'the wear and tear' of professional soccer players playing at high level is increasing from season-upon-season physical hardship. Pain in professional soccer players and other elite athletes is very common. Even healthy elite athletes are always in pain (P. Rosier, personal communication, March 24, 2015). Pain however can be a threatening feeling to their profession. In our educational program, we learned a few manual techniques to rehabilitate people who suffer from pain in many cases. In the context of our literature search, we chose to do research about massage therapy, a well-known therapy, often associated with the work of a physical therapist and widely used in sports rehabilitation.

In part two, massage therapy will be performed on a population of high level female soccer players in order to comprehend the impact of massage therapy on their pain, the meaning of this pain and their perception of pain before, after and during massage treatment. The experiment will take place in preparation of an international soccer match. Data acquired of this impact of massage therapy on pain perception will be processed in a phenomenological framework. Soccer players will be questioned based on a semi-structured interview. Part one of this master thesis is written by E. Groven and S. Houben, two students in physical therapy and rehabilitation science, under supervision of promotor Dr. J Calsius.

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PART I - LITERATURE STUDY

1. ABSTRACT

Background: Massage therapy is a very old and widely used therapy to aid athletes in their physical wellbeing. Though evidence supporting its use is controversial.

Aim: To investigate the impact of massage therapy on pain perception accompanying healthy professional soccer players in their daily practice.

Method: Literature search was performed on PubMed/Medline and Web of Knowledge, using a combination of Mesh-terms and free text additives.

Results: Overall, massage therapy had a positive effect on pain pressure threshold (PPT), perceived feeling of soreness, pain and perceived feeling of recovery in test subjects suffering from delayed onset of muscle soreness (DOMS). Statistical data containing a comparison between control and treatment group was frequently missing in included articles.

Discussion: Massage therapy seems to have a positive effect on pain associated parameters after DOMS in test subjects. Though overall quality of included studies is weak to moderate. Pain was induced in a consistent way but uniform protocols consisting massage treatment are lacking.

Conclusion: Overall, massage therapy can decrease pain associated parameters.

Key words: Pain perception, athletes and massage therapy.

2. INTRODUCTION

For many soccer players pain is a suppressed experience because pain is a really determinative aspect in their performance (Roderick, 2006). Many players will hide their injury from managers, trainers and physiotherapists because they do not want to lose their contract, bonuses or place in the team (Roderick).

After investigating injured players playing in a soccer game, the study of Hammond, Lilley, Pope and Ribbans (2014) revealed that 32 of 206 injured players, played a match while being injured. Furthermore, 6% of match time in one season is performed by injured players (Hammond, Lilly, Pope and Ribbans). In his doctoral thesis, P. Rosier revealed that even healthy elite athletes are always in pain (P. Rosier, personal communication, March 24, 2015). However, when a soccer player is continuously suffering, it could pressurize his mental state and delay his mental and physical recovery (P. Rosier, personal communication). So maybe if this perception of pain can be reduced, this could have an influence on the mental state and subsequently on the sport performance of soccer players.

In this literature search, the aim is to reveal in which way massage therapy can diminish pain feelings in soccer players. Moreover, the purpose is to investigate the effects of massage therapy on pain perception. Massage therapy is defined as “mechanical manipulation of body tissues with rhythmical pressure and stroking for the purpose of promoting health and well-being” (Nédélec et al., 2013). Massage therapy is a widely used treatment to ameliorate recovery after sports games (Galloway and Watt, 2002). In the period between 1987 and 1998, the percentage of time in treatment amounted 24.0 – 52.2% for massage at twelve important athletic events (Galloway and Watt). Even though Galloway and Watt discussed the importance of massage in track and field sports, they were not sure if massage therapy was the best treatment after an important sport game. In their study Nédélec et al. discussed recovery strategies in soccer, they came to a conclusion that overall physiological evidence supporting massage therapy is lacking. On the other hand, there are some studies that show an improvement in perceptual recovery after massage treatment (Micklewright, Griffin, Gladwell and Beneke, 2005; Ogai, Yamane, Matsumoto and Kosaka, 2008). This is an interesting contradiction that raises a lot of questions. Therefore in this master thesis, literature concerning pain perception after massage treatment will be reviewed.

3. METHODS

3.1 RESEARCH QUESTION

What is the impact of massage therapy on pain perception in healthy professional soccer players?

3.2 LITERATURE SEARCH

A PubMed and Web of Knowledge search was performed using a combination of following MeSH-terms and free text additives: Massage (MeSH), Soft tissue therapy (MeSH), Pain perception (MeSH, Title/abstract), Soccer (MeSH, Title/abstract), Athletes (MeSH, Title/abstract), Sports (MeSH), Myalgia (MeSH). Relevant articles were selected on title and abstract.

No literature was found concerning professional soccer players and massage therapy. Therefore literature search was extended to athletes in general but this resulted in mostly amateur athletes and healthy subjects. Subjects with pathology or injuries were excluded because research in part two of this master thesis is targeted at healthy professional soccer players. References of resulting articles were checked. After selection on title and abstract in these references, an additional twelve articles were included (Appendix 1 – Table 1, 2, 3 & Figure 1).

3.3 SELECTION CRITERIA

Inclusion criteria:

- Pain or pain perception in outcome
- Intervention: massage therapy
- Written in English/Dutch/French

Exclusion criteria (Appendix 1 – Table 5):

- Massage in combination with exercise therapy
- Medical procedure/operation
- Non-healthy subjects.

An overview of the included articles can be found in Appendix 1 – Table 4.

3.4 QUALITY ASSESSMENT

To assess quality of the literature, Cochrane checklist for RCT and systematic review were used (Appendix 2 – Table 6 & 7).

Narrative reviews could not be analyzed by the Cochrane checklist for systematic review. The main difference between narrative and systematic reviews is the adequately formulated research question, which is missing in narrative reviews, and the adequately performed search protocol, which is only available in systematic reviews. Outcomes, described in narrative reviews, will be discussed in Appendix 3 – Table 9.

3.5 DATA EXTRACTION

After literature search and quality assessment seventeen studies were included. Data concerning pain-related outcomes were checked. Performance related data or physiologic outcomes were not included

because this is not the purpose of this master thesis. Parameters used for data extraction were: Pain pressure threshold, pain, perceived feeling of muscle soreness and perceived feeling of recovery. Details of data extraction can be found in Appendix 3 – Table 9.

4. RESULTS

4.1 RESULTS STUDY SELECTION

At the outset, a general search on pain perception after massage therapy was done. Next a search for pain perception in elite athletes (especially soccer players) after massage therapy was performed. This however did not result in any hits or useable articles. Therefore healthy subjects who received massage therapy after strenuous exercise were included. In most articles delayed onset of muscle soreness (DOMS) was induced by exercise, mainly eccentric, performed in laboratory setting.

Out of 54 studies, 49 were excluded for various reasons (Appendix 1 – Table 5). Most studies were excluded because massage therapy was not applied. Pathological test subjects were another important reason for exclusion. Quality assessment and further data extraction of remaining articles was performed (Appendix 2 & 3) and discussed in further sections.

4.2 RESULTS QUALITY ASSESSMENT

Modalities of used therapies in the included articles showed no consistency. A range of different therapy modalities was used. A lot of questions in RCT checklist could not be answered due to a lack of information about randomization or blinding. For this reason lower quality scores than initially hoped, were obtained. Overall quality of included studies was low to moderate. A few included studies used within-subjects design so therapy could not be blinded for test subjects. They did not randomize test subjects but their body parts instead. Therefore a few questions could not be answered. Details of quality assessment can be found in Appendix 2. A summary of strengths and weaknesses of the included articles can be found in Appendix 2 – Table 8.

4.3 RESULTS DATA EXTRACTION

Pain

In the study of Dawson KA, Dawson L, Thomas and Tiidus (2011), the research group found no significant treatment effect, but a time effect in massage group and control group. It was remarkable that in massage group, subjects were more confident in pain associated with running although pain did not differ between groups. Frey Law et al. (2008) found a significant effect of deep tissue massage on stretch pain. Superficial massage and control group showed no significant effects. Jönhagen, Ackerman, Eriksson, Saartok and Renström (2004) found no significant difference between two therapy modalities. The study of Leivadi et al. (1999) showed a significant decrease in neck, shoulder and back pain in both massage therapy group and relaxation group. Results in included reviews vary. Two articles in the review of Best, Hunter, Wilcox and Haq (2008) found a significant effect of massage on pain. In the review of Ernst (1998), four articles reported a decline in DOMS, but the effect was not significant.

Pain pressure threshold

Four out of seventeen studies measured pain pressure threshold (PPT). In their study Arroyo-Morales et al. (2008) found no difference between massage intervention group and rest control group. Frey Law et al. (2008) measured an elevation of PPT in deep massage group and superficial massage group but not in control group. Anderssen et al. (2013) found a significant difference between massage and control

group and between active exercise and control group. There was no difference between massage and active exercise. Mancinelli et al. (2006) found only an effect on the left side of the body.

Perceived Feeling of Soreness

Seven of the included studies reviewed perceived feeling of soreness. Between studies, massage therapy seems better in alleviating perceived feeling of soreness than control groups. Timing of measuring treatment effect differs between studies, so it is hard to formulate an overall conclusion of duration of treatment effect. The study of Anderssen et al. (2013) found a significant effect of massage and exercise, but there was no difference between groups. By Delextrat, Hippocrate, Leddington-Wright and Clarke (2014), the advantage of massage combined with stretch in women was significantly higher than massage alone in women. Hilbert, Sforzo and Swensen (2003) found an effect of massage 48 hours after intervention. Intensity of soreness was significantly lower in massage group compared to control group, but only 48 hours post intervention. Mancinelli and his research group found an effect of massage, but no significant difference between massage group and control group (Mancinelli et al. 2006). Micklewright (2009) on the other hand, found an effect in control group, but no significant difference between treatment and control group. Zainuddin, Newton, Sacco and Nosaka (2005) found an effect of massage in musculus brachioradialis and extensors of the arm, but not in musculus brachialis and flexors of the arm. All included articles in the review of Best (2008) and Ernst (1998) showed no significant effects of massage on perceived feeling of soreness. In the study of Moraska (2005), results are contradicting. Two studies showed no effect in the quadriceps. One study showed an effect at all time points (1, 24, 48, 72, 96h after massage), whereas another four studies showed only an effect at 48h or 24h after massage treatment. In the review of Nelson (2013), one study found no significant effect of massage, meanwhile five studies revealed an effect of massage. One study found an effect of soft tissue release. Finally, in the study of Weerapong (2005), two studies did not find a treatment effect, four were in favor of massage treatment.

Perceived Feeling of Recovery

Only two articles discussed the effect of this outcome. Hemmings and his team showed a significant effect of massage on perceived feeling of recovery in eight amateur boxers (Hemmings, Smith, Graydon and Dyson, 2000). In the review of Weerapong (2005), two studies found an effect of massage treatment, one study did not.

5. DISCUSSION

5.1 REFLECTION QUALITY ASSESSMENT

As mentioned in section 4.2, score of the included studies was low to moderate. Used therapy was the main reason for not blinding subjects and intervention practitioners. Mostly, type of intervention was clear for test subjects. However, blinding of test subjects is an important part of study design and corresponding quality score because of possible placebo effect.

In most studies dropout was not described. In all studies, there was a short follow-up time. This requires less effort from test subjects. Probably dropout was not mentioned because there were no dropouts.

Because of within-subjects design not all studies used randomization. Therapy was limited to one body part whereby the other side of the body functioned as control.

5.2 REFLECTION RESEARCH QUESTION

The purpose of this master thesis was to evaluate the available literature on the impact of massage therapy on pain perception in professional soccer players. However it was very difficult to find any solid literature concerning professional soccer players.

5.3 REFLECTION STRENGTHS AND WEAKNESSES OF LITERATURE SEARCH

The interest of this master thesis was pain perception in athletes and especially soccer players, but this resulted in a limited amount of articles.

A strength was the consistent content of the studies obtained by this literature search. Another advantage was that pain was induced in a consistent way. Mostly exercise was used to induce DOMS. In a laboratory setting DOMS is easy to induce. Pain associated with medical procedures was excluded because this was not the purpose of this master thesis. In our experience as amateur soccer players, DOMS is comparable to pain experienced in pre-competition training sessions.

A disadvantage was the difference in designs of the articles. There was a difference in time of follow-up, number of massage interventions, duration of massage and timing of intervention after inducing DOMS.

In most studies, there was a significant effect of massage intervention. A weakness in some studies was that they did not statistically compare massage intervention effect with control group effect.

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

In literature there is lack of a consensus in duration of therapy and time interval between exercise and intervention when using massage to alleviate DOMS. In articles various protocols were used when treating test subjects. More studies with larger sample sizes and uniform protocols are needed to make stronger conclusions. Also in most studies complex feelings as pain and perceptual recovery are examined by simple scales such as VAS. In our opinion, such scales are not extensive enough to describe such complex feelings.

It is hard to make a profound analysis of pain perception using a quantitative design. In quantitative design, often VAS or other pain scales are used to measure pain levels. Pain however, is a complex feeling that cannot be fully expressed by these scales. By using a qualitative design with semi-structured interview, subjects can describe their perception of pain in an extensive way. Therefore in part two of this master thesis we will prefer a qualitative approach.

6. CONCLUSION

In general, massage has a positive effect on pain-related outcomes (pain, PPT, perceived feeling of recovery and perceived feeling of soreness), yet literature concerning professional athletes is sparse and there was no literature concerning soccer players.

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40. Petrucio Venceslau de, M., Pinto Costa da, SE., Pinto Costa da, SP., Monteiro de, F. & Iraquitã de Oliveira, C. (2013, December). Meaning of physical pain in practice of sport performance. *Revista Brasileira de Ciências do Esporte*, 35(4), 10005-1019
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42. Queme, F., Taguchi, T., Mizumura, K. & Graven-Nielsen, T. (2013, November). Muscular heat and mechanical pain sensitivity after lengthening contractions in humans and animals. *Journal of Pain*, 14(11), 1425-1436
43. Schoffl, V., Morrison, A., Schwarz, U., Schoffl, I. & Kupper, T. (2010). Evaluation of injury and fatality risk in rock and ice climbing. *Sports Medicine*, 40(8), 657-679
44. Sheaves, E., Snodgrass, S. & Rivett, D. (2012, February). Learning lumbar spine mobilization: Effects of frequency and self-control of feedback. *Journal of Orthopaedic and Sports Physical Therapy*, 42(2), 114-124
45. Sran, M. & Khan, K. (2005, February). Physiotherapy and osteoporosis: practice behaviors and clinicians' perceptions: Survey. *Manual Therapy*, 10(1), 21-27
46. Wang, H. & Keck, J. (2004, June). Foot and hand massage as an intervention for postoperative pain. *Pain Management Nursing*, 5(2), 59-65
47. Weeks, S. & Tsao, J. (2010, December). Incorporation of another person's limb into body image relieves phantom limb pain: Cas study. *Neurocase*, 16(6), 461-465
48. Yildirim, G. & Sahin, N. (2004). Effect of breathing and skin stimulation techniques on labour pain perception of Turkish women. *Pain Research & Management*, 9(4), 183-187
49. Zhu, X., Wong, F., Bensoussan, A., Lo, S., Zhou, C., Yu, J. (2010, October). Are there any cross-ethnic differences in menstrual profiles? Pilot comparative study on Australian and

Chinese women with primary dysmenorrhea. Journal of Obstetrics and Gynaecology Research
Impact, 36(5), 1093-1101

8. APPENDICES

APPENDIX 1 – SEARCH STRATEGY

Table 1 – Search Strategy PubMed

#	Terms	01/2015	04/2015
1	"Massage"[MeSH]	4 780	4 838
2	"Therapy, Soft Tissue"[MeSH]	5 222	5 303
3	"Pain Perception"[MeSH]	1 711	1 896
4	"Pain Perception"[Title/Abstract]	3 897	3 995
5	"Soccer"[MeSH]	4 428	4 598
6	"Soccer"[Title/Abstract]	4 644	4 805
7	"Athletes"[MeSH]	3 990	4 276
8	"Athletes"[Title/Abstract]	27 580	28 417
9	"Sports"[MeSH]	130 285	132 759
10	"Myalgia"[MeSH]	8	296
11	#1 AND #3	5	5
12	#1 AND #4	10	10
13	#11 OR #12	14	14
14	#13 AND #5	0	0
15	#13 AND #6	0	0
16	#14 OR #15	0	0
17	#13 AND #7	0	0
18	#13 AND #8	0	0
19	#17 OR #18	0	0
20	#13 AND #9	1	1
21	#2 AND #3	5	5
22	#2 AND #4	11	12
23	#21 OR #22	15	16
24	#23 AND #5	0	0
25	#23 AND #6	0	0
26	#24 OR #25	0	0
27	#23 AND #7	0	0
28	#23 AND #8	0	0
29	#27 OR #28	0	0
30	#23 AND #9	1	1
31	#10 AND #1	8	8
32	#10 AND #2	8	8
33	#10 AND #3	8	10
34	#10 AND #4	4	4
35	#33 OR #34	10	12
36	#35 AND #1	0	0
37	#35 AND #2	0	0
38	#31 OR #32 OR #35 OR #36 OR #37	18	20
39	#13 OR #16 OR #19 OR #20	14	14
40	#23 OR #26 OR #29 OR #30	15	16
41	#38 OR #39 OR #40		36

Table 2 – Final Search Strategy PubMed

Final search strategy PubMed	
<p>((((((((((((Myalgia[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Myalgia[MeSH Terms] AND Pain perception[Title/Abstract])) AND Therapy, soft tissue[MeSH Terms])) OR ((((((Myalgia[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Myalgia[MeSH Terms] AND Pain perception[Title/Abstract])) AND Massage[MeSH Terms])) OR ((((((Myalgia[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Myalgia[MeSH Terms] AND Pain perception[Title/Abstract])) OR ((Myalgia[MeSH Terms] AND Therapy, soft tissue[MeSH Terms])) OR ((Myalgia[MeSH Terms] AND Massage[MeSH Terms])) OR (((((((((Massage[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Massage[MeSH Terms] AND Pain perception[Title/Abstract])) OR (((((((((Massage[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Massage[MeSH Terms] AND Pain perception[Title/Abstract])) AND Soccer[Title/Abstract])) OR (((((((((Massage[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Massage[MeSH Terms] AND Pain perception[Title/Abstract])) AND Athletes[Title/Abstract])) OR (((((((((Massage[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Massage[MeSH Terms] AND Pain perception[Title/Abstract])) AND Athletes[MeSH Terms])) OR ((Sports[MeSH Terms] AND (((((((((Massage[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Massage[MeSH Terms] AND Pain perception[Title/Abstract])) AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[Title/Abstract])) AND Soccer[MeSH Terms])) OR (((((((((Therapy, soft tissue[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[Title/Abstract])) AND Soccer[Title/Abstract])) OR (((((((((Therapy, soft tissue[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[Title/Abstract])) AND Athletes[Title/Abstract])) OR (((((((((Therapy, soft tissue[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[Title/Abstract])) AND Athletes[MeSH Terms])) OR (((((((((Therapy, soft tissue[MeSH Terms] AND Pain perception[MeSH Terms])) OR ((Therapy, soft tissue[MeSH Terms] AND Pain perception[Title/Abstract])) AND Sports[MeSH Terms]))</p>	

Table 3 – Search Strategy Web of Science

#	Terms	01/2015	04/2015
1	TOPIC: (pain perception) AND TOPIC: (soccer)	9	14
2	TOPIC: (pain perception) AND TOPIC: (manu*l therapy) AND TOPIC: (sports)	2	4
3	TOPIC: (pain perception) AND TOPIC: (manu*l therapy) AND TOPIC: (soccer)	0	0

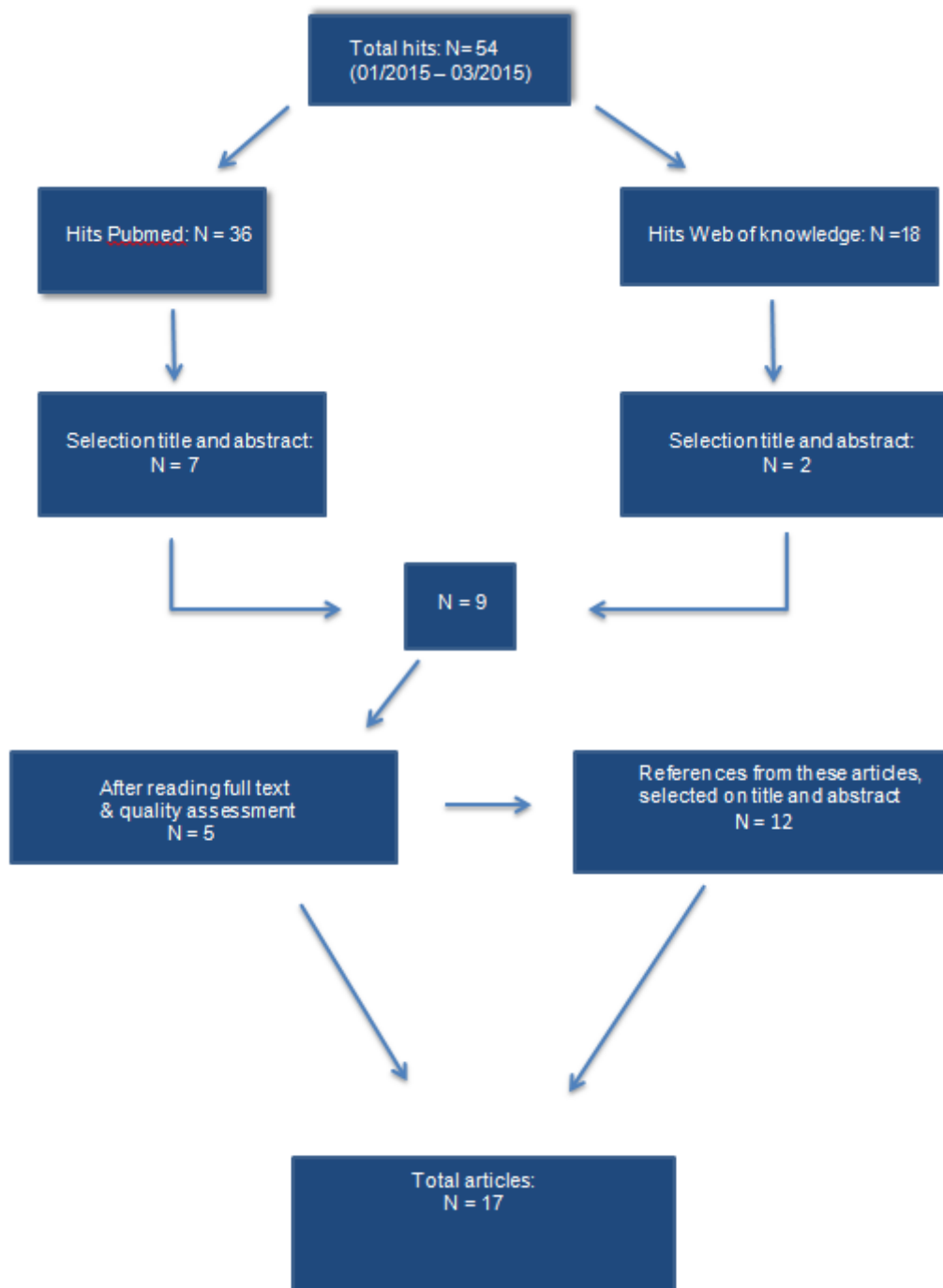


Figure 1 – Flowchart Search Strategy

Table 4 – Included Articles

Authors	Title
Anderssen, L., Jay, K., Andersen, C., Jakobsen, M., Sundstrup, E., Topp, R. & Behm, D. (2013)	Acute effects of massage or active exercise in relieving muscle soreness: Randomized controlled trial.
Arroyo-Morales, M., Olea, N., Manuel Martinez, M., Hidalgo-Lozano, A., Ruiz-Rodriguez, C. & Diaz-Rodriguez, L. (2008)	Psychophysiological effects of massage-myofascial release after exercise: Randomized sham-control study.
Best, T., Hunter, R., Wilcox, A. & Haq, F. (2008)	Effectiveness of sports massage for recovery of skeletal muscle from strenuous exercise.
Dawson, KA., Dawson, L., Thomas, A. & Tiidus P. (2011)	Effectiveness of regular proactive massage therapy of novice recreational runners.
Delextrat, A., Hippocrate, A., Leddington-Wright, S. & Clarke, N. (2014)	Including stretches to a massage routine improves recovery from official matches in basketball players.
Ernst, E. (1998)	Does post-exercise massage treatment reduce delayed onset muscle soreness? A systematic review.
Frey Law, L., Evans, S., Knudtson, J., Nus, S., Scholl, K. & Sluka, K. (2008)	Massage reduces pain perception and hyperalgesia in experimental muscle pain: Randomized, controlled trial.
Hemmings, B., Smith, M., Graydon, J. & Dyson, R. (2000)	Effects of massage on physiological restoration, perceived recovery, and repeated sports performance.
Hilbert, J., Sforzo, G. & Swensen, T. (2003)	The effects of massage on delayed onset muscle soreness.
Jönhagen, S., Ackermann, P., Eriksson, T., Saartok, T. & Renström, P. (2004)	Sports massage after eccentric exercise.
Leivadi, S., Hernandez-Reif, M., Field, T., O'Rourke, M., D'Arienzo, S., Lewis, D., del Pino, N., Schanberg, S. & Kuhn, C. (1999)	Massage therapy and relaxation effects on university dance students.
Mancinelli, C., Davis, S., Aboulhosn, L., Brady, M., Eisenhofer, J., Foutty, S. (2006)	The effects of massage on delayed onset muscle soreness and physical performance in female collegiate athletes.
Micklewright, D. (2009)	The effect of soft tissue release on delayed onset muscle soreness: Pilot study.
Moraska, A. (2005)	Sports massage: Comprehensive review.
Nelson, N. (2013)	Delayed onset muscle soreness: Is massage effective?
Weerapong, P., Hume, P. & Kolt, G. (2005)	The mechanisms of massage and effects on performance, muscle recovery and injury prevention.
Zainuddin, Z., Newton, M., Sacco, P. & Nosaka, K. (2005)	Effects of massage on delayed-onset muscle soreness, swelling and recovery of muscle function.

Table 5 – Excluded Articles

<p>No Dutch/English/French</p>	<ul style="list-style-type: none"> - Petrucio Venceslau de, M., Pinto Costa da, SE., Pinto Costa da, SP., Monteiro de, F. & Iraquitán de Oliveira, C. (2013, December). Meaning of physical pain in practice of sport performance.
<p>No healthy subjects</p>	<ul style="list-style-type: none"> - Abdallah, B., Badr, L. & Hawwari, M. (2013, December). Efficacy of massage on short and long term outcomes in preterm infants. - Chen, H., Chang, F. & Hsu, C. (2005, August). Effect of acupressure on nausea, vomiting, anxiety and pain among post-cesarean section women in Taiwan. - Ferrell-Torry, A. & Glick, O. (1993, April). Use of therapeutic massage as a nursing intervention to modify anxiety and the perception of cancer pain. - Lauche, R., Materdey, S., Cramer, H., Haller, H., Stange, R., Dobos, G. ... (2013, June). Effectiveness of home-based cupping massage compared to progressive muscle relaxation in patients with chronic neck pain: Randomized controlled trial. - Luk, J., Tsang, R. & Leung, H. (2014, April). Lateral epicondylalgia: Midlife crisis of a tendon. - McNamara, M., Burnham, D., Smith, C. & Carroll, D. (2003, January-February). Effects of back massage before diagnostic cardiac catheterization. - Mok, E. & Woo, C. (2004, November). Effects of slow-stroke back massage on anxiety and shoulder pain in elderly stroke patients. - Nabb, M., Kimber, L., Haines, A. & McCourt, C. (2006, August). Does regular massage from late pregnancy to birth decrease maternal pain perception during labour and birth? Feasibility study to investigate a programme of massage, controlled breathing and visualization, from 36 weeks of pregnancy until birth. - Paanalahti, K., Holm, L., Nordin, M., Asker, M., Lyander, J. & Skillgate, E. (2014, March). Adverse events after manual therapy among patients seeking care for neck and/or back pain: Randomized controlled trial. - Sran, M. & Khan, K. (2005, February). Physiotherapy and osteoporosis: practice behaviors and clinicians' perceptions: Survey. - Wang, H. & Keck, J. (2004, June). Foot and hand massage as an intervention for postoperative pain.
<p>No massage therapy</p>	<ul style="list-style-type: none"> - Adams, N. & Field, L. (2001, July-August). Pain management 1: Psychological and social aspects of pain. - Ahlsen, B., Bondevik, H., Mengshoel, A. & Solbrække K. (2014). (Un)doing gender in a rehabilitation context: Narrative analysis of gender and self in stories of chronic muscle pain. - Akhter, R., Benson, J. Svensson, P., Nicholas, M., Peck, C. & Murray, G. (2014). Experimental jaw muscle pain increases pain scores and jaw movement variability. - Anaf, S. & Sheppard, L. (2010, June). Lost in translation? How patients perceive the extended scope of physiotherapy in the emergency department. - Comstock, B., Thomas, G., Dunn-Lewis, C., Volek, J., Szivak, T., Hooper, D. ... (2013, December). Effects of acute resistance exercise on muscle damage and perceptual measures between men who are lean and obese. - Crowcroft, S., Duffield, R., McCleave, E., Slattery, K., Wallace, L. & Coutts, A. (2015, June). Monitoring training to assess changes in fitness and fatigue: Effects of training in heat and hypoxia. - Davis, J. & Green, J. (2009). Caffeine and anaerobic performance ergogenic value and mechanisms of action. - Duncan, M., Stanley, M., Parkhouse, N., Cook, K. & Smith, M. (2013). Acute caffeine ingestion enhances strength performance and reduces perceived exertion and muscle pain perception during resistance exercise.

- Finberg, M., Braham, R., Goodman, C., Gregory, P. & Peeling, P. (2013, May). Effects of electrostimulation therapy on recovery from acute team-sport activity.
- Fuller, C. & Drawer, S. (2004). Application of risk management in sport
- Healey K., Hatfield, D., Blanpied, P., Dorfman, L. & Riebe, D. (2014, January). Effects of myofascial release with a foam rolling on performance.
- Horjales-Araujo, E., Demontis, D., Lund, E., Vase, L., Finnerup, N., Børglum, A. ... (2013, August). Emotional modulation of muscle pain is associated with polymorphisms in the serotonin transporter gene.
- Horjales-Araujo, E., Finnerup, N., Jensen, T. & Svensson, P. (2013, July). Differential effect of visual and gustatory stimuli on experimental jaw muscle pain.
- Hosseinzadeh, M., Andersen, O., Arendt-Nielsen, L. & Madeleine, P. (2013, October). Pain sensitivity is normalized after a repeated bout of eccentric exercise.
- Hurley, C., Hatfield, D. & Riebe, D. (2013, November). Effect of caffeine ingestion on delayed onset muscle soreness.
- Kaalund, S. & Madeleine, P. (2014, September-October). Effects of shock-absorbing insoles during transition from natural grass to artificial turf in young soccer players: Randomized controlled trial.
- Kumar, A., Castrillon, E. & Svensson, P. (2015). Can experimentally evoked pain in the jaw muscles or temporomandibular joint affect anterior bite force in humans?
- Kwan, W. & Li, W. (2014, April). Effect of ear acupressure on acute postpartum perineal pain: Randomised controlled study.
- Liebano, R., Waszczuk, S. & Correa, J. (2013, December). Effect of burst-duty-cycle parameters of medium-frequency alternating current on maximum electrically induced torque of the quadriceps femoris, discomfort and tolerated current amplitude in professional soccer players.
- Madeleine, P., Hoej, B., Fernandez-de-las-Penas, C., Rathleff, M. & Kaalund, S. (2014, August). Pressure pain sensitivity changes after use of shock-absorbing insoles among young soccer players training on artificial turf: Randomized controlled trial.
- Michelotti, A., Cioffi, I., Rongo, R., Borrelli, R., Chiodoni, P. & Svensson, P. (2014). Effects of muscle pain induced by glutamate injections during sustained clenching on the contraction pattern of masticatory muscles.
- Montgomery, P. & Hopkins, W. (2013, May). Effects of game and training loads on perceptual responses of muscle soreness in Australian football.
- Muller, M., Seo, Y., Kim, C.-H., Ryan, E., Pollock, B., Burns, K. ... (2014, April). Cold habituation does not improve manual dexterity during rest and exercise in 5°C.
- Pain, M. & Harwood, C. (2008). Performance environment of the England youth soccer teams: Quantitative investigation.
- Queiroz, A., de Brito, R., Ramacciatto, J., Motta, R. & Florio, F. (2013, December). Influence of mouthguards on the physical performance of soccer players.
- Queme, F., Taguchi, T., Mizumura, K. & Graven-Nielsen, T. (2013, November). Muscular heat and mechanical pain sensitivity after lengthening contractions in humans and animals.
- Schoffl, V., Morrison, A., Schwarz, U., Schoffl, I. & Kupper, T. (2010). Evaluation of injury and fatality risk in rock and ice climbing.
- Sheaves, E., Snodgrass, S. & Rivett, D. (2012, February). Learning lumbar spine mobilization: Effects of frequency and self-control of feedback.

	<ul style="list-style-type: none"> - Weeks, S. & Tsao, J. (2010, December). Incorporation of another person's limb into body image relieves phantom limb pain: Cas study. - Yildirim, G. & Sahin, N. (2004). Effect of breathing and skin stimulation techniques on labour pain perception of Turkish women. - Zhu, X., Wong, F., Bensoussan, A., Lo, S., Zhou, C., Yu, J. (2010, October). Are there any cross-ethnic differences in menstrual profiles? Pilot comparative study on Australian and Chinese women with primary dysmenorrhea.
Intervention with additional exercise	/
No pain (perception) in outcome	<ul style="list-style-type: none"> - Crawford, SK., Haas, C., Butterfield, T., Wang, W., Zhang, X., Zhao, Y. & Best, T. (2014, June). Effects of immediate vs. delayed massage-like loading on skeletal muscle viscoelastic properties following eccentric exercise. - Cherian, K., Cherian, N., Cook, C. & Kaltenbach, J. (2013, July-August). Improving tinnitus with mechanical treatment of the cervical spine and jaw. - Fitschen, P., Kistler, B., Jeong, J., Chung, H., Wu, P., Walsh, M., ... (2014, September). Perceptual effects and efficacy of intermittent or continuous blood flow restriction resistance training. - Gatin, P., Meyer, D. & Robinson, D. (2013, September). Perceptions of wellness to monitor adaptive responses to training and competition in elite Australian football. - Hiraiwa, Y., Arijji, Y., Kise, Y., Sakuma, S., Kurita, K. & Arijji, E. (2013, October). Efficacy of massage treatment technique in masseter muscle hardness: Robotic experimental approach. - Pain, M., Harwood, C. & Mullen, R. (2012, September). Improving the performance environment of a soccer team during a competitive season: Exploratory action research study.

APPENDIX 2 – QUALITY ASSESSMENT

Table 6 – Quality Assessment RCT

Article	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Score
Andersen LL et al. (2013) ¹	Yes	No info	No	No	Yes	No info	Yes	Yes	Yes	5/9
Arroyo-Morales M. et al. (2008)	Yes	Yes	No	No	No info	Yes	Yes	Yes	Yes	6/9
Dawson, KA., Dawson, L., Thomas, A. & Tiidus P. (2011)	No	No	No	No	No info	Yes	Yes	Yes	No	3/9
Delextrat, A., Hippocrate, A., Leddington-Wright, S. & Clarke, N. (2014)	Yes	No info	No	No	No info	Yes	Yes	Yes	Yes	5/9
Frey Law LA et al. (2008)	Yes	Yes	Yes	No	Yes	No info	Yes	Yes	Yes	7/9
Hemmings, B., Smith, M., Graydon, J. & Dyson, R. (2000)	No	No	No	No	No info	No info	Yes	Yes	Yes	3/9
Hilbert, J., Sforzo, G. & Swensen, T. (2003)	Yes	No info	Yes	No	No info	No info	No	Yes	Yes	4/9
Jönhagen, S.,	No	No	No	No	No info	Yes	Yes	No	Yes	3/9

¹ Paired within-subjects control design with repeated measures.

Ackermann, P., Eriksson, T., Saartok, T. & Renström, P. (2004)										
Leivadi S. et al. (1999)	Yes	No info	No	No	No info	Yes	Yes	Yes	Yes	5/9
Mancinelli CA et al. (2006)	Yes	No info	No	No	Yes	Yes	No info	Yes	Yes	5/9
Micklewright D. (2009)	Yes	No info	No info	No	No info	No info	Yes	Yes	Yes	4/9
Zainuddin, Z., Newton, M., Sacco, P. & Nosaka, K. (2005)¹	No	No	No	No	No info	Yes	Yes	No	Yes	3/9

- Question 1: Was the allocation of intervention of the subjects randomized?
- Question 2: Was the person who included subjects in the experiment blinded for randomization sequence?
- Question 3: Was knowledge of the allocated intervention hidden from test subjects?
- Question 4: Was knowledge of the allocated interventions adequately hidden from the practitioners?
- Question 5: Was knowledge of the allocated interventions adequately hidden from effect assessors?
- Question 6: At baseline, were the groups comparable?
- Question 7: Is complete follow-up of sufficient number of included subjects available?
- Question 8: Are all included subjects analyzed in the same group in which they were randomized?
- Question 9: Are the groups treated equally apart from intervention?

Table 7 – Quality Assessment Systematic Reviews

Review	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Best, T., Hunter, R., Wilcox, A. & Haq, F. (2008)	Yes	Yes	Yes	Yes	No	Yes	Yes	No pooling
Ernst (1998)	Yes	Yes	Yes	No	No	No	No	No pooling

- Question 1: Is the question formulated adequately?
- Question 2: Is the literature search performed adequately?
- Question 3: Is the selection procedure of the literature performed adequately?
- Question 4: Is the assessment of the quality performed adequately?
- Question 5: Is it adequately described how they performed the data extraction?
- Question 6: Are the main characteristics of the original studies described?
- Question 7: Did they treat the clinical and statistical heterogeneity adequately?
- Question 8: Is the statistical pooling performed correctly?

Table 8 – Strength/Weakness-assessment

Authors	Strengths	Weaknesses
Anderssen, L., Jay, K., Andersen, C., Jakobsen, M., Sundstrup, E., Topp, R. & Behm, D. (2013)	<ul style="list-style-type: none"> - Extensive research protocol - Blinding of effect assessors - Sufficient number of test subjects 	<ul style="list-style-type: none"> - Can only be generalized for woman and DOMS - Within-subject randomization → overall effect? - No blinding of test subjects - No statistical information available - Only a time effect
Arroyo-Morales, M., Olea, N., Manuel Martinez, M., Hidalgo-Lozano, A., Ruiz-Rodriguez, C. & Diaz-Rodriguez, L. (2008)	<ul style="list-style-type: none"> - Extensive research protocol - Whole body massage after bicycle effort - More subjective effects of massage are questioned (vigor, POMS) - Sufficient number of test subjects - Groups are matched for gender 	<ul style="list-style-type: none"> - Only effects on short term - No blinding of test subjects - Only a time effect between groups
Best, T., Hunter, R., Wilcox, A. & Haq, F. (2008)	<ul style="list-style-type: none"> - Adequate description of search strategy - Individual studies adequately described - Research question adequately described 	<ul style="list-style-type: none"> - Great variance between studies in application of massage therapy (treatment time, number of interventions,...) - There was no information in included studies about the amount of force used by the practitioner.
Dawson, KA., Dawson, L., Thomas, A. & Tiidus P. (2011)	<ul style="list-style-type: none"> - Pain in subjects is not exited in laboratory setting - Extensive research protocol - Sufficient number of test subjects - More subjective effects of massage are questioned 	<ul style="list-style-type: none"> - Less determined program: subjects complete 'start-to-run'. - No information about exclusion when missed training sessions/missed therapy sessions. - No blinding of test subjects - No significant effects between groups in terms of pain.
Delextrat, A., Hippocrate, A., Leddington-Wright, S. & Clarke, N. (2014)	<ul style="list-style-type: none"> - Extensive research protocol - Tested in within same circumstances - Effect between groups in pain outcomes 	<ul style="list-style-type: none"> - No exact information about intensity of exercise prior massage therapy. - Massage therapy is not the same in both groups - No blinding of test subjects
Ernst, E. (1998)	<ul style="list-style-type: none"> - Research question adequately described - Adequate description of search strategy 	<ul style="list-style-type: none"> - Can only be generalized for woman and DOMS - Great variance in included studies - No statistical data of included articles available
Frey Law, L., Evans, S., Knudtson, J., Nus, S., Scholl, K. & Sluka, K. (2008)	<ul style="list-style-type: none"> - Blinding of effect assessors 	<ul style="list-style-type: none"> - Can only be generalized for DOMS
Hemmings, B., Smith, M., Graydon, J. & Dyson, R. (2000)	<ul style="list-style-type: none"> - Healthy subjects who participate in amateur boxing (sport) - Research in both physiological and perceptual recovery - Massage protocol adequately described 	<ul style="list-style-type: none"> - Small sample size - Trend towards higher punching force after massage in comparison to no massage, not significant due to high variability between test subjects

	-	-
Hilbert, J., Sforzo, G. & Swensen, T. (2003)	<ul style="list-style-type: none"> - More subjective effects of massage are questioned (differential descriptor scale, POMS) - Research in both physiological and perceptual recovery - Massage protocol adequately described and standardized. 	<ul style="list-style-type: none"> - Low statistical power in measurements pre 48 hour, post massage intervention. This was due to high overall variability. Subsequently it is hard to draw definitive conclusions. -
Jönhagen, S., Ackermann, P., Eriksson, T., Saartok, T. & Renström, P. (2004)	<ul style="list-style-type: none"> - Recreational athletes 	<ul style="list-style-type: none"> - Within subject randomization (leg to leg comparison) → overall effect of massage? - Only pain reviewed as perceptual recovery parameter
Leivadi, S., Hernandez-Reif, M., Field, T., O'Rourke, M., D'Arienzo, S., Lewis, D., del Pino, N., Schanberg, S. & Kuhn, C. (1999)	<ul style="list-style-type: none"> - University female dance majors (sports) - Massage protocol adequately described - Dancers reported less pain, pain was not exited by strenuous exercise. It was pain they experienced by being a dance major. 	<ul style="list-style-type: none"> - Different trained massage therapists - Only female athletes
Mancinelli, C., Davis, S., Aboulhosn, L., Brady, M., Eisenhofer, J., Foutty, S. (2006)	<ul style="list-style-type: none"> - Female collegiate athletes (NCAA division 1, volleyball and basketball) - Pain was not induced in laboratory setting but measurements took place after fourth training day of the season, when most DOMS was expected. - Massage protocol adequately described and standardized 	<ul style="list-style-type: none"> - No follow-up, only pre and post treatment measurements. - Amount of resistance training prior to start of the season differed between athletes, this had an influence on DOMS - Only female athletes
Micklewright, D. (2009)	<ul style="list-style-type: none"> - Subjects engaged in a mean of 2-5h aerobic exercise. - All interventions performed by the same massage therapist - Sham massage (applying of lotion) 	<ul style="list-style-type: none"> - Only male test subjects - Use of soft tissue release. This type of massage is targeted at manipulating deep tissues throughout the full range of motion. This is a different type of massage than applied in our other investigations and it exacerbated DOMS.
Moraska, A. (2005)	<ul style="list-style-type: none"> - Description of search strategy - Description of massage techniques - Description of various massage effects - Description of included articles - Healthy subjects in included articles 	<ul style="list-style-type: none"> - No description of research question - A lot of variability in timing of measurements after intervention between included articles - Can only be generalized for DOMS
Nelson, N. (2013)	<ul style="list-style-type: none"> - Description of search strategy - Description of research question - Description of Various massage effects - Description of included articles 	<ul style="list-style-type: none"> - No statistical data of included articles - Can only be generalized for DOMS - Variability in application of massage therapy in included articles

Weerapong, P., Hume, P. & Kolt, G. (2005)	<ul style="list-style-type: none"> - Description of search strategy - Description of possible effects of massage therapy - Description of included articles - Healthy subjects in included articles. 	<ul style="list-style-type: none"> - No description of research question - No statistical data of included articles - No description of limitations of search strategy. - Can only be generalized for DOMS
Zainuddin, Z., Newton, M., Sacco, P. & Nosaka, K. (2005)	<ul style="list-style-type: none"> - Long follow-up time (14 days) - All interventions performed by the same massage therapist - Massage protocol adequately described and standardized 	<ul style="list-style-type: none"> - Small sample size - Arm tot arm comparison model → overall effect of massage? - No blinding of test subjects possible

APPENDIX 3 - RESULTS

Table 9 – Results

Article (First Author)	Pain	Pain Pressure Threshold (PPT)	Perceived Feeling of Soreness (PFS)	Perceived Feeling of Recovery (PFR)
Andersen LL et al. (2013)		<p>Higher PPT in active exercise group compared with control group at 10,20 and 60 min after treatment</p> <p>Higher PPT in massage group compared with control group at 0,10,20 and 60 min after treatment</p> <p><i>p-value < .05</i></p> <p>No significant difference between the massage group and the active exercise group (<i>p-value > .05</i>)</p>	<p>Less soreness ratings in active exercise group compared with control group at 0,10,20 and 60 min after treatment</p> <p>Less soreness ratings in massage group compared with control group at 0,10 and 20 min after treatment</p> <p><i>p-value < .05</i></p> <p>No significant difference between massage group and active exercise group (<i>p-value > .05</i>)</p>	
Arroyo-Morales M. et al. (2008)		<p>No significant effect of massage in the masseter or trapezius muscle (<i>p-value = .2 and .6</i>)</p> <p>Significant time effect in both groups after exercise (<i>p-value < .001</i>)</p>		
Dawson, KA., Dawson, L., Thomas, A. & Tiidus P. (2011)	No difference between both interventions (<i>p-value = .410</i>) Positive time effect on pain during and after running (<i>p-value < .05</i>) in both groups			

	Massage group noticed that their pain management improved			
Delextrat, A., Hippocrate, A., Leddington-Wright, S. & Clarke, N. (2014)			<p><u>In women:</u> Lowest soreness in massage + stretch, followed by massage. Highest soreness was reported in control group immediately after treatment</p> <p>Lower soreness in massage compared with control (<i>p-value</i> $\leq .001$) and massage + stretch compared with control (<i>p-value</i> = .002) after 24h</p> <p><u>In men:</u> Lower soreness in massage and massage + stretch compared with control immediately after treatment (<i>p-value</i> $\leq .001$)</p> <p>Same effect post 24h as immediately after treatment in women</p>	
Frey Law LA et al. (2008)	<p>Less stretch pain in deep massage group compared with no treatment (<i>p-value</i> $< .01$)</p> <p>No difference in superficial group compared with two other groups (<i>p-value</i> = .3)</p>	<p>Increased PPT in deep massage group and superficial group compared with control group (<i>p-value</i> $\leq .05$)</p> <p>Decrease of PPT in control group (<i>p-value</i> = .02)</p>		
Hemmings, B., Smith, M., Graydon, J. & Dyson, R. (2000)				Improvement of perceived recovery in massage group (<i>p-value</i> $< .01$)
Hilbert, J., Sforzo, G. & Swensen, T. (2003)			Significantly less soreness ratings in massage group at	

			48h post exercise (<i>p</i> -value $\leq .000$) No significant effect at 6h and 24h post exercise	
Jönhagen, S., Ackermann, P., Eriksson, T., Saartok, T. & Renström, P. (2004)	No significant difference between treatment groups.			
Leivadi S. et al. (1999)	Less neck and shoulder pain in both groups (<i>p</i> -value $< .001$) Less back pain in both groups (<i>p</i> -value $< .01$) No statistical comparison between the two groups			
Mancinelli CA et al. (2006)		Significant increase in massage group on the left side compared with baseline (<i>p</i> -value = .0461) No significant effect on the right side (<i>p</i> -value = .1737) No statistical comparison between treatment and control group	Less perceived feeling of soreness in treatment group compared with baseline (<i>p</i> -value = .0011) No statistical comparison between treatment and control group	
Micklewright D. (2009)			Less soreness rating in control group immediately and at 48h after treatment at the mid and dorsal arm region (<i>p</i> -value $< .01$) No statistical comparison between treatment and control group	
Zainuddin, Z., Newton, M., Sacco, P. & Nosaka, K. (2005)²			Lower peak soreness in massage group of brachioradialis (<i>p</i> -value = .01)	

			and extensor muscle (<i>p-value</i> =.02) No difference in peak soreness of brachialis and flexor muscles in massage group (<i>p-value</i> >.05)	
Best, T., Hunter, R., Wilcox, A. & Haq, F. (2008)	<p>One study showed a decline in DOMS after massage treatment, this was not statistically significant. There was a significant decline in DOMS in massage group compared with baseline immediately after the treatment and 12h after therapy</p> <p>One study found a significant decrease (<i>p-value</i> <.05) in DOMS for women after a 17-min massage</p>		<p>One study showed a decrease in soreness intensity in massage group but there is no statistical evidence in the article</p> <p>One study showed no effect of massage immediately after a marathon</p>	
Ernst E. (1998)	<p>One study showed a decrease of pain levels in massage group, this was not statistically significant.</p> <p>One study showed a decrease of DOMS in massage group, this was not statistically significant. There was a significant decline in DOMS in massage group compared with baseline immediately after treatment and 12h after therapy</p>		<p>One study showed no significant difference between massaged leg and control leg at 24, 48 or 72h post exercise</p> <p>Another study showed no significant difference between massage group, placebo massage group and rest (control) group</p>	

	<p>One study showed a decline in DOMS after massage, but results were not statistically significant.</p> <p>One study showed a decrease of DOMS in massaged leg compared to control leg. Improvements were not statistically significant</p>			
Moraska A. (2005)			<p>2 included studies showed no effect of massage on soreness in quadriceps muscle</p> <p>1 study showed a decrease in soreness at all time points (1, 24, 48, 72, 96h after massage)</p> <p>2 studies showed only an effect at 48h post massage</p> <p>2 studies showed a decrease post 24h</p> <p><i>No statistical data available in the article!</i></p>	
Nelson N. (2013)			<p>One study found no significant effect of massage on DOMS</p> <p>5 studies showed a significant decrease in DOMS after massage treatment</p>	

			One study showed a significant increase in DOMS after soft tissue release	
Weerapong, P., Hume, P. & Kolt, G. (2005)			<p>4 articles found a significant effect on soreness</p> <p>2 studies found no significant effect of massage on soreness</p> <p><i>No statistical data available in the article!</i></p>	<p>One study found a significant effect of manual massage and mechanopressure massage</p> <p>One study found a significant effect on perceived recovery, but not on other outcomes</p> <p>One study found no significant effect</p> <p><i>No statistical data available in the article!</i></p>

PART II – RESEARCH PROTOCOL

1. INTRODUCTION

In part one of this master thesis, literature search revealed certain articles about presence of pain in mostly recreational athletes. Pain was mostly induced after excessive eccentric exercise and therapists reduced this pain using massage treatment. Most articles revealed a positive effect of massage therapy by ameliorating pain feelings (Dawson, KA., Dawson, L., Thomas and Tiidus, 2011; Frey Law et al., 2008; Leivadi et al., 1999; Best, Hunter, Wilcox and Haq, 2008; Ernst, 1998).

Massage therapy was chosen because it is a widely used therapy to accelerate recovery after sports performance, it is also well known by general population (Galloway and Watt, 2002). This master thesis supports massage as a therapy to reduce exercise related pain and perceptual recovery, yet little is known about its mechanisms and the meaning of massage for the athlete in reducing this pain. Therefore a qualitative design with a semi-structured interview will be used, this will give the opportunity to investigate pain perception of female soccer players in a profound way. Also, in comparison to VAS and other pain scales, more detailed information of this perception of pain can be acquired. Maybe this will give an explanation or new insights in the mechanisms (effects on pain) of massage therapy. In our opinion this will be the first study to evaluate the impact of massage therapy on professional female soccer players in a qualitative way, in order to obtain a better understanding of the phenomenon of improved pain perception and perceptual recovery after massage treatment.

As previously mentioned, even healthy elite athletes are always in pain (P. Rosier, personal communication, March 24, 2015). In this experiment, the aim is to evaluate the impact of massage therapy on this pain, in healthy elite female soccer players.

Professional female soccer players will participate in this experiment. An advantage of female test subjects is that they are more sensitive to pain and noxious stimuli (Wiesenfeld-Hallin, 2005). Because of this sensitivity to pain and noxious stimuli, maybe they can describe a more subtle change in pain perception than men. Furthermore, we think women can more easily express their inner feelings and feelings of pain.

2. RESEARCH GOAL

2.1 RESEARCH QUESTION

In which way can massage therapy influence pain perception or coping with pain in professional female soccer players?

3. METHODS

3.1 DESIGN

In this study, a qualitative design with a semi-structured interview after massage intervention will be used. During the first session, ten participants will receive massage therapy. To maintain standardization, first session will take place after a training day in soccer stage preparing an international soccer match. After one week, we will repeat the protocol in same circumstances. Interventions will be performed by the same practitioner in both sessions. Massage therapy will be performed by a professional massage therapist. Players will sign an informed consent at the start of the study. All soccer players will fill in VAS scale, ten players with highest VAS scores will participate in our experiment.

3.2 PARTICIPANTS

Ten professional female soccer players playing for Red Flames will be included (Woman National Belgian soccer team).

Exclusion criteria:

- Injury/ rehabilitating from injury

Inclusion criteria:

- Present at the soccer stage
- Healthy/fit players suffering from pain
- Playing for Red Flames (Belgian national female soccer team)
- Highest VAS scores

3.3 MEDICAL ETHICS

Application form for medical ethics committee will be submitted.

3.4 INTERVENTION

In this study thirty minutes of massage therapy will be performed by a professional massage therapist. It will be the same therapist in first and second intervention. Immediately after treatment a semi-structured interview, performed by two students, will take place.

3.5 OUTCOMES

Outcomes will be collected by a semi-structured interview. Data will be analyzed in a phenomenological framework. Questions will be asked in Dutch, a list of questions is available in Appendix 1.

3.6 DATA ANALYSIS

No statistical analysis will be used because of the qualitative nature of this research. Answers will be transcribed verbatim and analyzed within a phenomenological framework.

4. TIMEPLANNING

This is a possible timeplanning:

	August 2015	September 2015	October 2015	November 2015	December 2015	January 2016	February 2016	March 2016	April 2016	May 2016	June 2016
Intervention & interview	X	X									
Data analysis			X	X	X						
Writing						X	X	X			

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APPENDICES

APPENDIX 1 – SEMI-STRUCTURED INTERVIEW

Interview na de eerste sessie

- Kan u de pijn/gevoel voor behandeling omschrijven?
- Kan u het gevoel omschrijven tijdens de therapie?
- Kan u het gevoel omschrijven op dit moment? Net na de therapie?
- Kan u het gevoel/de pijn vergelijken voor en na de behandeling?
- Hoe gaat u om met de pijn tijdens een training?
- Hoe gaat u om met de pijn tijdens de voorbereiding van een wedstrijd?
- Hoe gaat u om met de pijn tijdens de wedstrijd?

Interview na de tweede sessie

- Kan u het gevoel van de afgelopen week beschrijven?
- Kan u het pijngevoel voor de behandeling beschrijven?
- Kan u het gevoel omschrijven tijdens de therapie?
- Kan u het gevoel omschrijven op dit moment? Net na de therapie?
- Kan u beide interventies met elkaar vergelijken op het moment van de interventie?
- Kan u beide interventies met elkaar vergelijken na enkele uren?

APPENDIX 2 - VOORTGANGSFOMULIER



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VOORTGANGSFOMULIER MASTERPROEF DEEL 1

DATUM	INHOUD OVERLEG	HANDTEKENINGEN
29-10-14	Eerste contact copromotor. Toelichting onderwerp en verwachtingen	Promotor: Dr. J Calcius Student(e): Elke Groven Student(e): Senne Houben
26-11-14	Bijsturing eerste literatuursearch, uitzetten volgende stappen.	Promotor: Dr. J Calcius Student(e): Elke Groven Student(e): Senne Houben
19-01-15	Tussentijdse evaluatie	Promotor: Dr. J Calcius Student(e): Elke Groven Student(e): Senne Houben
28-01-15	Tussentijdse evaluatie Vorbereiding schrijven part 1 Brainstorm part 2	Promotor: Dr. J Calcius Student(e): Elke Groven Student(e): Senne Houben
29-04-15	Bespreking draft masterproef 1 Vorbereiding protocol deel 2	Promotor: Dr. J Calcius Student(e): Elke Groven Student(e): Senne Houben
07-05-15	Bespreking draft masterproef	Promotor: Dr. J. Calcius Student(e): Elke Groven Student(e): Senne Houben
		Promotor: Copromotor: Student(e): Student(e):
		Promotor: Copromotor: Student(e): Student(e):

Auteursrechtelijke overeenkomst

Ik/wij verlenen het wereldwijde auteursrecht voor de ingediende eindverhandeling:

The impact of massage therapy on pain perception in professional soccer players: A literature research

Richting: **master in de revalidatiewetenschappen en de kinesitherapie-revalidatiewetenschappen en kinesitherapie bij musculoskeletale aandoeningen**

Jaar: **2015**

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