Available online at www.sciencedirect.com

ScienceDirect

European Journal of Integrative Medicine 6 (2014) 74–81

European Journal of INTEGRATIVE MEDICINE

www.elsevier.com/eujim

Original article

# Meridian energy analysis of the immediate effect of coffee consumption

Ming-Yen Tsai [a,b], Chun-En Kuo [a], Yu-Chuen Huang [b,c], Ching-Liang Hsieh [b,c], Yung-Hsiang Chen [b,c,*], Wen-Chi Chen [b,c,*]

[a] *Graduate Institute of Integrated Medicine, School of Chinese Medicine, College of Chinese Medicine, Acupuncture Research Center, China Medical University, Taichung 40402, Taiwan*

[b] *Department of Traditional Chinese Medicine, Kaohsiung Chang Gung Memorial Hospital and Chang Gung University College of Medicine, Kaohsiung 83301, Taiwan*

[c] *Departments of Chinese Medicine, Urology, and Medical Research, Genetics Centre, China Medical University Hospital, Taichung 40402, Taiwan*

Received 20 March 2013; received in revised form 26 August 2013; accepted 4 September 2013

**Abstract**

*Introduction:* Coffee consumption has immediate physiological, behavioral, and subjective effects. Despite its widespread use, few studies have described the impact of energy distribution and transformation in meridian vessels. The purpose of this study was to use a Ryodoraku instrument to measure the changes of meridian electrical conductance in healthy volunteers before and after coffee consumption.

*Methods:* In thirty-one healthy volunteers, the meridian electrical conductance, blood pressure (BP), heart rate (HR), and index of sympathovagal balance were continuously recorded before and after drinking a cup of instant coffee.

*Results:* Statistical analysis showed that 30 min after coffee consumption, the mean values of electrical conductance increased on most meridians except the bilateral Triple Energizer, Liver, and Stomach, as well as the left Kidney and Large Intestine. From 30 to 60 and 60 to 120 min, the electrical conductances were maintained significantly only on the bilateral Spleen, Urinary Bladder, and left Pericardium meridians, as well as on the bilateral Spleen, Urinary Bladder, and right Kidney meridians, respectively. The average index of sympathovagal balance decreased significantly at 30 min, while BP increased and HR decreased.

*Conclusion:* These findings suggest changes in the specific energy distribution and transformation in the meridian vessels after coffee consumption. Coffee consumption has a similar immediate effect on the cardiovascular system, including increase in BP and decrease in HR. Interestingly, coffee has a temporary stabilizing effect on the higher index of sympathovagal balance. This response may explain why the index is not relevant to the autonomic nervous system but is relevant to mental tasks after coffee consumption.



*Keywords:* Coffee; Caffeine; Ryodoraku; Meridian; Electrical Conductance; Autonomic nervous system

## Introduction

Coffee, has been brewed from roasted coffee beans for almost 700 years and is the most popularly consumed beverage worldwide, second only to water, with a worldwide consumption of approximately 10 million tons per year [1,2]. Owing to the high consumption of coffee, it has been investigated extensively to determine the either beneficial or detrimental effects on the human organism [3–5]. Studies have shown that coffee consumption can promote neuroprotective, antioxidant, and metabolic activities [6–8]. However, some controversy regarding its risks still exists, due to the association of coffee consumption with an increased risk of developing cardiovascular complications and cancer [9,10]. In fact, coffee is a complex chemical mixture containing more than a thousand compounds [11]. At intake levels associated with coffee consumption, caffeine appears to exert most of its biological effects through stimulating sympathetic and psychoactive systems, resulting in central nervous system stimulation, increased blood pressure, increased metabolic rate, sleep disorder, and diuresis [12].

* Corresponding authors at: Graduate Institute of Integrated Medicine, China Medical University, No. 91, Hsueh-Shih Road, Taichung 40402, Taiwan. Tel.: +886 4 22053366x3512; fax: +886 4 22037690.

*E-mail addresses:* yhchen@mail.cmu.edu.tw, d87a03@ym.edu.tw (Y.-H. Chen), wgchen@mail.cmu.edu.tw (W.-C. Chen).

1876-3820/$ – see front matter © 2013 Elsevier GmbH. All rights reserved.
http://dx.doi.org/10.1016/j.eujim.2013.09.002

According to Traditional Chinese Medicine (TCM) and "Qi-blood" theory, all the stimulation and ingestion is seen to flow into and affect specific cells, tissues, and organs through different meridians [13]. It is generally assumed that the electrical conductivity measurements of meridians provide information about the balance of bioenergy or Qi-blood in the body [14,15]. The Ryodoraku mechanism for measuring electrical activity of meridians, was developed by Dr. Yoshio Nakatani, in the 1950s, reflects the condition of certain organs by analyzing and comparing their mutual relations and according to changes in micro-electrical currents [16]. The electrical conductance of the acupuncture points of human subject can be measured by a computerized testing instrument with a very low electrical current. The Source (Yuan) acupoints on the wrists and ankles, (the places where the Yuan Qi of the corresponding Zang-Fu organs passesthrough abundantly), have the property to represent the relevant meridian [17,18]. Several studies have used this mechanism to investigate changes in human moods or the mechanism of the sympathetic system [19,20]. Moreover, Ryodoraku theory has been shown to be a supplementary diagnostic method for selective diseases and a useful parameter for evaluating therapeutic effects of acupuncture [21,22]. However, there has been no previous no research concerning the application of Ryodoraku theory for the detection of the diverse effects of coffee intake and chronic coffee consumption.

In the present study, we used a device based on the electrical conductance theory to measure the association of sympathetic nerves and meridian energy on instant coffee consumption in normal human participants. The purpose of this study was to evaluate whether measurement of the electrical conductance of healthy people who consumed coffee could be used to predict meridian trends and potential health effects.

## Materials and methods

### *Sampling method*

Thirty-one healthy volunteers (15 men and 16 women) aged 25–45 years [29.1 ± 4.5 years, mean ± standard deviation (S.D.)] participated in the study. Most of the participants (29/31) consumed <1 cup of coffee per day. The mean duration of coffee consumption was 2.1 years. All participants worked in a hospital. The average body-mass index (BMI) value was $21.7 \pm 3.6\,kg/m^2$. The reasons for exclusion were as follows: (1) women menstruating or pregnant, (2)currently smoking, drinking and/or chewing betel nut, and (3) currently taking pharmaceuticals or dietary supplements. All participants were asked to avoid intake of either caffeinated beverages or diets including "coffee, wine, chocolate, and tea" in the 3 days preceding and during the experiments. The recruitment of participants and the study design were approved in case No. 100-4025A3 of the Chang Gung Institutional Research Board.

### *Coffee preparation*

A soluble sample of 2.3-g instant coffee was prepared in the standard amount (200 ml) by dilution in hot water. The instant coffee was the brand Starbucks VIA® Ready Brew Italian Roast (The Zuoying THSR store, Kaohsiung, Taiwan). As shown in Table 1, the caffeine content on the label of one coffee package was 56.5 mg caffeine/g (5.65%). However, the true content of caffeine was 4.68%, as analyzed by SGS Taiwan LTD. The coffee was brewed at 85–95 °C and served at 50–60 °C, and the participants were asked to drink the entire volume within 10 min under supervision. No additives (such as milk or sugar) were allowed. All participants were instructed not to consume anything else except mineral water during the experiments.

Table 1
The labeled and true amount of caffeine in the coffee package.

| | Label content | SGS result |
|---|---|---|
| Caffeine (mg/g) | 56.5 | 46.8 |
| Protein (%) | 21.7 | 22.1 |
| Special gravity | N/A | 1.007 |

### *Study design and procedure*

The electrical conductance of an acupoint was measured using a Meridian Energy Analysis Device (MEAD100, MedPex Enterprises, Taichung, Taiwan) operating at DC 12 V and 0 to 200 μA. The method and procedure of the MEAD is based on the Ryodoraku theory and is similar to equipment used in previous studies [15,16]. Higher values indicate higher conductance between the reference electrodes. One metal cylinder is held in the right hand of the participant. The other, a spring-loaded probe, is moistened with 5% saline and, after sterilization, applied sequentially to the 24 Source (Yuan) acupoints located along the 12 meridians: Lung (Taiyuan, LU9), Pericardium (Daling, PC7), Heart (Shenmen, HT7), Small Intestine (Wangu, SI4), Triple Energizer (Yangchi, TE4), Large Intestine (Hegu, LI5), Spleen (Taibai, SP3), Liver (Taichong, LR3), Kidney (Taixi, KI3), Urinary Bladder (Jinggu, BL65), Gallbladder (Qiuxu, GB40), and Stomach (Chongyang, ST42) (Fig. 1).

After 2.5 s the device was automatically interrupted, and the average value was recorded on a computerized system. The environmental condition was controlled by maintaining a room temperature of 26 °C and 28 °C, and moisture was kept constant. The participants were asked to lie flat and rest for 15 min in a stable mood. All measurements are performed by one operator. They were first measured between 7:00 am and 9:00 am, 1 h after consuming a light breakfast. The first measurement, taken before instant coffee ingestion, was used as the baseline values of acupoint conductance (designated as point X). After participants ingested a cup (200 ml) of instant coffee and rested for 30 min, second measurements were taken. Subsequent measurements of the acupoint conductances followed at 30, 60, and 120 min (designated as points A, B, and C, respectively).

Also recorded was the index of sympathovagal balance, defined as the ratio of the highest and the lowest average values of electroconductivity on the dorsal or ventral side during the MEAD analysis.

To confirm the stability of the MEAD data, we followed the model of Huang et al. [23]. Before the study was conducted, 31