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# Chiropractic Treatment in Sports: Systematic Review of Randomized Controlled Trials

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**Abstract:** Background: Since 1980, chiropractic has been used at the Olympic Games to accompany the USA's top athletes therapeutically. The rapidly developing professional sports sector offers great scope for new therapeutic support for athletes in the areas of prevention, performance improvement, injury treatment and medical rehabilitation. The aim of this systematic review is to analyse the latest scientific findings, which can be evaluated on the basis of existing clinical controlled studies. The present article deals with the question: How efficient is the use of chiropractic in sports in the above-mentioned areas? Methods: The research is carried out in the PubMed database. The evidence level of the individual studies is determined using the PEDro scale. The studies with evidence class I are evaluated in tabular form according to the PICO model. Endpoints assessed are grip strength in judo athletes, ankle injuries, medical rehabilitation with recurrent ankle sprains, jet lag symptoms. Results: The literature review include 232 researched articles 8 on the subject, including 3 systematic reviews and 5 randomized clinical trials, of which 4 include evaluable results. Overall, in 3 studies, outcomes in the intervention group for performance enhancement, injury treatment and medical rehabilitation are significantly improved by the use of chiropractic care. The jet lag treatment show no differences compared to the control group. Conclusion: In 3 out of 4 studies, there are significant improvements with the use of chiropractic in therapy. Thus, it can be concluded, that the use of chiropractic in sports can improve performance and reduce injury times in medical rehabilitation. Chiropractic in sports is therefore quite efficient.

**Keywords:** Sports, Chiropractic, Manipulation, Review, Rehabilitation, Athletes

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## 1. Introduction

Since 1980 the USA has used chiropractic for its athletes at the Olympic Games. The Brazilians have been at the Olympic Games and Pan-American Games since 2000. In 1995 at the All African Games, 1135 athletes from 6000 athletes received a total of 1957 chiropractic treatments. Light athletes (38%) and martial artists (14.7%) received these treatments. In 2007 in Rio de Janeiro at the Pan-American Games, 209 chiropractic treatments were performed for 95 athletes by a total of 660 Brazilian athletes (14.40%). Another study found that 77% of the American Football League athletes used a chiropractor. Another 31% of athletes had chiropractors who were part of their medical team.

The rapidly evolving professional sports sector creates a wide field in which new therapeutic techniques have great potential for growth and development, provided their effectiveness on sports performance has been proven. [1] In western medicine, there has been a specialization of general

practitioners in sports in recent years.

In addition, medical professionals, such as physiotherapists, have emerged as well as a number of alternative and complementary health professionals. Chiropractic is one of them. Similar to conventional medicine, a separate "special group" has developed, the sports chiro practice. This is not only about manipulation. Sports chiropractors are often regarded as unimodal practitioners with limited consideration of conventional medical approaches. This "modern" multimodal sports chiropractic management, should contain components of the passive and active supply. Both the acute, inflammatory pain phase and the chronic injury, rehabilitation and prevention phase should be treated. The typical approach is to diagnose, rule out exacerbations, diagnose and treat symptomatic tissues, and identify and evaluate functional deficits, and etiologic factors responsible for sports injuries. Traditional orthopedic and neurological testing, chiropractic assessments, structural analysis, palpation (movement and statics), referral for radiological analysis and other specialized services may be required. [2]

Chiropractic has been used at various national and international sporting events, and previous studies have shown that chiropractic is an accepted, well-used treatment option for athletes. [3]

In this review, an overview of the scientific status of chiropractic in the field of sports will be given, on the basis of the researched clinical studies

## 2. Methods

### 2.1. Literature Research

A systematic search in the PubMed database was carried out in August 2018 to identify the literature. The search was limited to English-language literature. The search was limited to articles with keywords such as "chiropractic", "manual therapy", "spinal manipulation", "chiropractic care", "manipulative therapy", "chiropractic treatment" and "chiropractic intervention" combined with the words "athletes", "sports", "rehabilitation". Google Scholar also searched for additional English-language and German-language literature (see figure 1 in the appendix).

### 2.2. Rating According to PEDro Scale

Eleven evaluation criteria can be used to divide studies into different levels of evidence. The PEDro-scale is based on the Delphi list. This was developed at the University of Maastricht, Department of Epidemiology, by Verhagen and colleagues. This is a set of criteria for evaluating the quality of the studies. The Delphi list and the PEDro scale are not based on empirical data, but on expert consensus. Criteria 2 to 9 check the internal validity in order to interpret the results in criteria 10 to 11 via statistical information. Criterion 1 aims at external validity, but is not included in the evaluation (see Table 5 the appendix). [4]

The following points of a study were evaluated:

1. Inclusion and exclusion criteria were specified (external validity, no evaluation point).
2. Subjects were randomized.
3. Assignment to the groups was hidden.
4. Groups were similar for prognostic indicators.
5. Subjects were blinded.
6. Therapists were blinded.
7. Investigators were blinded.
8. A central result was measured in more than 85% of the assigned volunteers.
9. All volunteers who were available for result measurements received the treatment after allocation. If not, at least one central result was analyzed by an "intention to treat" method.
10. For a central result, a statistical group comparison was proven.
11. For a central result, point measurements and measures of dispersion were reported (standard deviation, standard error, confidence interval).

If one of the criteria, with the exception of the first, is fulfilled, a point was awarded. A total of ten points can, therefore, be scored. The evidence level was derived from the total number of points (see table 6 in the appendix).

The core data of the evidence class I studies were compiled according to the PICO model (see Table 5 in the appendix).

In this table, the studies are evaluated according to the PICO model.

In detail, the points are:

- a.) Study,
- b.) Population,
- c.) intervention group,
- d.) Control group,
- e.) Results intervention group,
- d.) Results control group, compared.

## 3. Results

### 3.1. Literature Research

Literature research resulted in 8 articles on the subject of 3 systematic reviews [5 - 7] and 5 randomized clinical trials [1, 8 - 10]. One study was withdrawn [1]. Four studies were finally used to analyse the topic [1, 8 - 10] (see Figure 1 in the Appendix).

### 3.2. Results PEDro Scale

The methodological quality of the researched studies was evaluated using the PEDro scale (PEDro = Physiotherapy Evidence Database) (see Table 5 in the appendix). Here, each study was subjected to a question scheme. If a criterion is met, one point was awarded. A total of ten points were scored. From the total number of points the evidence level was determined: The studies have a high methodological quality of seven or more points, an average methodological quality of four to six and a low quality of up to three points [11].

Evidence level I was awarded to four studies:

- a.) Botelho and Andrade 2012 [1]
- b.) Lubbe et al. 2015 [8]
- c.) Pellow and Brantingham 2001 [9]
- d.) Straub et al. 2001 [10]

### 3.3. Results PICO Model

#### 3.3.1. Botelho and Andrade 2012 [1]

Grip strength for judo athletes

Primary Endpoint: Grip Strength

In the intervention group with three times spinal manipulation treatment the following results were achieved:

1. after 1st intervention: mean increase of 6.95% right hand and 12.61% left hand
2. after 3rd intervention: mean increase of 10.53% right hand and 16.82% left hand

In the control group with three times apparent spinal manipulation treatment, no statistically significant differences between the grip strength measurements were measured. This clearly shows that cervical spinal manipulation treatment significantly increased the grip strength of judo athletes.

#### 3.3.2. Lubbe et al. 2015 [8]

Recurrent ankle sprain with functional instability

In the intervention group five weeks to seven days and six rest days 29 training units for rehabilitation plus six "manipulations treatment" were carried out. Primary

endpoint: pain with FADI<sup>1</sup> and VAS<sup>2</sup>

**Table 1. Results intervention group.**

	FADI	VAS
Baseline	80.4	47.3
Final	98.9	6.2
18.5 Improvement	41.1 Improvement	

In the control group there were the pure rehabilitation training sessions without "manipulations treatment", with the following results. Primary endpoint: pain with FADI and VAS.

**Table 2. Results control group.**

	FADI	VAS
Baseline	75.9	40
Final	91.3	22.1
15.4 Improvement	17.9 Improvement	

Clear improvement values can be seen here in the course of treatment using rehabilitation training units combined with chiropractic treatment.

### 3.3.3. Pellow and Brantingham 2001 [9]

Treatment of subacute and chronic ankle inversion sprains of grades I and II

Primary endpoints: Pain & Functionality

Measurement methods: Mc Gill questionnaire<sup>3</sup>, Numeric Pain rating scale<sup>4</sup>, Goniometer<sup>5</sup>, Algometer<sup>6</sup>

Mean values were measured in both groups after four weeks of treatment and one month of "follow up", the following results were observed in the intervention group with chiropractic treatment alone.

**Table 3. Results intervention group.**

	after 1st treatment:	after one month follow up:
Mc Gill scores	0.2	0.03
NPRS	28%	8%
Goniometer	5 grd.	13 grd.
Algometer	2.4 kg/qcm	4.2 kg/qcm

The following results were achieved in the control group with ultrasound treatments.

**Table 4. Results control group.**

	after 1st treatment:	after one month follow up:
Mc Gill Scores	0.24	0.13
NPRS	31%	17%
Goniometer	6.5 grd.	8 grd.
Algometer	2.9 kg/qcm	3.8 kg/qcm

Also, here the better results after the treatments and "follow up" times in the chiropractic intervention group can

1 Foot and Ankle Disability Index, 26 points questionnaire, (4 pain related questions, 22 activity related questions) in which each question is answered (on a scale of 0 – 4, total score 104), then converted into percent. clinically significant difference at 8 points.

2 Visual Analog Scale, 0 – 100 mm Scale 0 = painless, 100 max. pain, clinically significant difference 20 – 30 mm.

3 Questionnaire on pain perception 0 – 3, 0 = pain-free.

4 Pain scale from 0 – 10, 10 = max. pain.

5 Measuring instrument for the determination of angles.

6 Device for measuring the pressure pain threshold.

be clearly seen.

### 3.3.4. Straub et al. 2001 [10]

Effect of Chiropractic on Jetlag in Finnish Junior Elite Athletes

There were 19 days of chiropractic treatments in the intervention group and 19 days of sham chiropractic treatments in the control group. To assess the jetlag effect in the athletes, the following measurements were performed.

Primary Endpoint: Jetlag Symptom Improvement

Measurement methods: "Profile of Mood States"(POMS)<sup>7</sup>, Heart rate measurements<sup>8</sup>, Sleep disorders<sup>9</sup>, Jetlag scale<sup>10</sup>

There were no significant differences in the groups.

## 4. Summary

Four evaluable RCT studies were available to evaluate the topic of chiropractic in sports. One study on performance enhancement [1, 2] on injury and rehabilitation [8, 9] and another study on evaluation of performance reduction through jetlag or jetlag improvement [10] through chiropractic treatment. In the area of performance improvement by increasing the grip strength in judo athletes [1] as well as in injuries and rehabilitation measures [8, 9], the results could be significantly improved by the use of chiropractic treatments. The study to prove that chiropractic reduces the jetlag effect could not provide any evidence in this respect. Although the quantity of evaluation is low due to the number of studies, it is clearly evident, that chiropractic treatment already has a positive effect on performance enhancement, injury and rehabilitation measures.

## 5. Discussion

The results of the considered studies [1, 8, 9,] show clear improvements for the intervention groups. The endpoints investigated to demonstrate the use of chiropractic in the sports fields of performance enhancement [1] injury treatment [9] and medical rehabilitation [8]. The study on the improvement of jetlag symptoms [10] by chiropractic intervention show no differences in the groups.

The review by Ernst and Posadzki [5] from 2012 comes to similar results, but the study by Hoskin and Pollard [13] on the topic: prevention of back pain, knee pain and injuries of the lower limbs in elite Australian regular footballers was withdrawn and is therefore not included in the evaluation. Altogether in the majority of the 6 examined studies, better results for the employment of the chiropractic can be proven.

For example, in the study by Petersen [14] and Brantingham [15] on the treatment of metatarsal pain.

The Brantingham study [15] from 2005 investigated the treatment of hallux valgus<sup>11</sup> better results by chiropractic,

7 Questionnaire with 65 questions on the state of health in certain clinical and non-clinical areas of the patient.

8 Polar Advantage NV heart rate monitor (Polar Electro Kempele Finland).

9 Measured via Actiwatch (16 AW, Mini Mitter, Bend, Ore).

10 Ten points scale, 10 points max. jet lag, measured 4 days after arrival from Helsinki in Marietta and 4 days after return flight.

11 Medical term for the obliquity of the big toe.

although hallux valgus does not represent a typical sports injury, it is obstructive to the practice of sports.

Conway's [6] summary focuses primarily on understanding anatomy, biomechanics, movement patterns and kinetic chains of the lower limb, including the pelvis. On this point, the supervisors and trainers are primarily responsible. Even the smallest changes in the athlete are detected early and can prevent injuries and loss of performance. The pelvic obliquity plays a significant role here. In such cases, chiropractic is an excellent therapy.

Liebenson [7] notes that provocative maneuvers such as McKenzie or orthopedic tests can be carried out on a "small scale" to prevent further injuries or performance losses in athletes. These initial measures could well be controlled by coaches or supervisors.

In the majority of cases, the results of the studies examined speak in favor of treatment with chiropractic in sports. However, previous studies in this direction are very small. The number of participants in these studies is also quantitatively weak. It is necessary to uncover a large discrepancy between the use of chiropractic in sports in all segments such as prevention, performance improvement, injury treatment and medical rehabilitation and the necessary scientific evidence. Only through the clinically scientific implication can sport chiropractic find far-reaching recognition.






































For this reason, further studies with a higher number of participants in the field of sports are needed. The material to be evaluated in randomized controlled trials (RCT) is very limited. Research in this field is still in its infancy. Sport chiropractic could be a useful innovation for the entire field of sport.

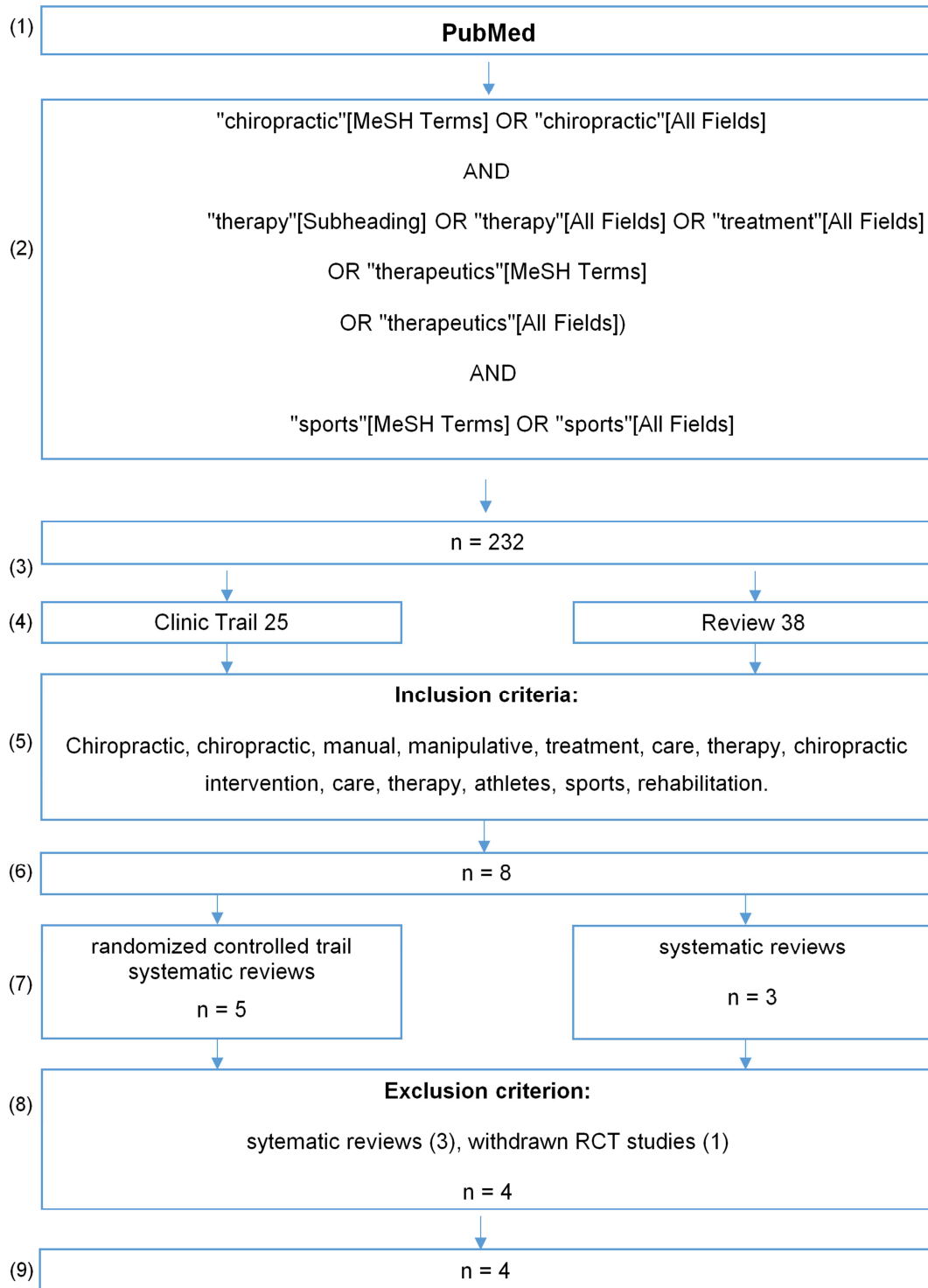
## 6. Conclusion

Sport chiropractic, although already used since 1980 by the American Olympic athletes, struggles with the deficit of daily use by athletes and proving its scientific nature. Therefore, it is necessary to continue to present studies in this field with high numbers of participants, including prevention, performance improvement, injury treatment and medical rehabilitation. On the basis of the studies carried out so far in this field, manual medical treatment could represent a therapeutic innovation for the coming years. For this purpose, it is necessary to publish further studies in this field and to provide scientific evidence for the application of chiropractic treatments in the field of prevention, performance enhancement and rehabilitation in an appropriate broad cross-section of sports. With the studies currently available, a trend towards manual therapy in the form of chiropractic treatment can be clearly seen.

## Appendix

Table 5. PEDro Scala.

Studies PEDro criteria	Botelho and Andrade 2012 Brazil [1]	Lubbe et al. 2015 South Africa [8]	Pellow and Brantingham 2001 South Africa [9]	Straub et al. 2001 America [10]
Inclusion and exclusion criteria were specified				
Randomisation of test persons				
Allocation to the groups hidden				
The most important prognostic indicators in the groups were similar to each other				
Test subjects were blinded				
Therapists were blinded				
Investigators were blinded				
more than 85% of the test persons assigned to the groups completed the study				
"Intention to treat" method followed				
Group comparison of at least one central outcome				
Report about point, as well as scatter measures of at least one central outcome				
total score	8/10	8/10	9/10	8/10
level of evidence	I	I	I	I



**Figure 1.** Flowchart of the research.

(1) Database for literature research of RCTs and SR updated until 28.07.2018

(2) Search criteria

(3) Total hits n = 232

(4) of which studies and reviews

(5) Inclusion criteria

(6) Relevant literature n = 8 articles on the subject

(7) Breakdown by study design

(8) Exclusion criteria: n = 3 SR and n = 1 RCT, total n = 4

(9) usable RCTs on the subject n = 4 RCTs

SR systematic reviews

RCT randomized controlled trials

Table 6. Evidence classification according to achieved PEDro scale points.

PEDro values	max. 10 score	Grad
10 – 7	of high quality	I
6 – 4	median	II
1 – 3	faint	III

Table 7. Core statements of the studies according to the PICO model.

Study	Population TN	Interventional group	Control group	Result: Intervention group	Result: Control group
Botelho and Andrade 2012 Brazil [1]	n = 18	Group 1: n = 9 SMT in 3 Weeks 3 x cervical SMT NW: 3 – 6 h after BH light head and neck pain	Group 2: n = 9 SSMT in 3 weeks 3 x cervical SSMT without NW	Primary endpoint: grip strength measured with a dynamometer in kg/force after the first intervention: average increase of 6.95% right hand and 12.61% left hand after the third intervention: mean increase from 10.53% right hand and 16.82% left hand Primary Endpoint: Pain with FADI <sup>12</sup> and VAS <sup>13</sup> FADI Baseline 80.4 Final 98.9 18.5 enhancement VAS Baseline 47.3 Final 6.2 41.1 enhancement Primary endpoints: Pain and Functionality Measurement methods: Mc Gill questionnaire Numeric pain rating scale gonometer algometers averages after 1st treatment: Mc Gill scores 0.2 NPRS 28% Goniometer 5 grd. Algometer 2.4 kg/qcm after one month follow up: Mc Gill Scores 0.03 NPRS 8% Goniometer 13 grd. Algometer 4.2 kg/qcm Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups	Primary endpoint: grip strength measured with a dynamometer in kg/force no statistically significant differences between the grip thickness measurements Primary Endpoint: Pain with FADI and VAS FADI Baseline 75.9 Final 91.3 15.4 enhancement VAS Baseline 40 Final 22.1 17.9 enhancement Primary endpoints: Pain and Functionality Measurement methods: Mc Gill questionnaire Numeric pain rating scale gonometer algometers averages after 1st treatment: Mc Gill scores 0.24 NPRS 31% Goniometer 6.5 grd. Algometer 2.9 kg/qcm after one month follow up: Mc Gill scores 0.13 NPRS 17% Goniometer 8 grd. Algometer 3.8 kg/qcm Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups
Lubbe et al. 2015 South Africa [8]	n = 33	Group 2: n = 15 rehab + MT 5 weeks x 7 days, 6 RT → 29 TE + 6 MT	Group 1: n = 18 rehab 5 weeks x 7 days, 6 RT → 29 TE	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups
Pellow and Brantingham 2001 South Africa [9]	n = 30	Group 1: n = 15 MT BH to symptom-free or 4 weeks max. 8 BH	Group 2: n = 15 ultrasound BH to symptom-free or 4 weeks max. 8 BH	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups
Straub et al. 2001 Amerika [10]	n = 15	Group 1: n = 5 CA BH 19 days Ø 9 AJ / TN	Group 2: n = 5 SCA BH 19 days Ø 8,8 AJ / TN Group 3: n = 5 Control without BH	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups	Primary endpoint: Jetlag symptom improvement Measurement methods: "Profile of Mood States" (POMS) Heart rate measurements insomnia Jetlag scale There were no significant differences in the groups

n number of participants  
 MT manipulation therapy  
 RASFI recurrent ankle sprain with functional instability  
 FADI Foot and Ankle Disability Index  
 VAS visual analog Scala  
 TE training sessions  
 SMT spinal manipulation treatment

12 Foot and Ankle Disability Index, 26 points questionnaire, 4 pain-related questions, 22 activity-related questions, each question answered on a scale of 0-4, total score 104, is then converted into percent, clinically significant difference of 8 points

13 Visual Analog Scala, 0 – 100 mm Scala 0 = painless, 100 max. pain, clinically significant difference 20 – 30 mm

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