

Brief Communication

Effect of wet cupping on reducing bone pain for patients in King Abdulaziz University Hospital, Saudi Arabia. A retrospective study

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ABSTRACT

Objectives: To investigate the effectiveness of wet cupping as alternative treatment on reducing bone pain and built a model that predicts the level of improvement for patients who suffer from bone pain.

Methods: This retrospective study was conducted on 289 patients referred from specialty clinics to PMC between September 2013 and August 2015. The effectiveness of cupping is assessed on patients with bone pain who were redirected to the Prophetic Medicine Clinics (PMC) at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. An artificial neural network (ANN) method was used to propose a model that predicts levels of improvement for patients suffering from bone pain. Therefore, a random sample of 90% of the data was used to build the ANN model and tested by the remaining 10%. Inferential statistics were conducted to study relations and compare blood tests before and after treatment.

Results: Out of 289 patients suffering from bone pain, more than 11% were completely cured, and 55% improved after wet cupping treatment sessions. The proposed ANN model showed a good performance with more than 72% accuracy. In addition, the statistical analysis showed a significant improvement for most blood tests.

Conclusion: Wet cupping has positive effects on reducing bone pain. We recommend the use of an ANN model in PMC to predict whether patients will benefit from the treatment to reduce pain.

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Wet cupping is a traditional and alternative treatment that is still used to reduce patients' pain in several Eastern and European countries. It has been proven effective and has an essential role in reducing pain and as a treatment for many diseases in

past studies.¹⁻⁵ However, there is no previous research studying the effect of wet cupping on reducing bone pain. Bone pain is a common health problem and a major cause of activity restriction. This pain may not be limited to a particular age or gender. Patients with bone pain feel aching, tenderness, or other discomfort in some parts of their bones with or without moving. This pain may be due to any causes that affect the function or structure of the bone such as trauma or a deficiency in calcium and vitamin D, which could lead to osteoporosis, metastatic bone cancer, sickle cell anaemia, osteomyelitis, leukaemia, or pregnancy-related pelvic girdle pain. Bone pain may be reduced with pain relievers, powerful antibiotics, nutritional supplements, cancer treatments, or surgery according to the cause.⁶ In addition, acupuncture was significantly effective more than physical exercise to relieve pain according to the physical function score of the Zurich claudication questionnaire (ZCQ) and is considered as more satisfactory than medication according to the satisfaction score.⁷

We investigated the effectiveness of wet cupping as alternative treatment on reducing bone pain and built a model that predicts the level of improvement for patients who suffer from bone pain. In addition, we answered the following questions: Is there a relationship between bone pain and osteoporosis, and/or vitamin D deficiency? Does wet cupping improve patients' health?

Methods. This study was conducted according to the ethical principles of the Helsinki Declaration. The ethical Committees of the Faculty of Medicine at King Abdulaziz University (KAU), Jeddah, KSA approved the initiation of the Prophetic Medicine Clinics (PMC) as an outpatient Clinics in King Abdulaziz University Hospital (KAUH). Institutional Review Board (IRB) of KAUH approved the proposal of this study. The trials are registered in the World Health Organization Clinical Trials Registrant (Registration Number: IRCT2015050322060N1). The study guaranteed patients' confidentiality to participate in the research. Signed informed consent was obtained from each participant upon enrolment in the study and they received their usual ordinary treatment.

This study used different methods to find prior related research for the effects of wet cupping on reducing bone pain. These included searching for published articles in different databases such as MEDLINE®, PubMed, Google Scholar, Google, and Cochrane using key words in addition to evaluating bibliographies of related articles from 2013 to 2018.

A retrospective study was performed to measure the effect of wet cupping in reducing bone pain for 289 patients at PMC. These patients were referred from specialty clinics at KAUH from September 2013 to August 2015.

According to the research inclusion criteria, only patients with bone pain were tested. One part of the data was taken from a questionnaire and the other part from the KAUH patients' database that includes blood tests results conducted at the initial visit to PMC and after 3 sessions. The tests used in this study are the intracellular protein test (ferritin), autoantibodies that bind to contents of the cell nucleus (ANA), white blood count (WBC), red blood count (RBC), haemoglobin level (HB), thyroid stimulating hormone (TSH), vitamin D level (Vitamin D), C-reactive protein (CRP), and fasting blood sugar (FBS).

The wet cupping procedure used in the PMC involved cleaning the pain area with an alcohol swab, then placing disposable cups over the pain area and starting moderate suction. The cup is left for about 3 to 5 minutes. Then the cup is removed, and parallel incisions are conducted on the area of pain with a disposable lancet, as reported previously.^{2,3} Most patients repeated the wet cupping procedure each month until the pain was reduced.

Statistical analysis. The Statistical Package for the Social Sciences (SPSS) version 21 and the R program were used to analyse the cupping data.^{8,9} Inferential methods such as Wilcoxon signed rank test for paired sample test was used on all blood analyses because the data are non-normally distributed. *P*-value less than 0.05 was considered significant.

In addition, an artificial neural network (ANN) was used to propose a model that can predict the level of improvement and pain reduction after wet cupping for patients suffering from bone pain. ANN consists of 3 main layers: input units in the input layer that represent variables measured for each training instance. Those inputs are weighted and fed to a hidden layer at the same time. Output units or neuroses are the units in the hidden layers and output layer. Then, outputs of the hidden layer are fed to different hidden layer. Finally, weighted outputs of the last hidden layer are fed to the output layer, which gives the estimate and prediction for the instances. Each output unit uses a nonlinear

(activation function) to the weighted input.^{10,11}

The proposed model was built by dividing the data into training and test data. The training set used to build the model represents a random sample of 90% of the original patients' data and the test data is based on the remaining 10% of the data. The test data is used to measure the performance of the model using the "neuralnet" (NN) package.¹² Also, the NN method identifies the most important variables that have a significant effect on a patient's health in terms of improvement (cure, improve, did not improve). Finally, a validation technique called 'cross validation error' is calculated to estimate the accuracy and performance of the predictive model.¹³

Results. A total of 289 patients were referred to PMC suffering from bone pain, and most of the patients were ages 36-53 (n=138, 47%) (Table 1). The percentage of recovery from bone pain and improvement of pain was more than 66% (192 out of 289) for both males and females. In addition, patients aged less than 36 years had a higher rate 74% (55 out of 74) of recovery and improvement from bone pain in their age group than older patients. The study shows that 11.4% of the patients were completely cured after wet cupping, and 55% of patients had bone pain improvement. Each patient had blood tests before and after 3 wet cupping sessions. Therefore, the Wilcoxon signed rank test was used to see if there were significant differences in all blood tests before and after wet cupping. The results in Table 2 show significant differences between all blood tests before and after wet cupping except FBS, HB, RBC and WBC tests. According to the normal range used in KAUH devices, these differences showed improvement after wet cupping sessions. Focusing on CRP, TSH, and Vitamin D, we observed that there was significant improvement in blood test after wet cupping

Table 1 - Cupping impact on bone pain according to gender and age group.

Variables	Cupping impact on bone pain			Total
	No improvement	Improvement	Complete recovery	
<i>Gender</i>				
Female	70 (33.7)	112 (53.8)	26 (12.5)	208
Male	27 (33.3)	47 (58.0)	7 (8.6)	81
<i>Age</i>				
18-35	19 (25.7)	42 (56.8)	13 (17.6)	74
36-53	50 (36.2)	71 (51.4)	17 (12.3)	138
54-71	28 (36.4)	46 (59.7)	3 (3.9)	77
Total	97 (33.6)	159 (55.0)	33 (11.4)	289

Values are presented as number and percentage (%)

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Table 2 - Blood test comparison before and after wet cupping.

Variables	Mean±SD	95% Confidence interval	P-value	KAUH Normal range
Vitamin D before cupping	23.5 ± 36.4	30.4 - 39.7	40 - 80	
Vitamin D after cupping	26.7 ± 53.5	50.1 - 59.3		0.00*
CRP before cupping	22.1 ± 11.2	7.1 - 15.4	0 - 3	
CRP after cupping	13.1 ± 8.4	5.8 - 12.0		0.012*
FBS before cupping	2.6 ± 6.1	5.6 - 6.6	3.9 - 6.1	
FBS after cupping	1.9 ± 5.9	5.5 - 6.2		0.143
Ferritin before cupping	74.9 ± 49.7	35.6 - 63.8	13 - 150	
Ferritin after cupping	65.2 ± 59.1	46.8 - 71.3		0.013*
WBC before cupping	3.4 ± 6.8	6.1 - 7.4	4.5 - 11.5	
WBC after cupping	42.3 ± 10.9	3.0 - 19.0		0.663
RBC before cupping	0.6 ± 4.7	4.5 - 4.8	4 - 5.4	
RBC after cupping	0.6 ± 4.7	4.5 - 4.8		0.257
Hb before cupping	1.7 ± 12.5	12.2 - 12.8	12 - 15	
Hb after cupping	1.8 ± 12.6	12.2 - 12.9		0.246
TSH before cupping	19.1 ± 4.8	0.8 - 8.0	0.27 - 4.2	
TSH after cupping	9.6 ± 3.2	1.4 - 5.0		0.015*

*Statistically significant at p -value <0.05. CRP - C-reactive protein, FBS - fasting blood sugar, WBC - white blood count, RBC - red blood cells, Hb - hemoglobin level, TSH - thyroid stimulating hormone, KAUH - King Abdulaziz University Hospital

sessions, especially Vitamin D level that showed a clear improvement for most patients. The average of Vitamin D level before wet cupping was 36.4 and after wet cupping it reached the normal range of 53.5. In addition, the TSH improved and reached the normal range. The CRP also improved but remained above the normal range.

Descriptive analysis shows that 73 patients who had bone pain suffered from osteoporosis, and more than 50% of these patients belonged to age group 36-53 years, while 45.2% of the patients who suffered from osteoporosis belonged to age group 54 and 71 years. Therefore, we conducted a chi-square test to explore the factors that have relationships with osteoporosis. The relationships between osteoporosis and patients' age, deficiency of Vitamin D, and sex were significant at $p < 0.05$. However, there was no significant relationship between family history of the patient and osteoporosis.

In addition, we built an ANN model that represented a classification for the level of improvement. The input layer consisted of sex, age, osteoporosis, vitamin D level test, CRP, and family history as input units. The levels of improvement (complete recovery, improvement, no improvement) were considered as output units. The proposed ANN model has one hidden layer as shown in Figure 1. The performance of the neural networks model

was evaluated by the misclassification rate, which was 0.276. Hence, model accuracy was 0.724. Moreover, we obtained from the ANN model the important input variables that have strong relationships with the level of improvement. These were the CRP test, Vitamin D level, and nonexistence of family history, which have strong positive relationships, while osteoporosis has a moderate negative relationship with the level of improvement.¹⁴

Discussion. This study was performed to measure the effect of wet cupping in reducing bone pain for 289 patients at PMC. That is, the study was limited to the patients who were referred from specialty clinics at KAUH, Jeddah, Saudi Arabia from September 2013 to August 2015. The results show the beneficial effects of wet cupping on reducing pain for most patients, where 11.4% of the patients were completely cured after wet cupping, and 55% of the patients' health was improved. We have observed that the absence of significant differences in the changes in some blood tests, WBC, FBS, RBC and HB, is positive because these blood tests remained in the normal range after wet cupping, which shows the effectiveness of wet cupping on a patient's overall health as reported in previous studies (5,15).

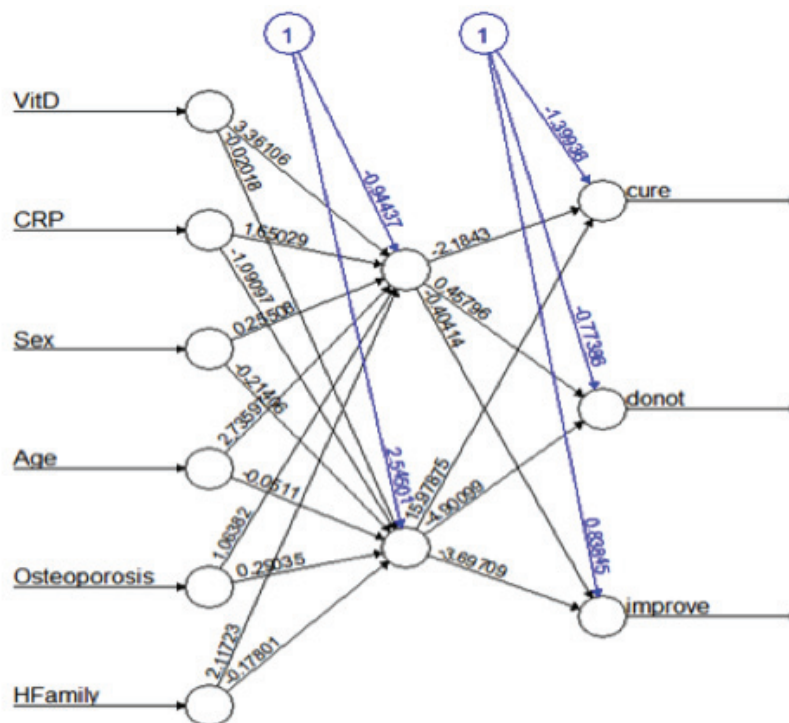


Figure 1 - Neural networks model for the patient data in Prophetic Medicine Clinics at King Abdulaziz University Hospital. VitD - vitamin D, CRP - C-reactive protein, provide a high resolution figure

That is, all related research identified a limited part of the bones and proved that cupping has a positive effect on pain treatment, but this research did not specify a specific part of the bone. It proved the positive effect of cupping on all the body's bone by reducing or curing pain. Furthermore, the technique used in this study differs from the techniques used in the clinical trial as done by the Ministry of Health in Saudi Arabia, but the results were similar.¹

The proposed ANN model showed a good performance with accuracy of more than 72% and will support doctors in cupping clinics to predict patients' level of improvement prior to starting the wet cupping treatment. This will be useful to decide whether the admitted patients will benefit from the wet cupping treatment to reduce pain.

In conclusion, this study shows promising effects of wet cupping therapy that can be considered as a complementary therapy because it clearly reduced bone pain for most patients. In addition, cupping shows a positive impact on the regulation of several blood test levels. Therefore, further studies are recommended with a larger sample of patients to confirm the findings of

this study. Also, there is a need to construct models based on age or gender and explore the most effective factors on patient health and use alternative statistical model techniques to compare with the ANN model.

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