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## Blood immune function parameters in response to combined aerobic dance exercise and honey supplementation in adult women

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## ABSTRACT

To date, information on the effectiveness of combined aerobic dance exercise with honey supplementation on immune function in women is lacking. The present study investigated the effects of 8 weeks of combined aerobic dance exercise and honey supplementation on blood immune function parameters in adult women. In this study, forty four healthy sedentary women (25–40 year-old) were assigned into four groups with  $n = 11$  per group: sedentary without supplementation control (Con), honey supplementation (H), aerobic dance exercise (D) and combined aerobic dance exercise with honey supplementation (HD) groups. Aerobic dance exercise was carried out for one hour per session, three sessions per week for eight weeks. Honey drink was consumed by H and HD groups, in a dosage of 20 g of honey diluted in 300 ml of plain water, consumed 7 days a week for 8 weeks. In HD group, the participants were required to consume honey drink 30 min before performing exercise. Before and after 8 weeks of experimental period, blood samples were taken to determine the concentrations of immune parameters which include full blood counts and immunophenotyping measurements. It was found that after 8 weeks of experimental period, there were statistically significant increases in T cytotoxic (CD8) ( $p < 0.05$ ) in HD group. Additionally, the percentages increase in total lymphocyte counts, T helper (CD4), and T cytotoxic (CD8) counts after 8 weeks were the highest in HD group among all the groups. As conclusion, combined aerobic dance and honey supplementation may have potential to enhance immune functions in women.

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### 1. Introduction

Physical activity is believed to have close relationship with immune function. Exercise induces physiological changes in the immune system. The benefits of exercise may result from the direct effect on immune response modulations or from the mechanism of psychological effects of exercise.<sup>1,2</sup> Exercise may be considered a

type of stress that affects immune response<sup>2</sup> differently dependent on the duration, intensity and frequency of the stress.<sup>3</sup> Generally, many researchers found that low intensity<sup>4</sup> and moderate intensity exercise<sup>5</sup> improves immunity, conversely strenuous exercise and overtraining decrease immunity and raise infection risk.<sup>6–11</sup>

Besides regular weight-bearing exercise, nutrition also plays an important role in influencing immune function status. Besides green tea and ginseng, honey is one of the nutraceuticals which are becoming more widely accepted as an adjunct to conventional therapies for enhancing general well being.<sup>12,13</sup> Honey contains mainly of carbohydrates<sup>14</sup> that may elicit beneficial effects on reducing stress to the immune system.<sup>13</sup> This speculation is based on a study by Nieman<sup>5</sup> which mentioned that ingestion of fluids that contain carbohydrate can reduce perturbations in the immune system with fewer disturbances in blood immune cell counts, lower granulocyte and monocyte phagocytosis and oxidative burst activity, diminished pro- and anti-inflammatory cytokine responses. Honey also has properties of antioxidant,<sup>15,16</sup> antimicrobial,<sup>12,17–19</sup>

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anti-inflammatory<sup>20</sup> and immunomodulatory<sup>12</sup> which are believed able to enhance immune functions.<sup>13</sup>

Understanding the relationship between exercise, honey supplementation and immune response has potential implication for public health. In addition to the important role of honey on the immune response, scientists also accept honey as a new effective medicine for many kinds of women related diseases.<sup>21</sup> Therefore, health programs for women could be developed in view of vast advantages of honey on the immune system. Previous study has been carried out to confirm the hypothesis that carbohydrates may influence exercise-induced immune changes.<sup>22,23</sup> In addition, several studies revealed that honey is an effective carbohydrate source to be consumed at pre, during and post physical training and exercise in athletes.<sup>24,25</sup> Nevertheless, the combined effects of aerobic dance exercise with honey supplementation which is a source of carbohydrate on immune functions has not yet been investigated in non-athletes, i.e. sedentary women with age ranging from 25 to 40 year-old. Hence, the present study was proposed for determining the effectiveness of this combination on blood immune function parameters in adult women.

## 2. Methods

### 2.1. Participants

Forty four physically healthy sedentary adult female participants, age between 25 to 40 years old from Kelantan region, Malaysia were recruited in the present study. The inclusion criteria of the participants were: No health problems, non-smoker, not habitual consumer of honey daily, do not engage in any training program and do not exercise more than once per week. Physical Activity Readiness Questionnaires (PAR-Q) forms were answered by the participants to screen for any signs or symptoms of heart diseases, pulmonary or contraindications during physical activity for ensuring the participants were eligible to engage with the exercise training programme without risking their health condition, and limiting the medication drugs' effect on the outcome later. The qualified participants were matched in age, body mass, height and percent of body fat before they were randomly assigned into the experimental groups.

All participants were fully informed by the researcher about the nature of the experiments, purpose of the study, procedures, benefits, risks of feeling discomforts experienced in this present study before giving their written and signed formal consent. The present study was approved by the human research ethics committee of Universiti Sains Malaysia (Ethical approval number: USMKK/PPP/JPeM[226.3(08)]). The human research ethics committee of Universiti Sains Malaysia is in compliance with ICH GCP guidelines. During the experimental period, the participants were provided checklists which have also been used in a published previous study,<sup>26</sup> and they were required to record their participation, i.e. frequency of performing aerobic dance in a week and daily honey consumption rate in the checklists for ensuring their compliance and commitment to the present study. Please refer to the Figure 1 for the flow chart of the experimental design for the study.

### 2.2. Experimental design

#### 2.2.1. Participants grouping

The participants were randomly divided into four groups with 11 participants per group ( $n = 11$ ): 8 weeks of sedentary without supplementation control (Con), 8 weeks of honey supplementation (H), 8 weeks of aerobic dance exercise (D), and 8 weeks of combined aerobic dance exercise and honey supplementation (HD) groups. Participants in the control group (Con) did not perform

exercises nor take any honey supplementation. Meanwhile, participants in the honey group (H) consumed honey drink for 7 days per week for a total of 8 weeks. Participants of aerobic dance exercise group (D) performed one hour aerobic dance exercise per session, 3 times per week for 8 weeks. Participants in combined aerobic dance exercise with honey supplementation group (HD) performed aerobic dance exercises one hour per session, 3 times per week for 8 weeks and consumed honey drink 7 days/week for 8 week with dosage similar to honey group (H). The participants in HD group were required to consume honey drink 30 min before performing aerobic dance exercise on the exercise days.

Sample size used in this study was calculated by using G Power Software. The power of the study was set at 80% with 95% confident interval and 30% of effect size. 20% was estimated as dropout rate which was equal to two participants per group. Thus, the actual numbers of participants recruited were 11 Participants per group, and the total numbers of participants recruited in this study were 44 Participants.

#### 2.2.2. Aerobic dance exercise program

The participants of aerobic dance exercise group (D) and combined aerobic dance exercise with honey supplementation group (HD) were required to have aerobic dance sessions for 3 sessions per week, one hour per session (from 5.30 pm to 6.30 pm) for 8 weeks. The aerobic dance exercise program of this study consisted of 2 sessions of 'high and low impact' and one session of a 'step board' aerobic dance exercises in a week. The 1-hour session started with 10–15 min of warm up period, 30–35 min of aerobic dance activities, and ended with 5–7 min of cool down. The activities prescribed in the present aerobic dance exercise program involved continuous, controlled movement of legs and trunk, and intermittent movement of arms. Movements involved were side stepping, fast walking, forward and backward stepping, leg lifts, placing foot to the front, side and behind, knee bends, forward and side-lunging, heel raise and also high impact movement such as jumping. In the high-impact and low-impact aerobic dance exercise sessions, participants were required to do upper and lower limb movements according to the beats of the music played, which ranged from slow to fast. In the 'step board' exercise sessions, participants were required to step up and down the step board while dancing. The intensity of aerobic dance exercise was estimated by using heart rate monitor (Polar, S710, USA) worn by participants throughout the dancing sessions. Besides, the participants were given pre-recorded CD containing aerobic dance workout, and they were required to follow the workout in the CD given at home if they missed any of the aerobic dance sessions.

#### 2.2.3. Honey supplementation

A honey drink was consumed by the participants in the honey (H) group and combined aerobic dance exercise and honey supplementation (HD) group in a dosage of 20 g<sup>27,28</sup> of Malaysian local Gelam honey diluted in 300 ml of plain water,<sup>29</sup> for 7 days per week for a total of 8 weeks. On the exercising days, the participants of the combined aerobic dance exercise and honey supplementation (HD) group were required to consume honey drink 30 min before performing aerobic dance exercise.

#### 2.2.4. Anthropometric measurements

Before the 8 weeks of experimental period, participants' anthropometric measurements such as body height, weight and percentage of body fat were carried out. The participant's body heights were measured by using a stadiometer (Seca 220, Germany), the body weight and percentage body fat were measured by using a digital body composition measuring device (Tanita TBF-410, Japan).

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