Original Article

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Effect of Wet Cupping Therapy on Cardiac Autonomic Function Assessed by 24-hour Holter Monitoring in Healthy Individuals

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Abstract

Aim: Despite increasing interest in wet cupping therapy (WCT), its effects on cardiac autonomic regulation have not been sufficiently investigated. In this context, we aimed to investigate whether WCT affects cardiac autonomic function in healthy individuals.

Methods: This study was designed as a prospective single-arm interventional pre-post study in which 24-hour rhythm Holter (RH) recordings were obtained before and after WCT between August 2, 2022, and December 31, 2022. Time-domain measures were used to assess heart rate variability (HRV). 50 healthy volunteers were included in the study. Before the WCT, nurses in the cardiology outpatient clinic Holter room attached 24-hour RHs to the participants; the RHs were removed after 24 hours, before the WCT was applied in the traditional and complementary medicine department. After the WCT procedure, the 24-hour RH was immediately reattached to the healthy participants in the Holter room and removed 24 hours later.

Results: No statistical difference was found between the two groups in the following parameters: standard deviation of NN intervals (SDNN) [95% Confidence interval (CI): -8.912-5.434, t=-0.487, p=0.628], SDANN (95% CI: -9.515-4.776, t=-0.666, p=0.508), SDNN index (95% CI: -2.815-2.245, t=-0.226, p=0.822), SDSD (z=-1.238, p=0.216), NN50 (z=-1.725, p=0.085), RMSSD (z=-1.048, p=0.295), pNN50 (z=-0.104, p=0.917) and triangular index (z=-1.355, p=0.176).

Conclusion: To the best of our knowledge, studies evaluating HRV parameters using 24-hour Holter monitoring before and after WCT are limited. When HRV parameters were compared before and after WCT, no statistically significant differences were observed between the two groups. More studies are needed with a larger number of healthy volunteers and with repeated WCT procedures.

Keywords: Heart rate variability, cupping therapy, autonomic nervous system, holter monitoring, complementary therapies

Introduction

Cupping therapy (CT) is one of the oldest traditional medicine practices, with a history spanning thousands of years (1). Although it is applied using different methods across cultures, the essence of CT is the idea of purification and activation of energy. The most common classification of cupping distinguishes procedures in which an incision is made [wet CT, or wet cupping therapy (WCT)] from those in which it is not (dry CT). In the dry cup application, no blood is taken from the body. When the cup is applied, the air inside the cup is evacuated and the skin swells due to negative pressure. WCT starts like the dry cup application, but superficial incisions are made on the skin to drain the blood from the skin in the area where the application is made (2). The autonomic nervous system consists of sympathetic and parasympathetic components that regulate body functions. Dysfunction in sympathetic and

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parasympathetic components can lead to cardiovascular disease. Heart rate variability (HRV) has evolved as a non-invasive indicator of cardiac autonomic modulation (3). According to cutivisceral reflex theory, the heart segment is defined as between the first and fifth thoracic vertebrae (4).

In traditional Chinese medicine, the body possesses energy channels called meridians that belong to the organs and these channels have acupuncture points with various features (5). In traditional Chinese medicine, GV-14, bilateral BL-15, and bilateral BL-18 points are associated with the heart. (6,7). While circadian rhythms triggered by sunlight in humans are well-defined, fewer clinical studies have been conducted on the effects of lunar gravity and light. In some traditional practices, the timing of WCT may align with specific lunar calendar days; however, the physiological significance of this practice is unclear. This view holds that the human body is subject to the Moon's gravitational effect, as liquids on Earth rise due to this effect during the full-moon phase. In prophetic traditions, WCT is recommended to be performed on the 17th, 19th, or 21st days of the lunar month, which coincide with peak gravitational influence during the full moon (8).

In this study, WCT application points were determined by considering segmental CT and mechanisms of traditional Chinese medicine. Wet cupping therapy practice was performed on the 17th, 19th, and 21st days of the lunar months. Nurses attached 24-hour rhythm Holter (RHs) to the participants; the RHs were removed after 24 hours and before WCT was applied in the traditional and complementary medicine departments. After the WCT procedure, 24-hour RH was immediately reattached to the participants in the Holter room and was again removed. We hypothesized, according to the cutivisceral reflex theory, that stimulating the heart meridians results in positive changes in HRV parameters.

Therefore, the present study aimed to evaluate the effect of WCT on cardiac autonomic regulation by comparing HRV parameters obtained from 24-hour Holter recordings before and after the intervention in healthy individuals. This will help determine whether WCT, which is commonly used in daily practice, affects cardiac autonomic function.

Materials and Methods

Compliance with Ethical Standards

Approval was obtained from the University of Health Sciences Türkiye, Sultan Abdulhamid II Educational and Research Hospital Traditional and Complementary Medicine Clinical Research Ethics Committee (approval number: SBUSAH-GETAT 2022- 024, date: 25.02.2022). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from the patients who agreed to take part in the study.

Study Design and Patient Selection

This study was designed as a prospective single-arm interventional pre–post study between August 2, 2022, and December 31, 2022. The 50 consecutive healthy participants over the age of 18 who presented to the hospital for WCT were included in the study.

The basic demographic characteristics and examination results of the participants were recorded. Individuals with active diseases at the time of application (e.g., acute tonsillitis, acute sinusitis, pneumonia, coronavirus disease-19, acute urinary tract infection, acute renal failure, acute liver failure, active cancer, acute decompensated heart failure, or acute coronary syndrome) were excluded. Participants with chronic anemia [women with hemoglobin (Hb) <11 g/dL and men with Hb <12 g/dL), bleeding diathesis, antithrombotic or antiaggregant therapy, platelet counts <50,000 × 10^3/μL, or concomitant chronic diseases (including chronic coronary syndrome, diabetes mellitus, hyperlipidemia, chronic liver failure, hypertension, chronic renal failure, psoriasis, chronic heart failure, and rheumatological diseases such as familial Mediterranean fever) were also excluded. Individuals who had received WCT within the past three months, those menstruating women, and pregnant women were additionally excluded. Participants were asked to restrict caffeine intake and physical activity before and after WCT.

Prior to WCT, all participants underwent blood tests conducted by the biochemistry laboratory. The laboratory findings were recorded in the standard electronic medical records at the same hospital. All participants were also evaluated at the cardiology outpatient clinic of the same hospital one day before the WCT. A 12-lead surface electrocardiogram (ECG) was performed at rest by nurses in the cardiology outpatient clinic. Transthoracic echocardiographic examinations in the left lateral recumbent position were performed using the ultrasound imaging system. The flowchart of the study is shown in Figure 1.

WCT Application and RH Monitoring

Wet cupping therapy sessions last approximately 20 minutes. Various cup materials, such as bamboo, glass, and plastic, can be used in practice. Disposable plastic cups were used in the study. In our patients, the area to be treated was first cleaned with a disinfectant, and then a dry cup was applied for 5 minutes. The cup was then removed, and superficial (0.2-0.5 millimeter) incisions were made in the skin with a number 15 scalpel. The cup

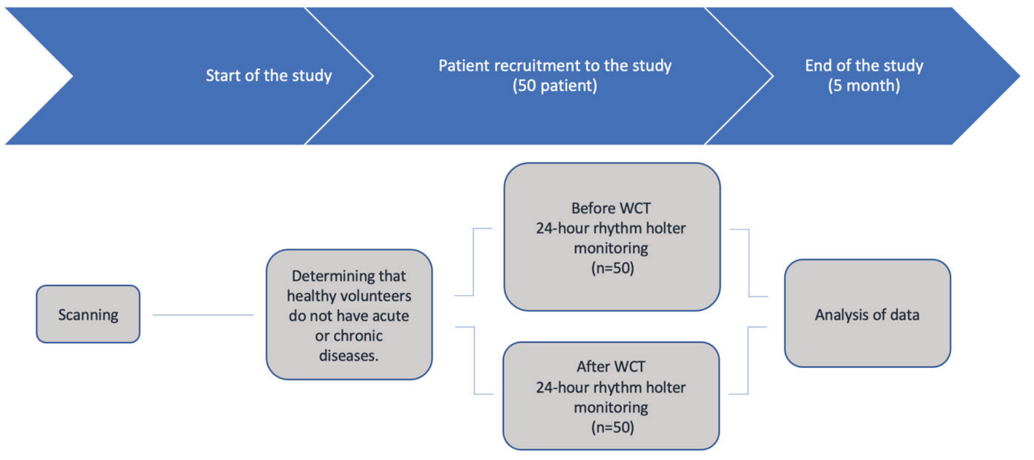

Figure 1. Flow chart of the study
WCT: Wet cupping therapy

was then reapplied to the incision site. After 10 minutes of blood collection, the application area was cleaned and dressed.

Before the WCT, nurses in the cardiology outpatient clinic Holter room attached 24-hour RHs to the participants; the RHs were removed after 24 hours, and the WCT was subsequently applied in the traditional and complementary medicine department. After the WCT procedure, 24-hour RH was again attached immediately to the healthy participants in the Holter room and again removed 24 hours later. The Holter recordings were analyzed using ABP analysis software (version 2.00.001, P1). Time-domain measures were used to measure the following HRV parameters: standard deviation of NN intervals (SDNN), standard deviation of the average NN intervals for each 5 min segment of a 24 h HRV recording (SDANN), mean of the standard deviations of all the NN intervals for each 5 min segment of a 24 h HRV recording (SDNN index), standard deviation of the differences between successive NN intervals (SDSD), number of pairs of successive NN intervals that differed by more than 50 ms (NN50), root mean square of successive NN interval differences (RMSSD), percentage of successive NN intervals that differed by more than 50 ms (pNN50) and integral of the density of the NN interval histogram divided by its height (triangular index).

The primary endpoint was the change in HRV parameters measured by 24-hour Holter monitoring before and after WCT.

Statistical Analysis

Statistical analyses were performed using SPSS software (version 26.0, SPSS Inc., Chicago, IL, USA). The normality of data distribution was assessed using the Kolmogorov-Smirnov test. Continuous variables were presented as mean ± standard deviation or median (interquartile range) as appropriate, while categorical variables were expressed as numbers and percentages. Comparisons between measurements obtained before and after wet CT were performed using the paired t-test for normally distributed variables and the Wilcoxon signed-rank test for non-normally distributed variables. Bonferroni correction was applied to adjust for multiple comparisons. A two-tailed p-value <0.05 was considered statistically significant.

Results

In this study, we consecutively enrolled 50 healthy volunteers who presented to our hospital for WCT. Of the participants, 25 (50%) were women and 25 (50%) were men. The mean age was 43.46 (10.93) years. The participants' basic clinical characteristics, including age, gender, and laboratory findings, are listed in Table 1. Impaired fasting plasma glucose is used when fasting plasma glucose is between 106 and 126 mg/dL. Impaired fasting plasma glucose was detected in 5 (10%) of the healthy participants. Hyperlipidemia was detected in 29 participants (58%). Lifestyle changes, diet, and exercise were recommended to the participants with impaired fasting glucose and hyperlipidemia. Neither deep vein thrombosis nor pulmonary embolism was detected in any participant. No abnormal findings were observed in the other laboratory tests.

The mean resting heart rate was 70.26 (8.91) beats per minute, and all participants had a normal sinus rhythm. Sinus bradycardia was detected in 5 (10%) of the participants, and a premature atrial complex was found on the resting ECG of 1 (2%) participant.

Data from the 24-hour RH monitoring before and after WCT are shown in Table 2. Comparison of HRV

Table 1. The demographic and laboratory findings of the patients		
Parameters	**Results**	**Normal range**
Gender (female/male) n (%)	25/25 (50/50)	
Age (years) mean ± SD	43.46 (10.93)	
Fasting plasma glucose (mg/dL) mean ± SD	92.06 (13.25)	74-106
Glomerular filtration rate (mL/min/1.73 m2) mean ± SD	105.76 (15.35)	-
Alanine aminotransferase (U/L) median (IQR)	19.00 (13.75-26.00)	0-50
Aspartate transaminase (U/L) median (IQR)	19.00 (16.00-23.00)	0-50
Triglyceride (mg/dL) median (IQR)	112.00 (84.75-168.00)	<150
Total cholesterol (mg/dL) mean ± SD	197.22 (43.59)	<200
High density lipoprotein (mg/dL) mean ± SD	48.38 (10.94)	>50
Low density lipoprotein (mg/dL) mean ± SD	118.92 (37.24)	<130
C reactive protein (mg/L) median (IQR)	2.40 (2.00-3.95)	0-5
Calcium (mg/dL) mean ± SD	9.41 (0.44)	8.8-10.60
Magnesium (mg/dL) median (IQR)	2.00 (1.81-2.10)	1.8-2.60
Sodium (mmol/L) mean ± SD	138.46 (2.01)	135-148
Potassium (mmol/L) mean ± SD	4.27 (0.31)	3.5-5.10
Thyroid stimulating hormone (mIU/L) median (IQR)	1.48 (0.95-2.07)	0.35-4.94
Thyroxine (T4) (ng/dL) mean ± SD	0.95 (0.10)	0.70-1.48
White blood cell count (10^3/mL) mean ± SD	7.04 (1.49)	3.98-10.04
Hemoglobin (g/dL) mean ± SD	14.20 (1.67)	11.7-16.00
Hematocrit (%) mean ± SD	41.14 (4.27)	38-50
Platelet (10^3/µl) mean ± SD	243.32 (46.05)	150-360
Cardiac troponin I (ng/L) median (IQR)	1.00 (1.00-1.00)	0-34
D-dimer (ug/mL) median (IQR)	0.27 (0.27-0.33)	0-0.5
Pro BNP (pg/mL) median (IQR)	10.10 (10.00-16.70)	0-100

IQR: Inter quantile range, n: Number, SD: Standard deviation, mg/dL: Milligram/deciliter, mmol/L: Millimole/liter, IU/mL: Micro international unit/milliliter, g/mL: Microgram/milliliter, L: Microliter, mg/L: Milligram/liter, pg/mL: Picogram/ milliliter, ng/L: Nanogram/liter, U/L: Unit/liter, Pro BNP: Pro B type natriuretic peptid

parameters before and after WCT revealed no statistically significant differences between the two groups in terms of SDNN [95% confidence interval (CI): -8.912-5.434, t=-0.48, p=0.628], SDANN (95% CI: -9.515-4.776, t=-0.666, p=0.508), SDNN index (95% CI: -2.815-2.245, t=-0.226, p=0.822), SDSD (z=-1.238, p=0.216), NN50 (z=-1.725, p=0.085), RMSSD (z=-1.048, p=0.295), pNN50 (z=-0.104, p=0.917) or triangular index (z=-1.355, p=0.176). When the other 24-hour RH parameters were compared, there were no statistically significant differences between the two groups in average heart rate (95% CI: -1.806-1.886, t=0.044, p=.965), minimum heart rate (z=-0.453, p=.651), or maximum heart rate (z=-1.826, p=.068) (Table 2).

Discussion

In this prospective pre–post study including 50 healthy volunteers, HRV parameters obtained from 24-hour Holter recordings were compared before and after WCT. The results demonstrated no statistically significant changes in HRV indices or other Holter-derived cardiac parameters following the intervention.

Several studies have examined the benefits of WCT. For example, in a pilot study, post-exercise WCT was applied to martial arts athletes. After WCT, the inflammatory markers (e.g., interleukin-6 and -tumor necrosis factor) were found to be significantly reduced. It has been argued that taking WCT immediately after exercise can alleviate the inflammatory response to exercise in martial arts athletes (9). It has also been reported that WCT can increase endogenous NO production; NO acts as a vasodilator. Thus, enlarged blood vessels will provide better delivery of nutrients and oxygen to the muscles. Therefore, it can contribute to improving physical performance (10). A randomized controlled study compared WCT with acupuncture in patients with migraine. migraine disability assessment scale and visual analog scale pain scores decreased significantly in both treatment groups after WCT, while they remained at similar levels in the control

Table 2. Comparison of heart rate variability and other 24-hour holter parameters before and after WCT

Variables	Before wet cupping	After wet cupping	p-value
*SDNN ms mean ± SD	144.44 (34.84)	146.18 (37.31)	0.628
*SDSD ms median (IQR)	33.21 (26.12-48.47)	33.20 (25.13-47.94)	0.216
*SDANN ms mean ± SD	129.95 (35.11)	132.31(36.89)	0.508
*NN50 median (IQR)	8351.00 (4122.75-15024.00)	7936.00 (3840.00-14342.50)	0.085
*RMSSD ms median (IQR)	32.46 (26.12-46.02)	33.20 (25.13-47.94)	0.295
*pNN50 median (IQR)	8.55 (4.28-16.65)	9.65 (4.05-16.78)	0.917
*SDNN index mean ± SD	62.17 (16.12)	62.45 (16.53)	0.822
*Triangular index median (IQR)	19.18 (17.60-25.04)	19.78 (16.64-24.03)	0.176
*Average heart rate (bpm) mean ± SD	74.90 (5.84)	74.86 (6.26)	0.965
*Minimum heart rate (bpm) median (IQR)	50.00 (40.00-55.00)	50.00 (38.00-53.00)	0.651
*Maximum heart rate (bpm) median (IQR)	130.00 (108.00-141.75)	135.00 (112.00-148.75)	0.068

*Significance values have been adjusted by the Bonferroni correction for multiple tests
IQR: Inter quantile range, n: Number, SD: Standard deviation, SDNN: Standard deviation of NN intervals, SDSD: Standard deviation of the differences between succesive NN intervals, SDANN: Standard deviation of the average NN intervals for each 5 min segment of a 24 h HRV recording, SDNN index: Mean of the standard deviations of all the NN intervals for each 5 min segment of a 24 h HRV recording, pNN50: Percentage of successive RR intervals that differ by more than 50 ms, RMSSD: Root mean square of successive RR interval differences, Triangular index: Integral of the density of the RR interval histogram divided by its height

group over the same period (11). A systematic review was conducted to investigate the effect of CT on metabolic outcomes (blood sugar, blood pressure, and lipid profiles) in women. The results of this study showed that CT had a positive effect on various metabolic parameters. Significant correlations were observed between CT and improvements in blood pressure, blood sugar levels, and lipid profiles (12).

We found studies examining the effect of WCT on cardiac autonomic function. Arslan et al. (13) conducted a study that applied WCT to 40 healthy participants (13). They recorded ECGs one hour before and one hour after WCT, and found that WCT corrected sympathovagal imbalances by stimulating the peripheral nervous system. The number of patients in our study was higher, and our Holter wearing time was longer than in their study. Contrary to their findings, our study found no increase in HRV parameters after WCT. This difference may be due to the fact that the effect of WCT is greatest immediately after application and decreases over time. During WCT, the heart meridians are stimulated for approximately 15 minutes. WCT stimulates the peripheral nervous system by acting on the sympathovagal system. This effect disappears when the stimulation is removed. During WCT, a small amount of blood is removed from the body. To investigate whether this has long-term effects on the sympathovagal system, we administered RH for 24 hours.

Çelik et al. (14) investigated the effect of WCT on ventricular repolarization in 120 participants (14). Electrocardiogram strips were recorded from each participant one hour before and one hour after WCT. They found no statistically significant change in the average heart rate, QT interval, or QTc interval before and after the procedure. Similarly, in our study, no statistically significant difference was observed in the mean heart rate before and after the procedure in 24-hour RH recordings.

Study Limitations

This study has several limitations. First, it was conducted at a single center with a relatively small sample size. Second, only a single session of WCT was performed; therefore, potential effects of repeated or longer-term applications may not have been fully captured in the 24-hour rhythm Holter recordings. Investigating the cumulative effects of WCT would require multiple treatment sessions. However, participation in this study required volunteers to commit approximately 48 hours and attend the hospital for prolonged monitoring, which posed practical challenges. Because the participants were healthy adults who were mostly actively employed, obtaining time away from work made recruitment for repeated WCT sessions difficult. In addition, the Holter device used in this study did not allow frequency-domain HRV analysis. Finally, the absence of a control group limits the ability to draw causal inferences from the observed findings. Despite these limitations, this study contributes valuable data to the limited literature evaluating HRV parameters before and after the WCT procedure.

Conclusion

In this study, cardiac autonomic function was evaluated using 24-hour rhythm Holter recordings before and after WCT. No significant changes were observed in

HRV parameters following the intervention. Future studies with larger populations and repeated WCT sessions are warranted to further elucidate the potential effects of WCT on cardiac autonomic regulation.

Ethics

Ethics Committee Approval: Approval was obtained from the Sultan Abdulhamid II Educational and Research Hospital Traditional and Complementary Medicine Clinical Research Ethics Committee (approval number: SBUSAH-GETAT 2022- 024, date: 25.02.2022).

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: G.A., M.M.C., Concept: G.A., M.M.C., Design: G.A., M.M.C., Data Collection or Processing: G.A., M.M.C., Analysis or Interpretation: G.A., M.M.C., Literature Search: G.A., M.M.C., Writing: G.A., M.M.C.

Conflict of interests: No conflict of interest was declared by the authors.

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