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REVIEW ARTICLE

Cupping therapy and chronic back pain: systematic review and meta-analysis

Ventosaterapia y dolor crónico en la espalda: revisión sistemática y metanálisis

Ventosaterapia e dor crônica nas costas: revisão sistemática e metanálise

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ABSTRACT

Objectives: to evaluate the evidence from the literature regarding the effects of cupping therapy on chronic back pain in adults, the most used outcomes to evaluate this condition, the protocol used to apply the intervention and to investigate the effectiveness of cupping therapy on the intensity of chronic back pain.

Method: systematic review and meta-analysis carried out by two independent researchers in national and international databases. Reference lists of systematic reviews were also explored. The quality of evidence was assessed according to the Jadad scale.

Results: 611 studies were identified, of which 16 were included in the qualitative analysis and 10 in the quantitative analysis. Cupping therapy has shown positive results on chronic back pain. There is no standardization in the treatment protocol. The main assessed outcomes were pain intensity, physical incapacity, quality of life and nociceptive threshold before the mechanical stimulus. There was a significant reduction in the pain intensity score through the use of cupping therapy ($p = 0.001$).

Conclusion: cupping therapy is a promising method for the treatment of chronic back pain in adults. There is the need to establish standardized application protocols for this intervention.

Descriptors: Review++ Chronic Pain++ Back Pain++ Cupping Therapy++ Meta-Analysis++ Nursing.

Resumen: Objetivos: evaluar las evidencias de la literatura al respecto de los efectos de la ventosoterapia sobre el dolor crónico en la espalda en adultos, los resultados más utilizados para evaluar esa condición, el protocolo utilizado para la aplicación de la intervención e investigar la eficacia de la ventosaterapia sobre la intensidad de dolor crónico en la espalda. Método: revisión sistemática y metanálisis, realizadas por dos investigadores independientes, en bases de datos nacionales e internacionales. Listas

de referencias de revisiones sistemáticas también fueron exploradas. La calidad de las evidencias fue evaluada por la escala Jadad. Resultados: fueron identificados 611 estudios y 16 fueron incluidos en el análisis cualitativo y 10 en el análisis cuantitativo. La ventosaterapia demostró resultados positivos sobre el dolor crónico en la espalda. No hay una estandarización en el protocolo de tratamiento. Los principales resultados evaluados fueron la intensidad del dolor, la incapacidad física, la calidad de vida y el umbral nociceptivo frente al estímulo mecánico. Hubo reducción significativa del puntaje de intensidad del dolor mediante uso de la ventosaterapia (p=0.001). Conclusión: la ventosaterapia es un método promisor para el tratamiento del dolor crónico en la espalda en adultos. Es necesario establecer protocolos de aplicación estandarizados para la intervención.

Descriptores: Revisión, Dolor Crónico, Dolor de Espalda, Ventosas, Meta-Análisis, Enfermería.

Resumo: Objetivos: avaliar as evidências da literatura a respeito dos efeitos da ventosoterapia sobre a dor crônica nas costas em adultos, os desfechos mais utilizados para avaliar essa condição, o protocolo utilizado para aplicação da intervenção e investigar a eficácia da ventosaterapia sobre a intensidade dor crônica nas costas. Método: revisão sistemática e metanálise, realizadas por dois pesquisadores independentes, em bases de dados nacionais e internacionais. Listas de referências de revisões sistemáticas também foram exploradas. A qualidade das evidências foi avaliada através da escala Jadad. Resultados: foram identificados 611 estudos e 16 foram incluídos na análise qualitativa e 10 na análise quantitativa. A ventosaterapia demonstrou resultados positivos sobre a dor crônica nas costas. Não há uma padronização no protocolo de tratamento. Os principais desfechos avaliados foram a intensidade da dor, a incapacidade física, a qualidade de vida e o limiar nociceptivo perante o estímulo mecânico. Houve redução significativa do escore de intensidade da dor mediante uso da ventosaterapia (p=0.001). Conclusão: a ventosaterapia é um método promissor para o tratamento da dor crônica nas costas em adultos. Faz-se necessário estabelecer protocolos de aplicação padronizados para a intervenção.

Descritores: Revisão, Dor Crônica , Dor nas Costas, Ventosaterapia, Metanálise, Enfermagem.

Introduction

Chronic back pain causes physical, emotional and socioeconomic changes[1-3] and, consequently, high use of medicines and health resources[4]. The search for demedicalization leads to an increasing use of integrative and complementary practices, such as Traditional Chinese Medicine (TCM) resources, to complement pain-related allopathic care[5]. Cupping therapy is one of the recommended TCM therapies for chronic pain reduction[6]. It involves the application of cups of different materials[7] in an acupoint or area of pain by means of heat or vacuum apparatus[8].

The effect on pain reduction has not yet been fully elucidated[9], but different mechanisms of action, based on several assumptions[10], are attributed to cupping therapy, such as the metabolic, neuronal hypotheses[9,11] and TCM[12]. Evidence of the efficacy of this intervention is limited because of the lack of high quality, well-delineated randomized controlled trials (RCTs)[6] that result in validated and efficient protocols for the treatment of chronic back pain. Therefore, this study aims to evaluate the literature evidence regarding the effects of cupping therapy on chronic back pain in adults compared to sham, active treatment, waiting list, standard medical treatment or no treatment, outcomes most

commonly used to assess this condition, the protocol used to apply the intervention and subsequently investigate the effectiveness of cupping therapy on the intensity of chronic back pain.

Method

A systematic review of the literature was performed, followed by meta-analysis, used to determine the intensity of back pain in adult clients. The study was based on the criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA Statement)[13].

The PICO (P - population; I - intervention; C - comparison; O - outcomes)[14] guided the elaboration of the guiding question: "What are the effects of cupping therapy on adults with chronic back pain?"

The search strategy, carried out by two independent reviewers from June 2017 to May 2018 was based on the following databases: Medical Literature Analysis and Retrieval System Online (MEDLINE) via the US National Library of Medicine National Institutes of Health (PUBMED), Web of Science, The Cumulative Index to Nursing and Allied Health Literature (CINAHL), Physiotherapy Evidence Database (PEDro), Embase, Scopus, as well as databases indexed in the Virtual Health Library (VHL), such as Latin American & Caribbean Health Sciences Literature (LILACS) and the National Information Center of Medical Sciences of Cuba (CUMED). Reference lists of systematic reviews were also explored in the search for relevant studies related to the guiding question.

The terms, controlled and free, were combined by means of the Boolean operators OR and AND as follows: ("Back Pain" OR "Low Back Pain" OR "Sciatica" OR "Chronic Pain" OR "Musculoskeletal Pain" OR Myalgia OR "Neck Pain" OR "Low Back Pains" OR "Musculoskeletal Pains" OR "Muscle Pain" OR "Neck Pains" OR "Cervical Pain" OR "Cervical Pains" OR Lumbago OR "lumbar pain") AND ("cupping therapy" OR cupping OR cups).

The eligibility criteria for the selection of articles were: RCT with adults (18 years or older); chronic pain (for three months or more)[15] in at least one of the segments of the spine (cervical, thoracic and/or lumbar); use of cupping therapy (dry, wet, massage, flash)[7] compared to one or more of the following groups: sham, active treatment, waiting list, standard medical treatment, or no treatment. We excluded studies that did not present online abstract in full for analysis, those that were not located by any means and studies with pregnant women.

In order to collect the information from the selected studies, we used an adapted form[16] in accordance with the recommendations of the Revised Standards for Reporting Interventions in Clinical Trials of Acupuncture (STRICTA)[17] and the classifications of cupping therapy[7,18].

The following data were extracted: article identification (title, author (s)/training area, journal, year of publication, study country/language); objectives; methodological characteristics (design, sample size and loss of follow-up; inclusion and exclusion criteria); clinical data (number of

patients by sex, mean age, diagnosis, duration of symptoms); description of interventions in the follow-up groups (number of sessions, duration of treatment, type of technique applied (dry, wet, flash or massage cupping), application device, time of stay of the device, suction method (manual, fire, automatic-electric)/suction strength (light, medium, strong or pulsating)[18]; peculiarities of the intervention; application points; training area of the professional who carried out the intervention; years of experience in the area); outcomes and methods of evaluation (number of evaluations, intervals between them, measurement tools); data analysis; main results; and study findings.

The methodological quality of eligible studies was assessed using the Jadad scale[19], which is centered on internal validity. The questions have a yes/no answer option with a total score of five points: three times one point for the yes responses and two additional points for appropriate randomization and concealment of allocation methods. Two independent reviewers conducted the evaluation, and a third investigator was consulted to solve possible disagreements.

Data analyzes were performed using Stata SE/12.0 statistical software. The absolute difference between means with 95% confidence intervals was selected to describe the mean differences between the treated and control groups in the evaluation performed shortly after treatment. P-value <0.05 was considered as statistically significant. Potential heterogeneity among the studies was examined using Cochran Q[20] and $I^{2(21}$ statistics. Since there was statistical significance in the test for heterogeneity of the results ($p < 0.05$) and the calculated value of I^2 suggested a moderate to high heterogeneity (67.7%)[21], the random effects model was adopted for the analysis.

Results

A total of 614 studies were found in electronic and manual searches. Of these, 296 were removed from the list because they were duplicates. After reviewing titles and abstracts, 265 studies were excluded and 53 remained for analysis of the full text. Of these, 11 studies were not found (online, via bibliographic switching or direct contact with authors) and 26 articles were excluded. Finally, 16 articles remained in the review for the synthesis of the qualitative analysis and 10 articles entered the quantitative analysis (Figure 1).

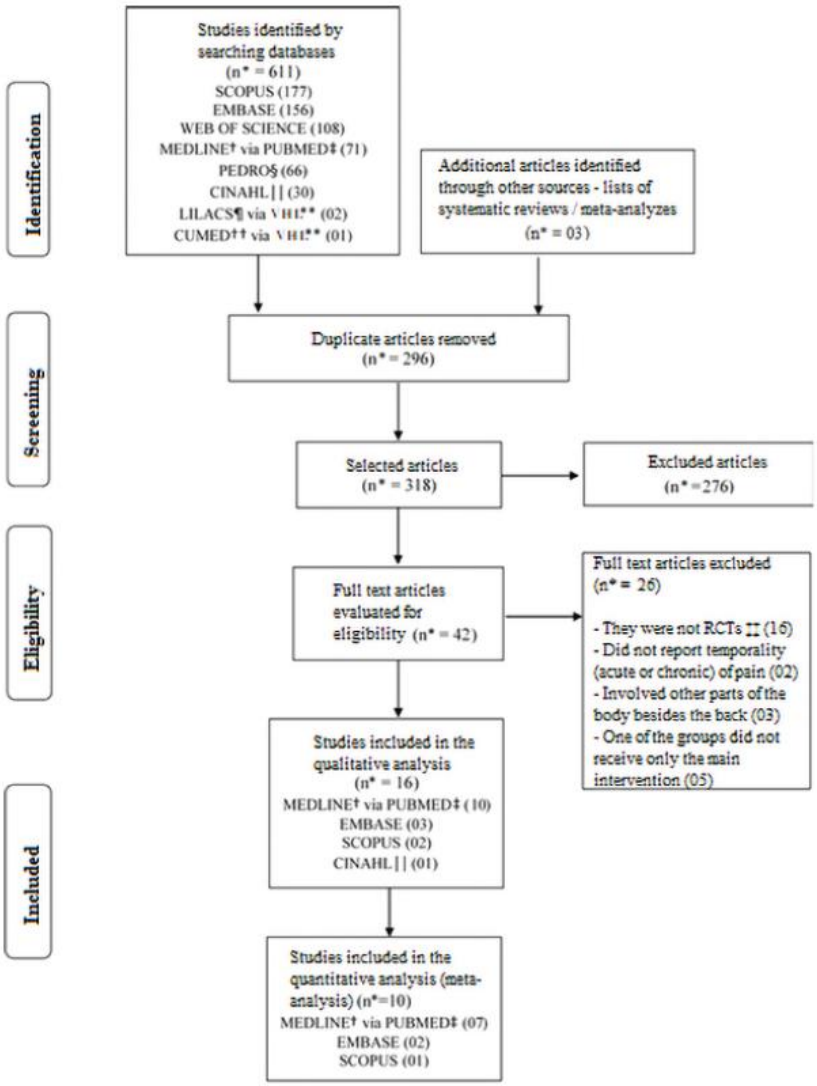

Figure 1

Flowchart of literature search and selection process. Belo Horizonte, MG, Brazil, 2018

*n - Number of articles; †MEDLINE - Medical Literature Analysis and Retrieval System Online; ‡PUDMED - US National Library of Medicine National Institutes of Health; §PEDRO - Physiotherapy Evidence Database; ||CINAHL - The Cumulative Index to Nursing and Allied Health Literature; ¶LILACS - Latin American and Caribbean Health Sciences Literature; **VHL - Virtual Health Library; ††CUMED - National Information Center of Medical Sciences of Cuba; ‡‡RCT - Randomized Clinical Trial

All articles selected were published in English language and were conducted in Germany[9,22-27], Taiwan[28-30], Iran[31-33], South Korea[34-35] and in Saudi Arabia[36]. Participants were a total of 1049 people, aged between 18 and 79 years, of whom 519 were in the groups receiving the experimental therapy and 530 in the control groups (sham, waiting list, standard medical treatment/active treatment or no treatment). Of these, all had chronic pain conditions[15], being the cervical spine/neck the most affected area[9,23-27,29,34], followed by the lumbar region[22,28,30-33,35-36]. Two other studies[31,33], although they did not make clear the temporality of the pain, were selected because this information could be inferred with great accuracy.

The characterization of the studies regarding the objective, the interventions applied in the experimental and control groups, and the main findings are presented in Figure 2.

Study identification	Objective	Intervention in the experimental group	Intervention in the control group	Main findings
Teut M et al. (2018)[25]	To investigate the effectiveness of Dry Pulsatile Cupping in reducing pain and improving back function and quality of life in patients with chronic nonspecific low back pain.	Pulsatile cupping with strong negative pressure and paracetamol on demand (n * = 37) Pulsatile cupping with weak negative pressure and paracetamol on demand (minimal cupping) (n=36)	Paracetamol (maximum dose of 4 times, 500 milligrams per day) on demand (n*=37)	Both suction cup forms were effective in chronic nonspecific low back pain, without showing significant differences in the direct comparison after four weeks. Only pulsatile suction cups showed effects compared to controls after 12 weeks.
Saha FJ et al. (2017)[23]	To test the effectiveness of Cupping Massage in patients with neck pain.	Cupping massage (n*=25)	Waiting list (patients were asked to continue medical care, but refrain from invasive treatments, such as injections or acupuncture) (n*=25)	Cupping massage appears to be effective in reducing pain and increasing function and quality of life in patients with chronic nonspecific cervical pain.
Lin ML et al. (2017)[26]	To evaluate the effectiveness of laser acupuncture associated with Chinese cupping therapy in the treatment of low back pain.	Laser acupuncture and Chinese cupping (n*=25)	Sham Laser and Chinese cupping (n*=23)	Laser acupuncture combined with Chinese cupping therapy at the acupuncture points B† 40 and *Ashi* effectively reduces low back pain. Changes in plasma cortisol levels have indicated that laser acupuncture combined with Chinese cupping therapy is an effective treatment for pain relief.
Yazdanpanahi Z et al. (2017) [31]	To evaluate the effects of acupuncture approaches on the severity of postpartum low back pain among primiparous women visiting selected educational centers affiliated with the University of Medical Sciences of Shiraz, Shiraz, Iran.	Cupping therapy (n*=50)	Acupressure (n*=50) Control group without intervention (n*=50)	Although pain intensity decreased in both groups, this reduction was significant in the cupping therapy group. Therefore, both cupping therapy and acupressure may be effective in reducing postpartum low back pain in primiparous women.
Chi LM et al. (2016)[28]	To investigate the efficacy of cupping therapy in relieving chronic neck and shoulder pain among community residents and changes in skin surface temperature.	Cupping therapy (n*=30)	Control group without intervention (n*=30)	Cupping therapy increased the surface temperature of the skin and reduced systemic blood pressure. The subjective experience of pain intensity also reduced. Cupping therapy resembles an analgesic effect that has no known negative side effects and can be considered safe.
AlBedah A et al. (2015)[29]	To assess the effectiveness and safety of Wet Cupping as a treatment for persistent and nonspecific low back pain.	Wet cupping and analgesic drug (maximum of three 500mg acetaminophen tablets per day) (n*=40)	Analgesic drug (maximum of three 500mg acetaminophen tablets milligrams per day) (n*=40)	Wet cupping works to reduce pain and improve disability associated with nonspecific and persistent low back pain for at least 2 weeks after the end of the intervention.
Emerich M et al. (2014)[6]	To measure, in parallel, the metabolic changes in the tissue under the glass cups and the pressure pain threshold.	Dry cupping (n*=12)	Comparison between the side on which cupping therapy was performed with the contralateral side, which did not receive the intervention (n*=12)	Cupping therapy promotes anaerobic metabolism lasting 280 minutes in the subcutaneous tissue and increases the immediate pressure pain thresholds in some areas.
Akbarzadeh M et al. (2014)[30]	To investigate the effect of Dry Cupping at point B† 23 on the intensity of low back pain in primiparous women.	Dry Cupping (n*=50)	Routine care and referral to a specialist in case of severe pain (n*=50)	Dry cupping in acupoint B† 23 had a desirable effect on reducing pain in patients. The VAS‡ scores agreed with those of the McGill short questionnaire.
Lauche R et al. (2013)[24]	To test the effectiveness of 12 weeks of Cupping Massage performed at home, compared to the same period of progressive muscle relaxation in patients with chronic nonspecific neck pain.	Cupping massage (n*=30)	Instructions and training to perform progressive muscle relaxation at home twice a week, 20 minutes per session, and to record this practice in a journal (n*=31)	Cupping massage is no more effective than progressive muscle relaxation in reducing chronic nonspecific neck pain. Both therapies can be easily used at home and can reduce pain to a clinically relevant minimum extent. However, cupping massage is better than progressive muscle relaxation in improving well-being and decreasing sensitivity to pressure pain.
Kim TH et al. (2012)[32]	To compare the effects of cupping therapy and the "heated pad" on neck pain, functional disability and quality of life in video display terminal workers.	Cupping therapy (n*=20)	Heated hot water pads applied to the neck and upper trapezius muscle for 10 minutes, 3 times a week, for 2 weeks (n*=20)	2 weeks of cupping therapy associated with an exercise program may be effective in reducing pain and improving neck function in workers at Video Display Terminal.
Lauche R et al. (2012)[22]	To test the efficacy of a single traditional cupping therapy treatment in patients with chronic nonspecific chronic neck pain.	Cupping therapy and non-steroid medication for pain and physical therapy (n*=22)	Non-steroid medication for pain and physical therapy (in both groups) (n*=23)	A single application of cupping therapy may be effective in the treatment of chronic nonspecific cervical pain.
Lin ML et al. (2012)[33]	To evaluate the effect of laser acupuncture and soft cupping on low back pain.	Laser acupuncture and soft cupping (n*=28)	Soft cupping and laser without radiation (n*=29)	Laser acupuncture and mild cupping therapy may be a suitable treatment for patients with low back pain.
Cramer H et al. (2011)[26]	To compare the effects of a series of 5 sessions of Pulsating Cupping with standard medical care in relieving chronic nonspecific cervical pain.	Pulsating Cupping (n*=24)	Self-directed standard medical care (physical therapy, exercises and analgesic drugs as needed) (n*=24)	Pneumatic pulsation therapy appears to be a safe and effective method to relieve pain and improve function and quality of life in patients with chronic neck pain.
Kim JI et al. (2011)[35]	To determine the efficacy and safety of Wet Cupping treatment for persistent nonspecific low back pain.	Wet-cupping (n*=21)	Usual care (booklets for exercise, general advice for nonspecific and persistent low back pain, and acetaminophen) in both groups (n*=11)	Wet cupping may have a potential effect on reducing pain associated with nonspecific and persistent low back pain.
Lauche R et al. (2011)[27]	To determine whether a number of cupping treatments effectively relieves chronic nonspecific cervical pain. In addition, the subjects' mechanical thresholds were measured to determine whether cupping therapy has an effect on mechanical hyperalgesia in patients with chronic neck pain.	Cupping therapy and non-steroid medication for pain and physical therapy (n*=22)	Non-steroid medication for pain and physical therapy (n*=24)	Five dry cupping sessions appear to be safe and effective in the treatment of chronic nonspecific cervical pain.
Farhadi K et al. (2009)[34]	To determine the effectiveness of Wet Cupping for the treatment of persistent and nonspecific low back pain.	Wet cupping (*n=48)	Usual care, combination of medication and exercises (n*=50)	Wet cupping is associated with greater short-term clinical benefit compared to usual care.

Figure 2

Characterization of the studies regarding the applied intervention, Belo Horizonte, MG, Brazil, 2018 (n=16)

*n - Number of participants; †B - Bladder; ‡VAS - Visual Analogue Scale.

Regarding the methodological quality of the RCTs, all reported the random sequence generation method and in only one study[9] this process was not appropriate. In another study[30] there is not enough information to infer this information. Only in four RCTs[22,24,28-29)] there was a description of masking and in only two[22,28] this was considered appropriate. Loss of follow-up was not described in only one RCT[29].

Therefore, 6.25% (n = 1) of the studies[9] scored one on the Jadad score; 12.5% (n = 2)[29-30] scored two; 62.5% (n=10)[23,25-27,31-36] scored three; 12.5% (n=2)[22,24] score four; and 6.25% (n=1)[28] scored five points.

The studied outcomes, the measurement tools, the number of evaluations and the interval between them are described in Figure 3.

Study identification	Outcomes	Measurement Tools	Number of evaluations/ Interval between them
Teut M et al. (2018)[22]	1-Pain intensity 2- Measure of back function 3-Quality of life	1- VAS* (0-100) 2-Funktionsfragebogen Hannover Rücken 3- SF-36†	03 (Baseline, after 4 and 12 weeks)
Saha FJ et al. (2017)[23]	1- Pain intensity 2- Pain to the movement 3-Physical disability 4-Quality of life 5- Nociceptive threshold 6- Mechanical detection threshold 7- Vibration detection threshold 8- 2-point discrimination threshold	1- VAS* (0-100) 2-Pain on Movement Questionnaire 3-NDI‡ 4-SF-36† 5- Algometer 6- Von Frey filaments 7-Diapason 8- Pair of compasses with blunt ends	02 (Baseline, 3 weeks after randomization)
Lin ML et al. (2017)[28]	1- Pain intensity 2- Plasma cortisol level	1-VAS* (0-100) 2- Biological sample (blood)	02 for cortisol (Baseline and after the session) / 06 for VAS* (Baseline and during session)
Yazdanpanahi Z et al. (2017)[31]	1- Pain intensity	1-Short-form McGill Pain Questionnaire	04 (Baseline, immediately after, 24 hours and 2 weeks after)
Chi LM et al. (2016)[29]	1- Pain intensity 2- Tissue temperature 3- Systemic arterial pressure	1-VAS* (0-10) 2- Infrared Camera 3- Mercury sphygmomanometer	02 for pain intensity (Baseline and after intervention) / 04 for tissue temperature (5-minute interval between each measurement)
AlBedah A et al. (2015)[36]	Pain intensity Physical disability	1-Numeric scale (0-100) 1-PPI§ 2-ODQ‖	03 (Baseline, after, follow-up of 2 weeks)
Emerich M et al. (2014)[9]	1- Pain intensity 2-Physical disability 3- Nociceptive threshold 4- Pyruvate, Lactate, Glucose, Glycerin and Adenosine	1/2-Neck Pain and Disability Scale 3-Algometer 4- Microfilament with semipermeable membrane (microdialysis)	04 for algometer (baseline, immediately after and 140 and 280 minutes after) / 02 for Neck pain and disability scale (Baseline and one week after / each 20 minutes for microdialysis
Akbarzadeh M et al. (2014)[32]	1- Pain intensity 2-Quality of pain	1- VAS* (0-10) 2-Short-form McGill Pain Questionnaire	04 (Baseline, immediately after, 24 hours and 2 weeks after)
Lauche R et al. (2013)[24]	1- Pain intensity 2- Perceived pain to the movement 3-Quality of pain 4-Physical disability 5- Psychological distress 6-Well-being 7-Quality of life 8- Nociceptive threshold	1- VAS* (0-100) 2- Flexing, extending, flexing sideways and rotating the neck laterally to the left and right (VAS*) 3-Pain Description List 4-NDI‡ 5-Hospital Anxiety and Depression Scale 6-Questionnaire on the Assessment of Physical Well-being 7-SF-36† 8-Algometer	02 (Baseline, week 12)
Kim TH et al. (2012)[34]	1- Pain intensity 2-Physical disability 3- Physiological and psychological symptoms 4- Range of motion	1- Numeric scale (0-100) 2-NDI‡ 3-Measure yourself medical outcome profile 2 score 4-Cervical range of motion instrument	03 (Baseline, 3 weeks, 7 weeks)
Lauche R et al. (2012)[25]	1- Pain intensity 2- Physical disability 3-Quality of life 4- Nociceptive threshold	1-VAS* (0-100) 2-NDI‡ 3-SF-36† 4-Algometer	02 (Baseline and 3 days after)
Lin ML et al. (2012)[30]	1- Pain intensity 2- Electrical current of the meridians	1- VAS* (0-10) 2-*Ryodoraku*	05 (Assessments for 5 consecutive days - 2 before and 2 after)
Cramer H et al. (2011)[26]	1- Pain intensity 2- Pain to the movement 3-Physical disability 4-Quality of life 5- Nociceptive threshold 6- Mechanical detection threshold 7- Vibration detection threshold	1-Numeric scale (0-10) 2- VAS* (0-10) 3-NDI‡ 4-SF-36† 5-Algometer 6- Von Frey filaments 7-Diapason	02 (Baseline and 2.5 weeks after baseline assessment)
Kim JI et al. (2011)[35]	1- Pain intensity 2-Physical disability	1- Numeric scale (0-100) 1-PPI§ 2-ODQ‖	03 (Baseline, after, follow-up of 2 weeks)
Lauche R et al. (2011)[27]	1- Pain intensity 2- Pain at rest and pain to the movement 3-Physical disability 4-Quality of life 5- Nociceptive threshold 6- Vibration detection threshold 7- Mechanical detection threshold	1-Numeric scale (0-10) 2- VAS* (0-100) 3-NDI‡ 4-SF-36† 5-Algometer 6-Diapason 7- Von Frey filaments	02 (Baseline and 18 days after first assessment)
Farhadi K et al. (2009)[33]	1- Pain intensity 2-Physical disability 3- Medication use	1-PPI§ 2-ODQ‖ 3-Medication Quantification Scale	02 (Baseline and after three months of follow-up)

Figure 3

Evaluated outcomes, measurement tools, number of evaluations and interval between them. Belo Horizonte, MG, Brazil, 2018. (n=16)

*VAS - Visual Analogue Scale; †SF-36 - Short Form 36 Health Survey Questionnaire; ‡NDI - Neck Disability Index; §PPI- McGill Present Pain Intensity questionnaire; ||ODQ - Oswestry Disability Questionnaire

The most evaluated outcomes were pain intensity (100%; n=16)[9,22-36], followed by Physical disability (62.5%; n=10)[9,23-27,33-36], quality of life (37.5%; n=6)[22-27] and nociceptive threshold before the mechanical stimulus, by means of an algometer (37.5%; n=6)[9,23-27].

The number of evaluations ranged from two (baseline and after treatment) to 18. Three studies performed evaluations between sessions[9,28-29]; and 13 studies performed follow-up evaluations after the end of the treatment, ranging from two days to three months [9,22-23,25-27,30-36] (Figure 3).

The characteristics of the intervention protocol were based on the recommendations of the Revised Standards for Reporting Interventions

in Clinical Trials of Acupuncture (STRICTA)[17] and in the classifications of cupping therapy[7,18], which are described in Figure 4.

Study identification	Type of technique	Number of sessions	Duration of treatment	Application device	Time of stay of the device	Suction method/suction strength	Peculiarities of the intervention	Application points
Teut M et al. (2018)[22]	Pulsatile dry cupping	8	4 weeks	Silicone cup	8 minutes	Automatic (Negative pressure between 150 - 350 mbar and aspiration intervals of 2 seconds/ weaker negative pressure around 70 millibar and aspiration intervals of 2 seconds)	//	Point in the lumbar region
Saha FJ et al. (2017)[23]	Cupping massage	5	3 weeks	3.5 to 5-cm* diameter glass cup, Karl Hecht GmbH, Sondheim / Rhön, Germany)	10 minutes	Manual (rubber ball on top of cup)	Arsenic massage oil (Weleda AG, Schwäbisch-Gmünd, Germany)	From the occipital bone to the middle thoracic spine and in the upper trapezius muscle
Lin ML et al. (2017)[26]	Dry cupping	5	1 week	Laser / 6- cm* diameter cups (DongBang Acupuncture, Kyunggido, Korea)	5 minutes	The suction of each cup was applied until the skin rose to 1 cm*.	The physician administered the treatment to all patients between 3 and 6 hours (time of exuberant flow of the bladder meridian)	Muscles of the lower back at the level of the spinal discs 2-5
Yazdanpanahi Z et al. (2017) [21]	Dry cupping	4	4 days	//	15 to 20 minutes	//	//	B¹23
Chi LM et al. (2016)[29]	Dry cupping	1	20 minutes	Glass cups with medium size of 4 cm* diameter and and 260 ml‡ volume (Cosmos International Supplies Co., Ltd., Taiwan)	10 minutes	Fire	//	SB¹15 (*jianshongshu*) GB¹ 21 (*jianjing*) LB¶ 15 (*jianju*)
AlBedah A et al. (2015)[30]	Wet cupping	6	2 weeks	Disposable 40 cc" cups (Seongho trade & company, Korea)	5 minutes	Manual (suction pump)	The skin was perforated at 6 points along the site marked with 2 mm†† deep, with disposable lancets	2 acupoints between B¹ 23, 24 and 25 (the most painful when manually pressed or when there were no pain points, we chose bilateral B¹ 25)
Emerich M et al. (2014)[9]	Dry cupping	1	15 minutes	168 ml‡ glass cup / opening area of 15.7 square cm*	15 minutes	Fire (negative pressure was obtained by holding the flame of a swab soaked in alcohol for 2 seconds in the opening of the cup and then immediately pressing the cup into the skin. The glass cup had a faucet that could be connected to a pressure gauge to measure the pressure in the cup).	//	Above the trapezius muscle, cupping therapy was performed above one of the sides randomly selected in healthy volunteers or in patients with neck pain, above the side with predominant pain / Cupping therapy was performed on the contralateral side of the lower back for investigation of pain thresholds
Akbarzadeh M et al. (2014)[32]	Dry cupping	4	4 days	Glass cups of size 75 and 100 cm*	15 to 20 minutes	Fire (the air inside the cups was rarefied by alcohol and small cotton balls)	//	B¹23 (*Shenshu*)
Lauche R et al. (2013)[24]	Cupping massage	24	12 weeks	3.5-cm* diameter glass cups (Karl Hecht, Germany)	10 to 15 minutes	//	200 ml‡ arnica massage oil (Weleda AG, Germany)	//
Kim TH et al. (2012)[34]	Dry cupping / Wet cupping	6	2 weeks	Disposable and sterile cups of various sizes - 1.5 cm* to 5 cm* in diameter (Seongho Trade & Company, Korea)	5 to 10 minutes	Manual (suction pump - 3 to 5 pumping cycles)	The skin was punctured 6 times to a depth of 2 mm†† with disposable 26 gauge lancets. 3 to 5 cc** of blood was drained	From 6 to 10 sensitive points of the posterior neck, upper trapezius and perispinal area of the neck and thoracic spine GV‡‡ 14,15,15,12, GB¹ 20, 21, SB¹17,11,12,13,14,15,15 B¹ 10,11, 12,13,14,15,16,17,41,42,43,44 and Extra Head / neck 15
Lauche R et al. (2012)[25]	Wet cupping	1	10 to 15 minutos	Double wall glass cups with 25 to 50 mm†† diameter	10 to 15 minutes	Fire (the cups were kept inverted over an open flame to warm the air in. The air inside the cup cooled and created vacuum that sucked blood through the incisions).	The superficial incisions were made with a disposable micro-lancet in the areas of pain and bulky geloses	Areas of pain
Lin ML et al. (2012)[33]	Dry cupping (soft cupping)	1	10 minutes	Laser LA400 (United Integrated Services Co., Ltd., Taiwan) / It does not describe the suction cup material	10 minutes	//	//	B¹40 (*Weizhong*) *Ashi* Points
Cramer H et al. (2011)[28]	Cupping massage + Dry cupping - Pneumatic Pulsation Therapy	5	2 weeks	38 mm glass cups (scanning) and 130-mm†† diameter silicone cups (fixed suction cup)	10 to 15 minutes with scanning and 5 to 10 minutes with the fixed suction cup	Automatic (electromechanical suction pump - Pneumatron® 200S Pneumed GmbH, Idar-Oberstein, Germany. The negative pressure intensity was adjusted according to the patient's sensitivity to produce a strong but comfortable sensation of oscillation - Strength: pulsatile).	Arnica massage oil (Weleda AG, Schwäbisch Gmünd, Germany, ingredients: sunflower oil, olive oil, arnica montana extract, betula alba leaf extract and natural essential oils) was applied in the neck and shoulders region for slippery suction cup.	Areas where manual pressure and lifting of the skin caused the greatest discomfort
Kim JI et al. (2011)[35]	Wet cupping	6	2 weeks	Disposable 40 cc" cups (Seongho trade & company, Korea)	5 minutes	Manual (suction pump)	The skin was punctured at 6 points along the marked site with 2 mm† deep with disposable lancets.	2 acupoints between B¹23, 24 and 25 (in each session, practitioners chose the 2 most painful points when pressed manually. When there were no pain points, the bilateral B25 was chosen)
Lauche R et al. (2011)[27]	Dry cupping	5	2 weeks	Double wall glass cups with 25 to 50 mm†† diameter	10 to 20 minutes	Fire (the cups were kept inverted by an open flame to warm the air inside, after which each cup was placed in an affected area).	//	Pain diagram and physical examination were used to identify areas of muscular tension and myogelosis, which usually occurred in the descending and
Farhadi K et al. (2009)[33]	Dry cupping / Wet cupping	3	1 week	Plastic cups- The cup size used was based on the size of the patient's body (75 or 120 cc").	3 to 5 minutes for the dry suction cup and then another 3 to 5 minutes for the wet suction cup	Automatic/manual (the cup was placed in the selected location and the air inside the cup was rarefied by electric suction or, rarely, due to technical reasons, manual suction).	Surface incisions were made on the skin using the "multiple superficial incisions" technique with 15-21 size sterile surgical slides.	a) between the two scapulae, opposite to the scapular spine, at the level of the thoracic vertebrae 1-3, in Phase 1; b) the area of the sacrum, between the lumbar vertebra and the coccyx bone, in Phase 2; and c) the calf area on the middle surface of the gastrocnemius muscle in Phase 3

Figure 4

Intervention protocol. Belo Horizonte, MG, Brazil, 2018 (n=16)

*cm - Centimeter; †B - Bladder; ‡ml - Milliliter; §SB - Small bladder; ||GB - Gallbladder; ¶LB - Large bladder; **cc - Cubic centimeter; ††mm - Millimeter; ‡‡GV - Governing Vessel

The intervention was predominantly applied by physicians (31.25%; n=5)[22,25-28,34]; followed by nurses (18.75%; n=3)[22,29,32] and pharmacists (6.25%; n=1)[32]. And 25% of the studies (n=4)[9,23,35-36] reported that the intervention was performed by a therapist, without specifying the training area.

Only 18,75% of the studies (n = 3) presented the time of experience of the professional who performed the intervention, from three[35-36] to four years[34]; 37.5% of the studies (n=6)[9,22-25,27] informed only that the intervention had been performed by experienced or trained professionals, but did not mention the time of training.

Of the 16 articles selected for the systematic review, 10 entered for meta-analysis that investigated the effectiveness of cupping therapy on

pain intensity. All of them approached the outcome in two comparison groups (experimental and control), in evaluations performed before and immediately after the treatment. Five studies[9,22,29,35-36] did not enter because they did not have enough data for this analysis and one study[33] performed the evaluation only three months after the end of treatment.

The results of the meta-analysis showed that cupping therapy was more effective in reducing pain compared to the control group (absolute difference between means: -1.59, [95% Confidence Interval: -2.07 to -1.10]; p = 0.001), with moderate to high heterogeneity (I^2 = 67.7%, p = 0.001) (Figure 5).

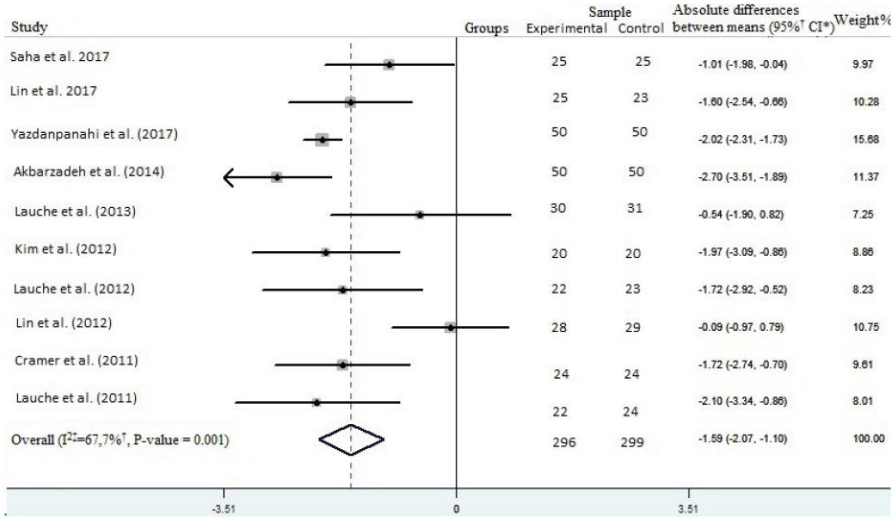

Figure 5

Forest plot of the pain intensity score. Belo Horizonte, MG, Brazil, 2018

*CI - Confidence interval; †% - Percentage; ‡I^2 - Measurement of heterogeneity

Discussion

Cupping therapy has shown positive results on chronic back pain in adults, not only in behavioral variables of pain, but also in physiological parameters in the majority of RCTs evaluated in this study, which contributes to the consolidation of its use in the treatment of this clinical condition in the study population.

Regarding methodological quality, most studies[23,25-27,31-36)] obtained a median score (three) according to the Jadad scale[19]. This score can be justified by the lack of masking of RCTs.

It is not feasible to conceal evaluation and intervention methods in cupping therapy[22], since the marks left by the suction cups are often visible and may persist for several days, making it difficult to perform a masking process[27]. Only one study[28] achieved masking properly; however, it was true only for volunteers who received laser therapy, an intervention used concomitantly with cupping therapy, where sham laser acupuncture was performed by applying the same procedure in one of the groups, but without energy. In a second study[24], there is a description that

the masking was applied to the evaluator of the results; however, the application of suction cups causes marks (ecchymoses, petechiae) and one of the evaluated outcomes was the pain threshold, using the algometer; for this evaluation, as the area must be naked, the marks on the skin make this kind of masking impossible. Finally, in another study[22], the majority of participants in the minimal cupping group (84%) was able to identify the allocation after four weeks, whereas in the cupping group 55% identified the allocation.

Regarding the evaluated outcomes, pain intensity predominated, which was measured mostly by means of the Visual Analogue Scale (VAS)[22-25,27-30,32] and the Numerical Scale[26,34-36], followed by the Neck Pain and Disability Scale[9], by the short version of the McGill Pain Questionnaire[31], and by the Present Pain Intensity Scale[33].

Although there are variations, the VAS usually consists of scores of 0-10 or 0-100, the extreme left being described as no pain and the extreme right as the worst possible pain; the numerical scale has a numerical rating of 0-10, 0-20 or 0-100. These scales can be classified as: painless (0), mild (1-3), moderate (4-6), and severe (7-10), and are frequently used in patients with chronic musculoskeletal pain[37]. In addition, some researchers[38-40] have pointed to these two scales as the gold standard for assessing pain intensity, these being the instruments most used when evaluating adults, both in clinics and research.

Physical disability was the second most approached outcome, measured by means of the Neck Disability Index (NDI)[23-27,34], of the Oswestry Disability Questionnaire (ODQ)[33,35-36] and the Neck Pain and Disability Scale[9]. In fact, the severity and chronicity of back pain are associated with severe functional limitations[37] that imply limitations in activities of daily living[41].

In addition, patients with chronic diseases, who require continuous treatment over a long period, present important changes in quality of life[42], being another important outcome to be evaluated, as occurred in six studies, through the Short Form 36 Health Survey Questionnaire (SF-36)[22-27].

Finally, the physiological parameter most evaluated in the studies was the nociceptive threshold before the mechanical stimulus, by means of a pressure algometer[9,23-27]. It is known that individuals who have pain in the spine have higher nociceptive sensitivity compared to healthy people[43]. However, this is still considered a subjective variable, since it is the patient who determines his/her pain threshold. In fact, when the evaluation process is more related to the symptoms, such as subjective phenomena, especially pain, than to physical or laboratory results, self-assessment is considered the most reliable indicator of the existence of pain[44]. Thus, the necessary information to carry out its evaluation has its origin in the individual's report[45], who is the primary source of the assessment.

The systematized analysis of cupping therapy application methods showed that there is no standardization in the treatment protocol for

chronic back pain. However, recent efforts have been made to standardize the cupping therapy procedure in general[46] and specifically for chronic back pain, since the most appropriate type of technique, duration of treatment, number of sessions, devices, time of application, method and suction strength and application points have not been determined.

It can be observed, however, that the most applied technique was dry cupping, specifically for the lumbar[22,28,30-32] and cervical regions[9,27,29,34]. This modality allows the stimulation of the acupoints in the same way as the acupuncture needles[47]. Researchers[18] suggest that laceration of the skin and capillaries, promoted by wet cupping, may act as another nociceptive stimulus that activates the descending inhibitory pathways of pain control[18], thus helping to treat chronic musculoskeletal conditions[35]. However, risk for infection, vasovagal attacks and scars are the disadvantages of this method[18]. Still, compared to cupping massage, authors[47] emphasize that dry cupping has a greater analgesic effect, since the use of lubricants can reduce the friction between the edge of the cup and the skin, a fact corroborated by some authors[24] who used arnica oil for the realization of cupping massage.

Despite the variability in the application of the intervention, it was possible to identify that, on average, the cupping therapy was applied in 5 sessions, with permanence of the cups in the skin for around 8 minutes, and interval of three to four days between the applications. According to some researchers[27], at least five sessions are required for any significant effects of cupping treatment to appear, in addition to ensuring the feasibility of the RCT. Moreover, authors[47] recommend that the cups should be left on the skin for 5 to 10 minutes or more, which culminates in the appearance of residual marks after treatment as a result of the rupture of small blood vessels that are painless and disappear between 1 and 10 days[12]. Therefore, an interval between sessions is necessary in order to allow the reestablishment of the cutaneous and subcutaneous tissues.

Regarding the application cups, the disposable ones are preferable a high-level sterilization or disinfection process is required prior to reuse, since the pressure exerted may cause extravasation of blood and fluids from the skin[46]. Nowadays, cupping therapy has increasingly been performed with plastic cups[47]. The size of the cups varies according to the place of application, but it is often applied in places with abundant muscles, such as the back[48].

Regarding the suction method to create negative pressure, the use of fire predominated[9,25,27,29,32], followed by manual pumping[23,34-36] and automatic pumping[22,26,33]. Suction with fire is the traditional method used in China, however, there is a risk of burns[18]. Manual vacuum is created when using a suction pump. This method allows microcirculation to increase more effectively if compared to fire[18]. Finally, automatic pumping is created using an electric suction pump, which allows to adjust and measure the negative pressure inside the cup, being the most suitable method for scientific research[18].

Only three studies[22,26,28] reported the suction strength used, which should be standardized in the application protocols. The suction can be light (100 and 300 millibar/one or two manual pumpings), medium (300 and 500 milibar/three or four manual pumpings), strong (above 500 milibar/five or more manual pumpings) or pulsatile (pressure inside the cups is variable, between 100 and 200 milibar every 2 seconds)[47,49]. The medium suction is often indicated for painful conditions of the musculoskeletal system[18].

There was also no standardization in relation to the application points of cupping therapy. Despite this, the application in specific acupoints in the cervical region, mainly on the bladder, gallbladder and small intestine meridians, prevailed[29,34], and in the lumbar region on the bladder meridian[30-32,35-36], followed by sensitive points[9,25-27,30] named *Ashi* by TCM or trigger points by Western medicine.

Meridians are passages for the flow of "*qi*" (vital energy) and "*xue*" (blood), the two basic body fluids of TCM, which spread throughout the body surface, uniting the interior with the exterior of the body and connecting the internal organs, the joints and the extremities, transforming the whole body into a single organ[50]. Part of the meridians of the bladder, small intestine and gallbladder pass through the dorsal region. The acupuncture points are located in the meridians; besides local action, they also play a systemic action and reestablish the energy balance of the body by adjusting the function of the organs, maintaining homeostasis and treating the disease[51], so the advantage in using them.

The trigger points or *Ashi* are specific points of high irritability; they are sensitive to digital pressure and can trigger local and referred pain[52]. They may be deriving from dynamic overload, such as trauma or overuse, or static overload, such as postural overloads occurring during daily activities and occupational activities[53], besides emotional tension. Addressing these points can also be a way to relieve local pain[54].

After the application of cupping therapy, both the acupoints of the meridians of the affected regions and the trigger points or *Ashi* may present bruising, erythema and/or ecchymoses. According to TCM, these signs represent stagnation of "*qi*" and/or "*xue*" and may help the therapist in identifying body disorders.

Finally, the meta-analysis revealed a significant reduction of the pain intensity score in adults with chronic back pain by using cupping therapy ($p = 0.001$). Compared with a control group (usual care/other intervention/waiting list), this modality has advantages in relieving pain, as can be seen in Figure 5.

Only two studies[24,30] did not present a statistically significant difference between the groups on the benefit or harm of this intervention (Figure 5). In fact, the first study[24] pointed out that cupping therapy has the same effect as other intervention (progressive muscle relaxation) in reducing chronic nonspecific neck pain; despite this, cupping therapy was better than relaxation in improving well-being and decreasing sensitivity

to pressure pain. The authors[24] justify this result, among other limitations, due to the fact that cupping therapy was performed by patients' relatives or friends at home. The second study[30], despite having found a positive result on the intensity of pain, did not obtain a result in the meta-analysis. It is believed that this may have been due to the fact that both groups received the intervention of soft cupping and both obtained positive results.

In the other studies[23,25-28,31-32,34], the intervention reduced the probability of the outcome, being the study with the largest sample[31] the one the most contributed (15.68% weight in the meta-analysis) for this (Figure 5). In fact, all these studies reported promising results of intervention on pain intensity.

However, the results of the effectiveness of cupping therapy still need to be confirmed by subgroup analyzes, based on different types of application techniques and control groups. In addition, it is important to perform meta-regression to find the source of heterogeneity of RCTs.

In a general way, the results showed a substantial variation in the application of cupping therapy, especially in relation to the type of technique, as well as differences in the control group, which made subgroup or meta-regression unfeasible, respectively, due to the small number of studies with each of these specifications.

Conclusion

Cupping therapy is a promising method for the treatment and control of chronic back pain in adults, since it significantly decreases pain intensity scores when compared to control groups. However, the high heterogeneity and the median methodological quality of RCTs has limited the findings.

Despite this, a protocol can be established for this clinical condition: application of dry cupping technique in 5 sessions, with permanence of the disposable or plastic cups on the skin for about 8 minutes, preferably automatic or manual pumping, with medium suction strength, and three to seven days interval between applications. It is better to opt for acupoints of the dorsal region, especially those from the bladder meridian in the lumbar region, and for the meridians of the bladder, gallbladder and small intestine in the cervical and thoracic regions, as well as *Ashi* or trigger points. This protocol needs to be validated in future studies. And the main outcomes evaluated for this clinical condition were pain intensity, physical disability, quality of life and nociceptive threshold before the mechanical stimulus (pressure).

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