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Effects of Bee Bread Supplementation on Isokinetic Knee Extension and Flexion of Lower Limb

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Abstract

A nutritional strategy is the common types of ergogenic aid used by athlete to enhance their sport performance. Athlete usually consumes bee products before a sports competition to make sure they have adequate nutrition, maximize their energy storage and enhance their sport performance. Scientific data on the ergogenic effects of bee products consumed at pre exercise on isokinetic knee extension and flexion of lower limb is scanty. This study investigated the effects of 8 weeks of bee bread supplementation at pre exercise on isokinetic knee extension and flexion of lower limb among athletes. Twelve volunteer athletes were recruited in this scientific study. Subjects consumed either bee bread at a dosage of 20 g.d-1 or placebo for 8 weeks prior to the experimental trial. Subjects' isokinetic knee extension and flexion of lower limb were measured before and after 8 weeks of experimental period. Statistical analyses were performed using ANOVA with repeated measures. This present study found that bee bread supplementation showed some positives impact on few measured parameters of isokinetic knee extension and flexion of lower limb.

Keywords: Isokinetic; Extension; Flexion; Lower Limb; Sport Performance

Introduction

Bee products have been become popular ergogenic supplement among athletes. Several studies investigated bee products and reported bee products have antioxidant [1-4], anti-inflammatory [5], antitumor [6], anti-allergic [7], and antimicrobial [8]. There are limited scientific researches on effect of bee products supplementation on sport performance. For instances, Earnest, et al. [9] found that supplementation of honey at a dosage of 15g every 16 km during a simulated 64-km cycling time trial was significantly faster to complete time trial compared to the placebo trial. Rahim, et al. [10] reported that combination of aerobic dance exercise and honey supplementation (20 g of honey diluted in 300 mL of plain water for 8 weeks) elicited more beneficial effects on bone health and immune function compared to the aerobic dance exercise or honey supplementation alone. Shukri, et al. [11] found that ingestion of 500 ml of honey drink one hour before trial and 3 ml per kg body weight of honey drink every 20 minutes during the running trial was as good as a sports drink in improving running time trial performance.

Tavafzadeh, et al. [12] indicated that combination of jumping exercise and honey supplementation (dosage of 1 g.kg of body weight day^{-1} for 8 weeks) may elicit beneficial effects on tibia and femur bone generally when compared to either jumping exercise or honey supplementation alone in young female rats. However, Abbey and Rankin [13] found that acute supplementation of honey beverage at a dosage of 1g.kg body weight^{-1} before and during soccer- stimulation test did not significantly improve progressive shuttle-run (PSR) test to exhaustion compared to the placebo trial. To

date, there is scanty information on the possible beneficial effects of bee bread supplementation on isokinetic knee flexion and extension. Therefore, the aim of this study was to investigate effects bee bread supplementation on isokinetic knee extension and flexion of lower limb among athletes.

Methodology

Twelve Malaysian male athletes were recruited in this study. Subjects were asked to refrain from exercise for 24-hour before the tests to ensure that they have adequate rest before the isokinetic knee extension and flexion tests. Their food diary and physical activity diary for the last 72 hours were also collected. Subjects recorded their 3-day food diary prior to the first trial and repeated the same diet over 3 days before the days of consecutive test to minimize the differences in muscle glycogen between the trials.

Isokinetic dynamometer (Multi Joint System 3 Pro: Biodex Medical System, USA) was used to measure subjects' isokinetic knee extension and flexion of lower limb. Testing angular velocities were set at $180^{o}.s^{-1}$ and $300^{o}.s^{-1}$ to measure knee extension and flexion muscular strength and power of subjects prior and post 8 weeks of experimental period. These testing angular velocities were used to measure the isokinetic right and left knee extension and flexion peak toque and average power of the subjects. Subject was required to do a quadriceps and hamstring stretching exercise before the exact testing to prevent injuries. Subject familiarised with the isokinetic dynamometer protocol before the actual testing for the measurements for knee extension and flexion.

To begin the test, subjects were seated while leaning against a backrest tilted 85^{o} from the horizontal position. The chair and dynamometer were rotated to 90^{o}. Knee attachment was attached to the dynamometer. Subject's knee axis of rotation was aligned with dynamometer shaft. The seat was raised or lowered or the subject was moved towards or away from the dynamometer to fine adjusts the testing position. Knee attachment was adjusted so that it was proximal to medial malleoli. Subject's knee, shoulder, waist and thigh were strapped to minimise body movement and gave stabilisation position during the test. Shoulder straps were applied diagonally across the chest to prevent excessive upper body movement. The lateral femoral epicondyle was palpated and used as a bony landmark for matching the axis rotation of the knee joint and the axis rotation of the dynamometer shaft. All subjects were fully informed about the procedures to determine the isokinetic muscular strength and power test before performing these tests. There were asked to do 5 repetitions for the $180^{o}.s^{-1}$ angular velocity and 10 repetitions for the $300^{o}.s^{-1}$ angular velocity for each lower limb. The subjects were given sixty seconds to rest between each angular velocity.

All the statistical analyses were computed by using the Statistical Programme for the Social Sciences (SPSS) version 26.0 (SPSS Incorp, United States). The level of significance for all analysis was set at $p<0.05$. All the collected data were expressed in mean and standard deviation (mean ± SD). ANOVA with repeated measures was used to determine the differences of the measured isokinetic knee extension and flexion parameters over time and between trials. Bonferroni adjustment for multiple comparisons was used to locate the differences when repeated measures analysis of variance revealed a significant main effect of time.

Results

Twelve volunteer athletes were recruited in this scientific study. The mean maximum oxygen consumption (VO_{2max}) reflected that the subjects had good cardio-respiratory fitness**.** Mean body mass index (BMI) of the subjects was categorised as healthy (Table 1).

Physical characteristics of subjects	Mean ± SD
Age (years)	24.0± 1.8
VO_{2max} ($mL.kg^{-1}. min^{-1}$)	52.0 ± 2.8
Height (cm)	173.7 ±6.1
Body mass (kg)	67.4± 6.2
Body mass index ($kg.m^{-2}$)	22.3 ± 1.3

Table 1: Mean and SD of Physical Characteristics of the Subjects.

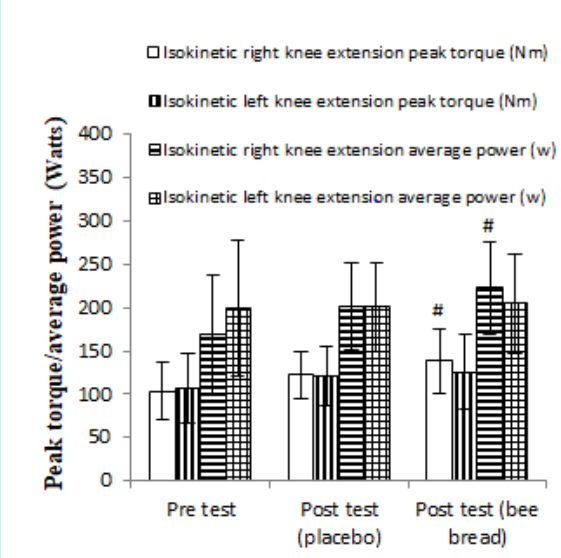

Figure 1: Right and left knee extension peak torque and average power at 180o.s-1 in the placebo and bee bread trials. Data are presented as mean ± SD.
# denotes significant difference from respective pre-test values at $p<0.05$

Figure 1 showed mean values of isokinetic right and left knee extension peak torque and average power at 180°.s^{1}. There was a significant main effect of time on isokinetic right knee extension peak torque and average power at 180°.s^{-1} in the bee bread trial ($p<0.05$). Isokinetic right knee extension peak torque and average power at 180°.s^{-1} was significantly higher at post test compared to pre test in the bee bread trial ($p<0.05$). Figure 2 showed mean values of isokinetic right and left knee flexion peak torque and average power at 180°. s^{1}. There was a significant main effect of time on isokinetic right knee flexion peak torque and average power at 180°.s^{-1} in the bee bread trial ($p<0.05$). Isokinetic right knee flexion peak torque and average power at 180°.s^{-1} was significantly higher at post test compared to pre test in the bee bread trial ($p<0.05$).

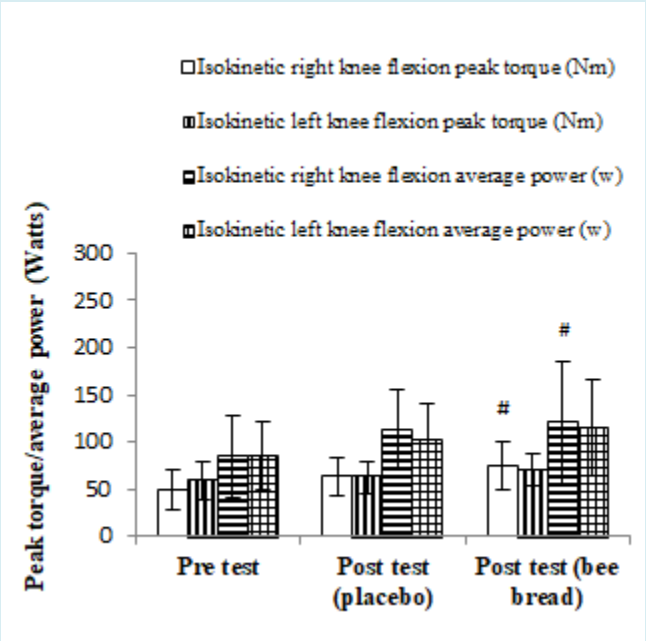

Figure 2: Right and left knee flexion peak torque and average power at 180o.s-1 in the placebo and bee bread trials. Data are presented as mean ± SD.
# denotes significant difference from respective pre-test values at $p<0.05$

The mean values of isokinetic right and left knee extension peak torque and average power at 300°.s^{-1} are presented in the Figure 3. There was no significant main effect of time on isokinetic right and left knee extension peak torque and average power at 300°.s^{-1} in both the trials ($p>0.05$). There was no significant difference in isokinetic right and left knee extension peak torque and average power at 300°.s^{-1} between pre and post tests in both the trials ($p>0.05$). Figure 4 showed the mean values of isokinetic right and left knee flexion peak torque and average power at 300°.s^{-1}.There was no significant main effect of time on isokinetic right and left knee flexion peak torque and average power at 300°.s^{-1} in both the trials ($p>0.05$). There was no significant difference in isokinetic right and left knee flexion peak torque and average power at 300°.s^{-1} between pre and post tests in both the trials ($p>0.05$).

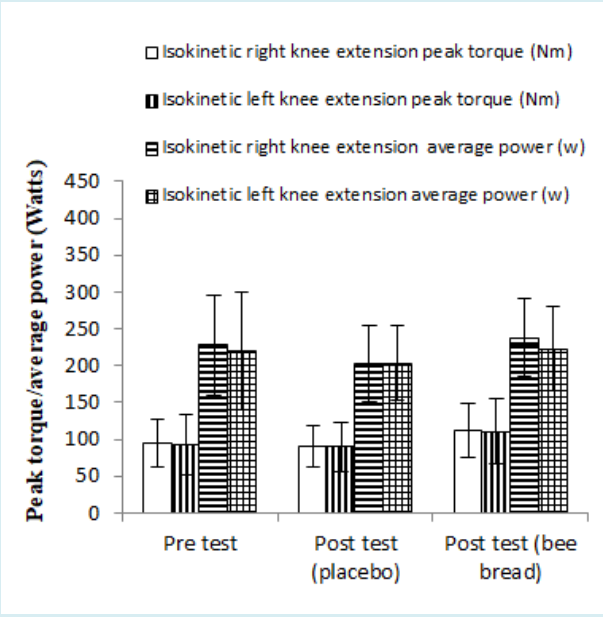

Figure 3: Right and left knee extension peak torque and average power at 300o.s-1 in the placebo and bee bread trials. Data are presented as mean ± SD.

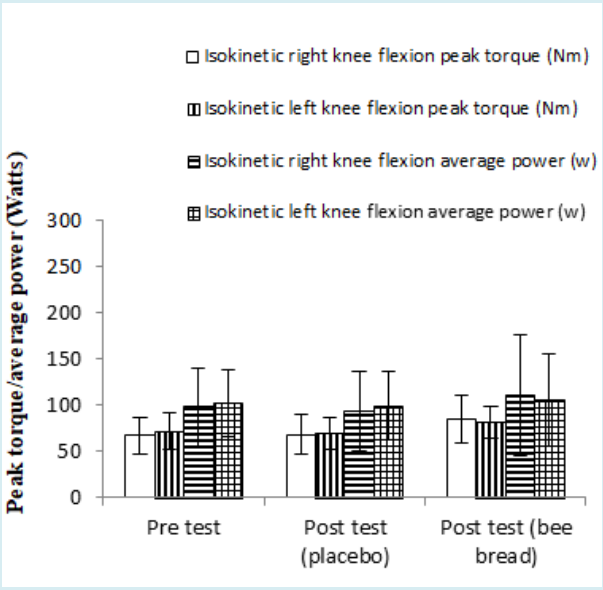

Figure 4: Right and left knee flexion peak torque and average power at 300o.s-1 in the placebo and bee bread trials. Data are presented as mean ± SD.

Discussion

Isokinetic assessment is the most common method used to measure isokinetic extension and flexion of lower limb muscles such as quadriceps and hamstring muscles. This present study found that there were significant increases in isokinetic right knee extension peak torque at $180^{o}.sec^{-1}$, right knee extension average power at $180^{o}.sec^{-1}$, right knee flexion peak torque at $180^{o}.sec^{-1}$ and right knee flexion average power at $180^{o}.sec^{-1}$ between pre and post test after 8-week supplementation in the bee bread trial. To our knowledge, this is the first study exploring the effect of bee bread supplementation on muscular strength and power. However, there was a study that investigated the effect of combined aerobic dance exercise and honey supplementation on muscular strength and power [10]. This previous study reported that combined of aerobic dance exercise and honey supplementation for 8 weeks elicited more beneficial effects on muscular strength and power compared to the aerobic dance exercise or honey supplementation alone.

Bee bread contains high protein, i.e. essential amino acid and non-essential amino acid [1-2] and it is speculated that protein contained in this supplement enhanced the muscular strength and power compared to placebo in this present study. Protein supplementation is one of the most common nutritional supplements used by athlete to increase the muscular strength and power [14]. Skeletal muscle is undergoing constant remodelling through the continuous and stimulation process of muscle protein synthesis and muscle protein breakdown [15]. Hence, it is speculated that bee bread supplementation was able to increase new or repair damaged muscle fibres through a cellular process where it fuses muscle fibres together to form new muscle myofibrils compared to the placebo in the present study. Skeletal muscle is composed of thread-like myofibrils and sarcomeres that form a muscle fibre and are the basic units of contraction. These new synthesis or repaired myofibrils increase in size of a muscle and number of myofibrils to create muscle become hyperplasia and hypertrophy [15] and lead to increased muscular strength and power with bee bread supplementation.

Many previous studies have reported that protein supplementation play an important role to repair and remodelling process of skeletal muscle fibres to increase muscular strength and power [16,17]. Rozenek, et al. [18] found that protein has important implications for improving both muscle size and strength. Burke, et al. [19] found that supplementation of whey protein at a dosage of 1.2 g/kg/day for 6 weeks significantly increased the peak torque compared to the placebo group. Based on these previous study findings, it seems that bee bread supplementation in this study was more advantageous compared to the placebo in terms of enhancing muscular strength and power.

This present finding was similar with previous study finding by Rahim, et al. [10] who also found that 20 g of honey supplementation alone for 8 weeks only improved few measured parameters of muscular and strength. Based on this previous finding, it is demonstrated that specific training of aerobic dance exercise with honey supplementation was crucial to increase muscular strength and power compared to the aerobic dance exercise or honey supplementation alone. This previous study suggested that combination of aerobic dance exercise and honey supplementation may elicit effects on reducing the increment in bone resorption, and more beneficial effects on lower limb muscular strength compared to aerobic dance exercise or honey supplementation alone. It is speculated that only with bee bread supplementation alone without any specific training program in this present study was not sufficient to increase all the measured parameters of muscular and strength power.

Conclusion

Supplementation of bee bread showed some positives impact on few measured parameters of isokinetic knee extension and flexion of lower limb.

Conflict of Interest

The author declare no conflict of interest

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