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Abstract

The consumption of beetroot supplementation has increased the popularity of studies that showed the ergogenic effects on exercise performance. Since beetroot juice supplement can enhance physiological processes in type II (fast twitch) muscle fiber, this supplementation has the potential to enhance performance in high intensity exercise which is sprinting. The purpose of this study is to determine the effect of beetroot supplement on sprint performance. Using a double blind, crossover design this study recruited 12 male sprinters from SMK Dato Sri Amar Diraja to measure their sprint performance in 30-meter sprint test. Data analyzed using paired sample t-Test. From the results, it showed no significant effects of beetroot supplement on sprinting performance were observed between beetroot and placebo group. The results were due to the lack of dose ingested showed no ergogenic effects of beetroot supplement on sprinting performance.

Keywords*: beetroot supplement, sprint performance, ergogenic effects,30 - meter sprint test*

INTRODUCTION

Dietary nitrate has become popular among researcher to promote as a sport supplement. In article reviewed by Jones (2014) proved that inorganic nitrate has it potential to enhance sports and exercise performance. The consumption of beetroot mainly in juice supplementation has increase the popularity of studies that showed inorganic nitrate (NO3) could increase plasma concentration of nitrate and nitrites (NO2) (Nyakayiru et al., 2017). In present, many human studies stated that beetroot supplementation may reduce oxygen cost during steady-state submaximal exercise. Beetroot contains 5–8 millimole of inorganic nitrate. The amount of 5-8 millimole of nitrate in beetroot can give positively effects on several physiological responses for example reducing the blood pressure while doing exercise (Wylie et al., 2013).

Beetroot also contains small amount of compound which is ascorbic acid that may increase antioxidant activity (Vasconcellos et al., 2016). The antioxidants contains in beetroot supplement can reduce injury and prevent further damage in muscle especially while performing intense exercise where free radical such as reactive oxygen species is highly produce during muscle contraction (Steinbacher & Eckl, 2015 ; Clifford et al., 2016).

Recently, studies on dietary nitrate pathway demonstrated several physiological functions such as vasodilation, blood flow regulation, mitochondrial biogenesis, mitochondrial respiration, glucose uptake and muscle contraction or relaxation occurs when nitrate (NO3) converted to nitrite (NO2) and reduced into nitric oxide (NO) (Domínguez et al., 2017). This pathway is called nitrate-nitrite-nitric oxide pathway and it is converted by anaerobic bacteria from saliva in mouth and continue in stomach (Potter, 2016). This process is facilitated in conditions of low oxygen availability such as hypoxia and ischemia (Domínguez et al., 2017).

In terms of exercise performance, previous studies showed the supplementation of nitrate oxide can enhance physiological response mainly in type II (fast twitch) compared to Type I (slow twitch) muscle's fiber (Jones, 2014). This result has been demonstrated in the

recent studies of chronic beetroot supplementation on force production during isometric knee extension and multiple cycling sprint performance. Both of these studies shows significant increased on the rate of force production in both exercises (Rimer, Peterson, Coggan, & Martin, 2016). Therefore, these findings showed that the ingestion of NO increased skeletal muscle power and it could be performance enhancer for athletes (Rimer et al., 2016).

The sprinting performance is associated with high intensity exercise where runners produce explosive power on the initial phase of running as it requires type II muscle's fiber during muscle contraction. Since beetroot juice supplement can enhance physiological processes in type II (fast twitch) muscle's fiber, this supplementation has the potential to enhance performance in high intensity exercise which is sprinting (Nyakayiru et al., 2017). This observation has become the beginning of evidence that shows ergogenic benefits of dietary ingestion as a performance enhancer. The sprinting performance was measured using 30 - meter sprint test.

Besides that, a runner required an explosive starting action for the acceleration phase. This included the ability to focus on the main accelerators which is producing powerful extension of runner hip, knee and ankle joints. However, the most crucial contribution in producing highest level of speed during sprinting is the hamstring, adductor magnus muscle and gluteus maximus muscle (Maćkała et al,.2015). In the current study, 30- meter sprint test was used to measure sprinting performance where athletes performed from acceleration phase until maximal speed. Hence, sprint time been taken to identify the effects from beetroot ingestion.

Several previous studies on the ergogenic effect of beetroot supplement usually focusing on muscular endurance type of performance. But, only a few studies were conducting for the effect of beetroot supplement on high-intensity or intermittent exercise (Nyakayiru et al., 2017). However, recent studies demonstrated that beetroot supplement may enhance sprint performance during 5m, 10m and 20m sprint running by 1-2%. Based on these findings, it could be suggested the ergogenic effect of beetroot supplement can be identified during initial phase of sprinting and this supplementation may improve the speed between 5m and 10m of sprint performance (Thompson et al., 2016).

Therefore, the purpose of this study was to determine the effect of beetroot supplement on sprint performance among 12 male sprinters in SMK Dato Sri Amar Diraja measured using 30- meter sprint test.

METHOD

Sampling

For the sampling technique, a purposive sampling has been used in this study. Participants consisted of 12 well trained sprinters (N=12) in SMK Dato Sri Amar Diraja with male athlete from age 13-14 years old. The criteria that excluded from this study was subject that allergies in beetroot and injured athlete. The participants' criteria included in this study was an athlete who participates in sprinting event which was 100 meters, 200 meters and 400 meters only. All participants been given an informed consents form for further references regarding to ethic concerned.

Experimental Design

The design used in this study was double blind crossover. Participants reported to the track on two separate days under the same experimental conditions (72 hrs between sessions). An anthropometric measurement consisted of age and BMI was taken at the beginning of session.

Then, on two separate occasions (session 1 and 2), as participants arrived at the track, participants received either beetroot capsules or placebo that has been allocated in packet A and packet B. In crossover study, participants received different packet on the second session from the first session as a wash out period for 72 hours. One hour after taking the supplement, all participants performed a 30 - meter sprint test and sprint time was recorded using digital hand held stopwatch. Data collected after all subjects performed the test and has been used for

analysis purpose to evaluate the effect of beetroot supplement on sprint performance.

Supplement Protocol

The supplement used was a beetroot powder extract organic that contain NO3. In one capsule of beetroot supplement contains approximately 4.40 mmol of nitrate capsules were blinded and stored in different packets which is packet A and packet B. Participants received either beetroot capsule or placebo 60 minutes prior to exercise test.

RESULTS

Sprinting performance between beetroot group and placebo group

Table 1: descriptive analysis between beetroot and placebo group

	N	Minimum	Maximum	Mean	Standard deviation
Age (Years)	12	13	14	13.50	0.52
BMI	12	15.06	20.57	18.42	1.86
30 meter sprint Beetroot (s)	6	4.00	4.70	4.39	0.19
30 meter sprint Placebo (s)	6	4.02	4.83	4.34	0.21

Based on the table 1 above, the descriptive analysis showed the mean value of age is 13.50 ± 0.52. For the BMI, the value is 18.42 ± 1.86. For the descriptive analysis on beetroot supplement, it showed the minimum time (s) recorded is 4.00 s and maximum time (s) is 4.70 s. The mean value in beetroot supplement group is 4.39 ± 1.86. In the placebo group, minimum time (s) recorded is 4.02 s and the maximum time (s) was 4.83 s and the mean value is 4.34 ± 0.21. Based on this result, there was a slightly improve in times for beetroot group compared to placebo group. From the data statistic, the mean age for all participants was 13

years old. This result based on the total number of the subject in this study N = 12

Comparison of sprinting performance between beetroot group and placebo group

Table 2: Comparison of 30- meter sprint between beetroot and placebo group (N = 12)

	Mean	Std. Deviation	Sig. (2-Tailed)
Beetroot supplement placebo group	0.051	0.151	.270

The table above showed the comparison of sprinting performance between beetroot supplement and placebo group. Significant value was set at $p < 0.05$. The mean value for both beetroot and placebo group is 0.05 ± 0.16. The sprint time (s) between beetroot and placebo group showed small different which is 0.05 seconds. Based on the results it shows that there was no significant effect between beetroot supplement and placebo groups on sprinting performance where the value was (11) - 0.270 $p > 0.05$. Therefore, the results from this study is failed to reject null hypothesis.

DISCUSSION

In this study, the ergogenic effects of beetroot supplement did not improved the sprint time (s) in this group. This was due to the amount of dose consumed by 6 male sprinters were not enough to show any ergogenic effects of beetroot supplement. From the previous study demonstrated the improvement on sprinting and intermittent high-intensity exercise performance was observed after players received moderate dose (6.4 mmol of NO3) of BR for 5 days. Thus, the potential of ergogenic aids to be effectively improved sprint performance could be done with acute supplementation (5 days) and moderate dose (6.4 mmol of NO3) specifically for short duration, all out sprint and high intensity intermittent exercise (Thompson et al,. 2016).

In this study, the duration of beetroot supplement ingested before exercise testing was 60 minutes. This method had been identified in the study of effect of caffeine intake on metabolism and endurance performance from Cox et al (2015). Cox stated that an amount of 70 – 400 mg of caffeine per day can be rapidly absorbed into bloodstream within 30 - 60 minutes (Cox et al., 2015). Using the same method in this study, beetroot supplement did not give the same result as well as the ingestion of caffeine that showed the effects in sport performance. Hence, consuming beetroot supplement 2 - 3 hour prior to exercise may give the ergogenic effect and this timing should be followed according to this evidence from previous study.

Based on current findings, to identify the ergogenic effect of beetroot supplement, the researcher must use the most suitable mechanism such as dosing strategy, optimal absorption time and energy before conducting the study. From the study of Cermak et al (2012), findings showed a consistent resulted with this study that showed a single dose of dietary nitrate in a form of beetroot juice did not influence endurance performance in well trained cyclist. The single dose of beetroot juice supplement used in this study contains 8.7 mmol of nitrate.

Apart from that, gender might influence on the effect of beetroot supplement on exercise performance. Most of the study were using male participants compare to females. For this study, the researcher used 12 male participants to identify the effect of beetroot on sprinting performance. This method was consistent from a study conducted by Bonilla Ocampo et al (2018) that identify the consumption of beetroot juice in reducing blood pressure based on individualization which were age, gender and obese status. It appeared that males seem to response better from the beetroot intervention compared to females (Bonilla Ocampo et al.,2018). Researchers suggested that, it was probably due to the pre-monopousal period where higher plasma level of nitrites (NO2) may lower the rate of reduction in blood pressure. However, this evidence still needed to be clarified in the future study.

CONCLUSION

The result for the investigation of the effect of beetroot supplement on sprinting performance measure with 30- meter sprint test showed in-significant effect on both beetroot supplement and

placebo group. Based on the significant value that was set to < 0.05, the null hypothesis for this study was failed to reject. The insignificant effects could be influence by several factors as found in the previous study especially on dietary nitrate and exercise performance.

The factors that influence the outcome of this study was the used of single dose of beetroot supplement in the beetroot group did not bare as ergogenic effect of beetroot supplement specifically on sprinting performance. Besides that, it stated that training status of the participants could influence the effeminacy of beetroot supplement. In this study, all 12 participants aged 13 – 14 years old were categorized as novice athletes. Therefore, it showed the average time recorded in 30 - meter sprint for males' category which was 3.3 – 4.4 s.

Another factor was found without any improvements of beetroot ingestion after consume the supplement, this study must include the pre and post time for 30 - meter sprint. In addition, the pre and post result was an important to identify the percent of improvement that can be seen in beetroot supplement group. In addition, using a large sample size also influence the insignificant of this study. A larger sample size was crucial even though it could contribute small changes but it still crucial for the outcome in sport performance.

This supplement and knowledge can be expended for future research using the most suitable method that have potential to identify the ergogenic effect of beetroot supplement on different types of performance.

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