

Elemental Analysis of Some Heavy Metals in Hijamah and Venous Blood Samples

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Abstract

Introduction: Hijamah as one famous therapeutic method used in traditional and new medicine can be done by special cups for sucking blood in wet and dry cupping therapy. The excessive use of minerals in various fields of life has become a threat to human health as they can accumulate in the body and lead to several chronic diseases.

Objective: This study was done to know the ability of wet hijamah on ridding the body of trace minerals and comparing the concentration of investigated elements with that found in venous blood samples.

Methods: The blood samples were collected from 18 volunteers. The samples were digested at $\sim 65^{\circ}\text{C}$ using a mixture of nitric acid and hydrogen peroxide in a ratio of (2:1), and then an inductively coupled plasma - optical emission spectrometry (ICP-OES) was used to determine the concentration of trace elements iron (Fe), nickel (Ni), chromium (Cr), cobalt (Co), cadmium (Cd), zinc (Zn), aluminum (Al), copper (Cu) and lead (Pb). Relationships between the studied blood samples were examined using SPSS statistical software.

Results: It was noted that some trace elements in hijamah and venous had statistically significant differences were Fe, Ni, Cd, Zn, Al, Cu, and Pb, where the values of p (< 0.0001 , 0.046, 0.024, 0.005, 0.009, 0.024, and 0.012 respectively). While the other elements did not show statistically significant differences, namely, Cr and Co, at p 0.263, and 0.416, respectively.

Conclusion: The study showed that wet hijamah can be safely applied to reduce the levels of trace elements in the blood. It may be useful for people who work in jobs where the accumulation of toxic elements in their bodies is possible.

Keywords: Hijamah Therapy, Blood Samples, Elemental Analysis, ICP-OES.

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التحليل العنصري لبعض الفلزات الثقيلة في عينات دم الحجاماة والوريد

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ملخص الدراسة

المقدمة: لحجاماة كأحد أشهر طرق العلاج المستخدمة في الطب التقليدي والحديث يمكن عملها باستخدام كؤوس خاصة لسحب الدم في العلاج الرطب والجاف بالكؤوس. إن الاستخدام المفرط للمعادن في مختلف مجالات الحياة أصبح خطراً يهدد صحة الإنسان بسبب إمكانية تراكمها في الجسم مما يؤدي إلى أمراض مزمنة مختلفة.

الهدف: تم إجراء الدراسة لمعرفة مقدرة الحجاماة الرطبة على إزالة معادن الجسم النزرة ومقارنة تركيز العناصر المتحقق منها مع تركيزها في عينات دم الوريد.

المنهجية: تم تجميع عينات الدم من 18 متبرعا. هضمت العينات عند $65 \pm C$ باستخدام مزيج من حمض النتريك وفوق أكسيد الهيدروجين بنسبة (1:2). استخدم جهاز طيف الانبعاث البلازمي المستحث في تقدير تراكيز العناصر النزرة: الحديد، النيكل، الكروم، الكوبلت، الكاديوم، الخارصين، الألمنيوم، النحاس، والرصاص. تم اختبار الارتباط بين عينات الدم المدروسة باستخدام برنامج الإحصاء SPSS.

النتائج: تم ملاحظة فروق معنوية بين عينات دم الحجاماة والوريد للعناصر حديد، نيكل، كاديوم، خارصين، ألمنيوم، نحاس، ورصاص عند مستويات معنوية $(p < 0.0001)$ ، 0.046 ، 0.024 ، 0.005 ، 0.009 ، 0.024 و (0.012) على التوالي بينما لم عنصر الكروم و الكوبلت فروقا معنوية بين عينات دم الوريد والحجاماة حتى مستويات 0.263 و 0.416 على الترتيب.

الاستنتاج: عرضت هذه الدراسة إمكانية التطبيق الآمن للحجاماة الرطبة في اختزال مستويات العناصر النزرة في الدم وهذا سيكون مفيدا للأشخاص الذين يعملون أعمالا تعرضهم لتراكم العناصر السامة في أجسامهم.

الكلمات المفتاحية: العلاج بالحجاماة، عينات الدم، التحليل العنصري، الانبعاث البلازمي المستحث.

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Introduction

Cupping therapy is one of the therapeutic methods that have been used since 3300 BC [1]. As it was used in ancient folk medicine in many eastern and western countries, where the artifacts that were discovered show their use in ancient Greece and Rome [2].

In traditional Arabian medicine, Hijamah means sucking (cupping), and it includes wet and dry cupping, but in Arabian culture, Hijamah usually refers to wet cupping [3].

Hijamah therapy is performed by Muslims as it is a form of medicine specifically mentioned and encouraged by the prophet Mohammed (may peace be upon him). Among other narratives "hadith", the prophet said that "Hijamah is the best of your remedies" where is used in the treatment of many diseases that existed, and people nowadays are using this type of treatment to treat many diseases [4,5].

In literature, there are different types of cupping, including dry cupping, wet cupping, moving cupping, and fire cupping. All types involve suction created by various means with or without bloodletting. The wet cupping Hijamah technique includes applying suction to the desired points on the skin using plastic, bamboo, earthenware, silicone, or glass cup. Thereafter, incisions are applied to the same areas of the skin to remove and suck the blood into the replaced cups [6].

As shown in randomized controlled trials (RCT), clinical trials, and meta-analyses (MAs), Hijamah could

effectively treat neck pain, lower back pain (LBP), lumbar pain, knee joint pain, herpes zoster, acne, skin itch, Gilbert's disease, senile pruritus, urticaria acuta, exogenous fever, cough, gastrointestinal function, migraine headache, and facial disease. Hijamah could improve related outcomes of the diseases and the prognosis [7].

Trace elements are important for maintaining a healthy state in an organism. As a result, disruptions in trace element homeostasis may lead to the emergence of pathologic conditions and diseases. Deficiency of critical trace elements and excess harmful trace elements are two of the most common patterns in modern humans. Insufficient trace element content in diets or increased organism requirements are common causes of such a shortage. Excessive entry of hazardous metals into the organism, on the other hand, is linked to poor environmental conditions [8].

The heavy metals that leads to many problems inside the cell and in the metabolic processes, and it is considered one of the main causes of harm to humans [9-14]. Human health depends on the ability to receive trace elements, which cannot be synthesized in humans' bodies, from the environment, including foods. Thus, essential trace elements are called "micronutrients" and are required in small (μg -to- mg per kg of diet). Trace elements and other mineral elements are obtained mostly from a foods-soils-rocks chain. Therefore, good mineral nutrition is required, at least in part [8].

When exposed to heavy metals or trace elements, this leads to their accumulation in the various organs

and tissues of the person, and this leads to the fact that these metals cause damage or chronic diseases for this person. The chelating materials were used as a therapeutic method of heavy metals in the body. These materials are associated with heavy metals and keep them in the bloodstream until they are filtered out from the kidneys and liver. Additionally, in some cases, chelating agents may redistribute heavy metals to vital elements such as the brain rather than excreting them from the body so this method is only used in confirmed cases through appropriate clinical and laboratory evaluation [15]. On the other hand, hijamah as a traditional therapeutic method, can be used by humans to remove undesired materials in the body including the toxic substances [16].

On continuous with previous Yemeni studies [17,18], this study focused on investigating the efficacy of hijamah therapy on explorer the heavy metals levels in the blood so that we would be able to assess the capability of hijamah in blood detoxification as it was pointed out as the therapeutic property of hijamah in traditional texts.

Methods

A Single-Arm Clinical Trial

Clinical trials for this study were conducted in two specialized centers for hijamah in the governorate of Aden, as well as in the graduate studies laboratories at the University of Aden, and the laboratories of the Supreme Authority for Medicines and Medical Appliances, Khormaksar, Aden, Yemen, between December 2019 and continued until January 2021, where a single-arm model was

applied for clinical trials before and after the test. During this period, we went to these two centers for hijamah therapy and placed advertisements in order to receive volunteers. They were shown to a doctor who accompanied us during this study to ensure their eligibility for physical examinations and their freedom from chronic diseases. The volunteers were also given paper questionnaires related to their health status. As a result, some volunteers were in good health while others were excluded according to criteria such the presence of any chronic disorder, taking daily medications, and contraindications to hijamah as defined in blood tests routinely performed before application.

Through their arrival at the specialized center for hijamah, 15 were received in the first center for cupping and 13 in the second center for hijamah, and they were selected for these clinical trials. Of the 28 people, 7 were excluded. Before starting hijamah, 3 people withdrew, and 18 people continued to achieve the study.

Collecting Blood Samples

a) Hijamah blood

Hijamah technique was applied (Figure 1) on the three days of the lunar months in the morning. Volunteers were directed to overnight fasting then the participants were seated to allow the vacuum glass cup to fit on the surface of the back. The skin was cleaned with the sterilized solution prior procedure. The cupping puts tightly on the cleaning area. The suction connected to the cup quickly. It was maintained until the skin pulled up within the cup. Applied pressure monitored with the height of skin

dome elevation one centimeter into the cup on the time of sucking for less than two minutes. Subsequently, the suction stopped and the cup was slowly removed. The cleaned skin was cut in some parallel longitude lines with the sterilized blade along the vertebral column, ~5-7 mm. Once again, cupping was applied. The blood oozed due to suction pressure with a duration of fewer than 3 min. At the end, blood samples were collected for laboratory investigation.



Figure 1: Wet hijamah therapy application

b) Venous blood

Venous blood samples were collected from the volunteers five minutes before performing the hijamah for them. Where 3 mL of venous blood was withdrawn from the volunteers and placed in a tube containing K₃EDTA, an analytical reagent to prevent blood clots until it reaches the laboratories. Blood was taken from the vein by a person who specializes in drawing blood, and who was accompanying us during the collection of blood samples for this study. Then, the vein blood samples were kept in dark and cold containers.

Digestion Using Conventional Wet Acid Method (CDM)

Before starting to prepare the samples for the analysis of trace minerals in the blood samples, the glassware was washed in water from the tap and soap three times and then followed by soaking in 10% nitric acid (v/v) for 24 hours and lastly washed in deionized distilled water three times. Blood samples were digested by the conventional wet acid method as follows. Accurately 0.5 mL of whole blood was taken into Pyrex flasks separately and 3 mL of a freshly prepared mixture of pure concentrated nitric acid and hydrogen peroxide [HNO₃ - H₂O₂] (2:1 v/v) was added and stood for 10 minutes. The flasks were covered with watch glasses then, digestion started at 60 - 70°C for 1-2 hours. The digests were then treated with 2mL nitric acid and a few drops of H₂O₂, while heating continued on a hot plate at about 80 °C until a clear digested solutions were obtained. The excess acid mixture was evaporated to semi-dry mass, cooled, and diluted with a 1mL nitric acid. These were transferred into 50 mL volumetric flasks and diluted to mark using deionized distilled water. A blank extraction (without the sample) was carried out through the complete procedure using deionized distilled water. The worked-up samples were stored in polyethylene containers in a refrigerator at 4°C before ICP-OES analysis.

Determination of Trace Elements Concentrations

All chemicals were in analytical grade and were used without any further treatment. The stock standard solutions of iron (Fe), nickel (Ni), chromium (Cr), cobalt (Co), cadmium (Cd), zinc (Zn), aluminum (Al), copper (Cu), and lead (Pb) were in 1000 ppm concentrations, as single or

multi-element solutions, and dilution was done by deionized water (~ 0.1 $\mu\text{S}/\text{cm}$). Blank and wash solutions were 2% HNO_3 (v/v) and 10% HNO_3 , (v/v) respectively. The investigated heavy metals in blood samples were instantaneously measured using a PerkinElmer (Avio 200, Singapore) inductively coupled plasma-optical emission spectrometer (ICP-OES) supplied with Syngistix software version 2.0. The standard method was followed as cited in [19] and the operating conditions of ICP-OES were summarized in Table 1.

Table 1: Avio 200 ICP–OES Parameters

Parameter	Operation
Radio Force (RF) power	1500 W
Plasma gas (Ar) flow rate	9 L/min
Auxiliary gas (N_2) flow rate	0.20 L/min
Nebulizer gas flow rate	0.70 L/min
Air pressure (in air compressor)	650 Kpa
Plasma position	Axial
Correlation factor	0.97
Signal background	Corrected
Auto integration range	0.1- 5 sec for each element
Analytical wavelength (nm)	Specified for each element

Table 2: Levels of Essential Trace Elements in Venous and Cupping Blood Samples (n=18)

Essential elements	Hijamah blood (mean \pm SD) ppm	Venous blood (mean \pm SD)* ppm**	<i>p</i>
Fe	4.552 \pm 0.845	3.852 \pm 0.785	< 0.0001
Cu	0.0231 \pm 0.0099	0.0184 \pm 0.0077	0.024
Zn	0.484 \pm 0.173	0.349 \pm 0.0754	0.005
Co	0.0916 \pm 0.255	0.0023 \pm 0.0035	0.416
Cr	0.0073 \pm 0.0111	0.0034 \pm 0.0030	0.263

* SD: Standard division, **ppm= part per million.

Statistical Analysis

Statistical analysis of the results was performed using SPSS version 25. Wilcoxon Signed Rank test was employed to compare trace elements contents of hijamah and venous blood samples at specific *p*-values.

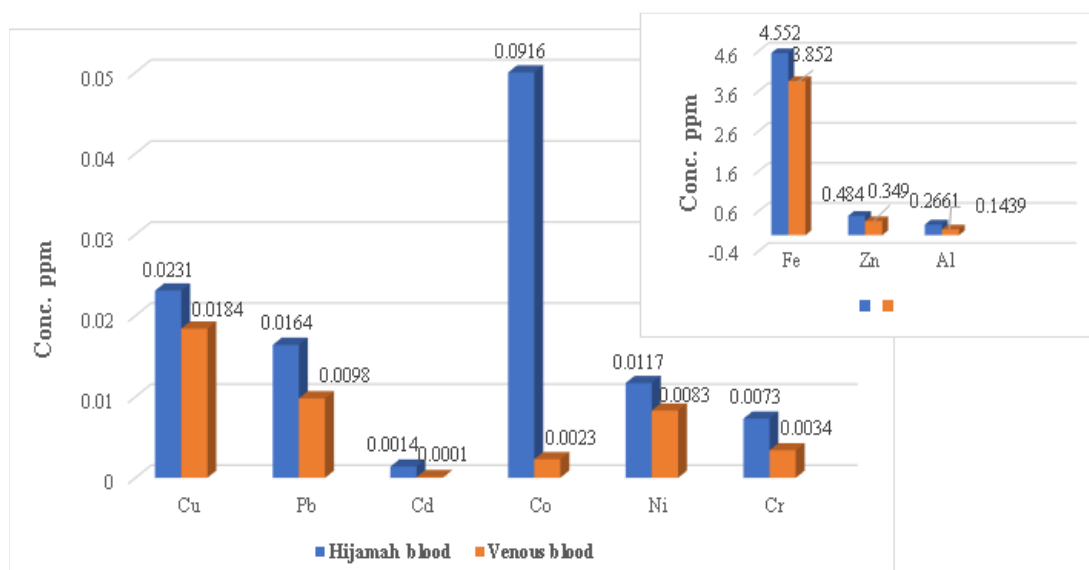
Results

From nine trace elements (Tables 2 and 3), seven elements were found significantly higher in hijamah blood, that are Fe ($p < 0.0001$), Al ($p = 0.009$), Pb ($p = 0.012$), Cu ($p = 0.024$), Zn ($p = 0.005$) Ni ($p = 0.046$), and Cd ($p = 0.024$). On the other hand, Cr and Co did not show significant differences at $p = 0.263$, and $p = 0.416$ -respectively- in cupping blood compared to venous blood (Table 2, and Figure 2). No adverse reactions were reported by any of the participants.

The toxic elements were found higher in hijamah blood than in venous blood (Table 3 and Figure2).

Table 3: Levels of Toxic Trace Elements in Venous and Cupping Blood Samples (n=18)

Toxic elements	Hijamah blood (mean \pm SD) ppm	Venous blood (mean \pm SD) ppm	<i>p</i>
Pb	0.0164 \pm 0.0158	0.0098 \pm 0.0029	0.012
Cd	0.0014 \pm 0.0020	0.0001 \pm 0.0003	0.024
Al	0.2661 \pm 0.2324	0.1439 \pm 0.1259	0.009
Ni	0.0117 \pm 0.0107	0.0083 \pm 0.0075	0.046

**Figure 2:** The Concentration of Elements (Cu, Pb, Cd, Co, Ni, Cr) and (Fe, Zn, Al) Inset in the Two Studied Samples

Discussion

The recent work starts from the perspective of highlighting the importance of this type of prophetic and traditional treatment. During our work, we compared the trace elements levels in venous and hijamah blood samples.

Through the results obtained, we noted that hijamah helps to remove excess metals found in the blood since the accumulation of heavy metals in the body leads to the destruction of the functions of fat, protein, enzyme, and DNA. This destructive nature of heavy metals is mediated, at least in part, by the production of free

radicals. Excess heavy metals accumulation is due to their lack of biodegradability [20]. Heavy metals widespread distribution in the environment raises serious concerns about their potential health effects on humans and toxicity depend on the type and form of the element, duration of exposure, and route [21]. Metal ions can bind to various molecules in body tissues such as proteins and sugars by entering the body from the environment. Moreover, a large number of these minerals are biologically active, participate in a variety of different physiological and pathophysiological interactions, and

may lead to various chronic disorders. For example, lead (Pb) is known as the most common toxic element whose high levels have increased cardiovascular mortality [22]. Lead exposure also causes damage to the brain, kidneys, nervous system, reproductive system, and can cause high blood pressure. From these dysfunctions, it has been found that the nervous system is the most sensitive to lead poisoning. Pb is especially affecting fetuses and young children causing them serious disorders [23]. Cadmium (Cd) is another element that causes harm to human health when exposed to it, as it causes damage to the kidneys and bones, and the kidneys are the organ most affected by cadmium [24]. Also, some of these elements, in small quantities, have an important role in maintaining human health, but when exposed to them and in large quantities, this leads to harm to health, such as copper, chromium, zinc, and others, where when exposed to them and in large quantities such as chromium, it may cause lung cancer as well as exposure to zinc and causes an imbalance in the absorption of other minerals such as copper [25]. Therefore, many studies explain the importance of hijamah in removing toxins in order to identify the effect of hijamah on the level of some heavy metals in the blood. Three heavy metals were studied, namely aluminum, zinc, and cadmium and found that hijamah can reduce the concentration of these minerals in the blood by collecting venous blood samples before and after hijamah [26].

Other studies were carried out at Saglik Bilimleri University in

Istanbul, Turkey, which was carried out by Benli *et al.*, on a group of steelworkers, to know the effect of hijamah on removing the accumulations of heavy metals in the body of workers in this field, and it was found that there is an effect of this type of treatment depends on the concentration of minerals in the blood, by taking blood samples before and after hijamah, as well as blood samples for hijamah and studying the concentration of minerals in them and comparing among them. They recommended that wet hijamah may be beneficial in workers who work in jobs where heavy metal toxicity can be seen [22].

Gok and others also conducted a study on the effect of hijamah on metals, by studying four elements: lead, aluminum, mercury, and silver. Through the results obtained from them. They found that hijamah contains a higher concentration of these minerals compared to venous blood. They also recommended that hijamah is useful in ridding the body of accumulations of these minerals except in children, women, or adult men [27].

Also, the importance of hijamah is not limited to removing mineral accumulations in the body only, but there are some studies on the importance of hijamah in removing toxins from the blood such as cholesterol levels [28].

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Conclusion

Through the results obtained during this study, it can be said that wet hijamah therapy is a successful treatment method in eliminating poisons such as those accumulated in the blood and helping improve human health. Hijamah can also be used to remove heavy and trace metals from the blood and various tissues by determining the appropriate position for placing the cupping cups. Further randomized controlled trials of hijamah, not only in heavy metal detoxification but also in different indications, are needed and will reduce prejudices about its use.

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