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<https://ejournal.upi.edu/index.php/penjas/article/view/43311>DOI: <https://doi.org/10.17509/jpjo.v7i1.43311>**The Effect of Watermelon Juice Supplementation on Perceived Recovery and Anaerobic Power Recovery in Young Karate Athletes****Gifran Rihla Gifarka Latief*, Samsul Bahri, Rini Syafiarini, Muhamad Fahmi Hasan**

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Article Info*Article History :**Received January 2022**Revised January 2022**Accepted January 2022**Available online April 2022**Keywords :**Anaerobic power, Perceived recovery, Watermelon juice, Young athletes***Abstract**

Karate is a popular and often played martial sport. Due to the limited recovery period experienced by karate athletes during matches, they must employ an appropriate recovery plan to regain their initial condition. Watermelon research has become popular in recent years for application in sports. This clinical trial used one crossover design. The participants in this study were young karate athletes supported by the West Java student education and training center. Subjects underwent two periods: the first in which the subject would not consume watermelon juice, and the second in which the subject would consume 500ml of watermelon juice every day for seven days. The data collection procedure includes measuring perceived recovery status to evaluate the degree of perceived recovery and anaerobic ability through a running-anaerobic sprint test. After the sample had completed the protocol in the form of a match simulation, measurements were taken. Wilcoxon and Mann-Whitney analysis analyzed data. The results indicated that drinking watermelon juice significantly affected perceived recovery status 48 hours after and 72 hours after the treatment. However, after consuming watermelon juice, there was no significant difference in the athlete's anaerobic abilities. Consumption of watermelon juice can aid athletes in their recovery process, which affects the athlete's reported recovery state. It does not, however, contribute to the recovery of anaerobic capability. Therefore, watermelon juice supplementation can be used to accelerate the athlete's recovery.

INTRODUCTION

Karate is defined as a high-intensity sport in which most of the action is carried out explosively with attacks using punches or kicks that require dominant anaerobic power (Arazi & Izadi, 2017). In addition, the sport of karate is characterized by high-intensity intermittent activity, as well as during competitions performed frequently throughout the day with short recovery times (Burke & Cox, 2009), indicating the need for strategies to address these issues.

Recovery is very important because it allows a person's performance to return to normal after doing physical activity or participating in sports. Failure to provide adequate recovery periods between training sessions and within the program can lead to decreased training capacity or an increased incidence of injury, illness, and overtraining (Sawczuk et al., 2018). In addition, physical performance will decrease due to poor recovery from one physical exercise to the next or from one match to the next (Timilshina et al., 2019).

Supplements for athletes are often used as a way for athletes to recover quickly. Several intakes, such as energy drinks, which include liquid food supplements, sports drinks, soft drinks, and juices, provide an easy way to consume energy and other important nutrients while meeting the fluid needs of athletes (Burke & Cox, 2009). Supporting nutritional training needs will allow athletes to train harder, recover faster between sessions, maintain their health, and reduce the risk of injury (Burke & Cox, 2009). What's more, nutritional supplementation as an ergogenic aid is popularly used by athletes to increase their physical performance (Cribb et al., 2006). Previous studies have demonstrated the positive ergogenic effect of l-citrulline supplementation in anaerobic exercise (Sureda et al., 2010).

Watermelon is a rich natural source of L-citrulline and L-arginine, which are precursors of Nitric Oxide (NO) (Gonzalez & Trexler, 2020; Martínez-Sánchez et al., 2017). L-Citrulline is a non-essential amino acid, the main dietary source of which is watermelon (*Citrullus vulgaris*). L-citrulline is a potent endogenous precursor of L-arginine, a substrate for NO (nitric oxide) synthase (NOs). NOs cause NO formation from L-arginine and oxygen and produce L-citrulline as a by-product (Suzuki et al., 2016). In exercise physiology, NO has also received much attention due to its ergogenic effects as a potent vasodilator and modulator of mito-

chondrial respiration during physical exercise, increasing muscle contractility, muscle repair, muscle blood flow, glucose uptake, and resistance exercise performance (Suzuki et al., 2016).

NO supplementation or nitric oxide contained in watermelon is known to improve muscle function, resistance to fatigue during exercise, and the recovery process after exercise (Besco et al., 2012). In addition, NO supplementation is considered an ergogenic aid that is an essential modulator of blood flow and mitochondrial respiration during physical exercise, which can enhance the tissue recovery process (Petróczi & Naughton, 2010).

Recovery monitoring can be measured through several indicators related to the return to the normal physiologic performance of athletes. The current perceived recovery status scale is often associated with the athlete's recovery after activity. This scale was developed by Laurent et al. (2011) that can be used to subjectively assess an individual's level of recovery in relation to sports performance (Heidari et al., 2019). These metrics have been reported to provide valuable information regarding recovery and have been linked to exercise performance.

It is critical for athletes to be able to accurately assess anaerobic strength (Castañeda-Babarro et al., 2020). Anaerobic strength is regarded as a performance factor and is typically tested in athletes as part of a physical capacity evaluation (Ponce-García et al., 2021). Athletes must restore their anaerobic strength to perform better, particularly karate athletes.

There is a lot of research on watermelon studies on watermelon. However, most of the study was done to determine the potential ergogenic effect of watermelon on enhancing performance (Blohm et al., 2020; Figueroa et al., 2017; Ridwan et al., 2019). However, a lack of studies on watermelon and athlete recovery suggests that additional research is necessary. Consequently, this study aimed to examine how watermelon juice intake affects young karate athletes' perceived recovery status and anaerobic strength restoration.

METHODS

Watermelon juice will be tested in clinical trials to see how it would benefit athletes. The study's research

design is a one-way crossover design in which two periods will be administered at two different times, separated by a washout interval. Crossover study designs have several advantages, including the fact that they require fewer participants than parallel designs because each participant serves as his or her own control, removing inter-participant variation (Evans, 2010). During the first period, the sample received no intervention and was assessed for a variety of characteristics. Following that, a seven-day washout period was implemented to erase the effect of the initial intervention and limit any residual effects that may have occurred between periods in the crossover trial (Piantadosi, 2017). Furthermore, a second period is carried out in which the sample is provided intervention in the form of watermelon juice, which the subject must drink.

Participants

The participants in this study were the best young karate athletes from the West Java Student Education and Training Center (PPLP). The participants in this study were chosen using a purposive sampling technique. Participants must be confirmed healthy and uninjured. Subjects were excluded from the study if they had consumed a protein supplement, l-citrulline, or l-arginine in the past year. Seven young male athletes between the ages of 14 – 17 years old who fit the criteria were recruited to participate in the study.

Watermelon Juice Preparation

This study used a seedless red watermelon (*Citrullus lanatus* (Thunb.) Matsum & Nakai). This study made full use of watermelon grown in Palembang, South Sumatra. A total of 500 ml of watermelon juice was provided to athletes to ingest after completing daily workouts for seven days. Watermelon juice is extracted using a juicer without adding any water or other substances.

Instrument and Procedure

The data collection technique in this study was carried out by first measuring the subject's body anthropometrics to ascertain the subject's anthropometric characteristics. Furthermore, the individual went through the first session by first performing an initial test to act as a pre-test or baseline. The subjects were then re-tested seven days after the intervention as post-test data. The post-test was administered four times: immediately following the simulated match, 24 hours

later, 48 hours later, and 72 hours later (Nicol et al., 2006). The perceived recovery status scale and the running-based anaerobic sprint test (RAST) were the variables measured during the first and second-period pre-test and post-test. This study was conducted throughout December 2021.

Perceived Recovery Status Scale

The perceived recovery status scale consists of values between 0 and 10, with 0–2 representing very poor recovery and with an anticipated decline in performance, 4–6 representing low to moderate recovery and similar expected performance, and 8–10 representing a high perceived recovery with a previously expected increase in performance.

Running-based Anaerobic Sprint Test

The running-based anaerobic sprint test methodology was carried out in accordance with established criteria. RAST consists of six maximal 35-meter sprint efforts separated by a 10-second recovery period. To finish each maximal sprint attempt, side end markers are used as lines. Prior to testing, participants were requested to do a 5-minute jogging warm-up, and the officer noted the time attained for further analysis.

Data analysis

The data in this study is processed and analyzed using IBM SPSS Statistics Software. The Wilcoxon test was used to compare within periods, while the Mann-Whitney test was used to compare between periods. The level of statistical significance for all portions of the study was set at $p < 0.05$ for all tests.

RESULT

The results of the measures taken on the subject revealed that the average \pm deviation of the total sample was based on age (15.29 ± 0.95 years), height (165.73 ± 33.95 cm), body weight (58.07 ± 9.51 kg), and body mass index (21.1 ± 30.77). Table 1 shows the statistics on the characteristics of the research subjects.

The value of the perceived recovery status scale is calculated to determine how the subject feels about his recovery. Data were collected before the treatment, immediately after the protocol, and 24, 36, and 72 hours later in the first and second periods. Figure 1 shows changes in the perceived recovery status scale value.

The Wilcoxon statistical test revealed a significant difference at T1 (first period) between SP, 24h, 48h, and Pre data (p0.05). Also, at T2 (second period) between 48 h and 72 h, compared to Pre (p0.05). Similarly, Mann Whitey data revealed a significant difference between T1 and T2 in SP at 48 h and 72 h (p0.05).

Table 1. Subject anthropometric

Variable	Average \pm SD	Min.	Max.
Age (y.o)	15,29 \pm 0,95	14	17
Body height (cm)	165,73 \pm 33,95	159,6	170
Body weight (kg)	58,07 \pm 9,51	47,6	76,1
BMI (kg/m ²)	21,1 \pm 30,77	17,4	26,3

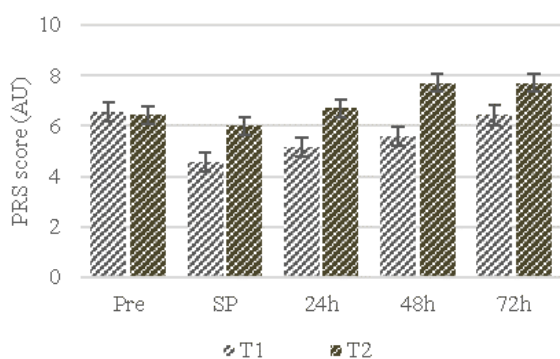


Fig 1. Changes in the perceived recovery status scale.

A running-based anaerobic sprint test was used to determine athletes' anaerobic strength. Several measurable characteristics were gathered from the testing, including peak power and average power. Data were taken at T1 and T2 before the protocol, immediately after the protocol, and 24, 36, and 72 hours afterward.

Figure 2 depicts the effects of variations in peak power value over time. The figure shows that there is a declining tendency in both periods. The statistical Wilcoxon test revealed a significant difference at T1 between the data 24h, 48h, and Pre (p0.05). Also, at T2, the difference between 24h and 48h was statistically significant (p0.05). The Mann Whitey data, on the other hand, revealed that there was no significant difference between periods one and two at any time.

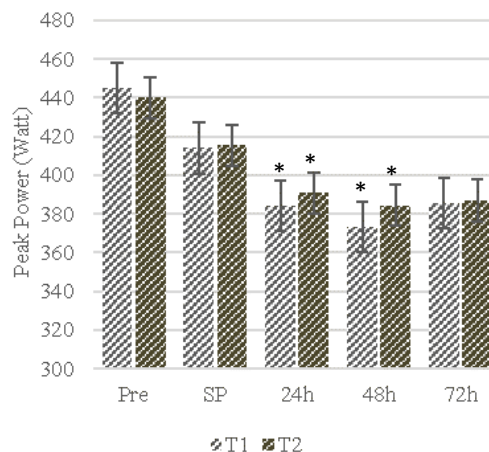


Fig 2. Changes in the peak power.

Figure 3 shows the effects of changes in the average power value. The Wilcoxon test findings showed a significant difference in period one between the data 24h, 48h, and Pre (p0.05). Also, in the second period, between 24h and 48h, compared to Pre (p0.05). On the other hand, Mann Whitey results revealed no significant difference between periods one and two at any time.

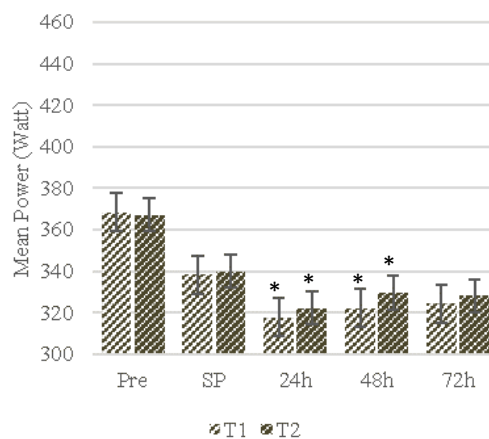


Fig 3. Changes in the peak power

DISCUSSION

This study attempted to discover information about each subject's recovery condition before and after consuming watermelon juice. This perceptual evaluation will provide a more thorough picture of the athlete's reaction to the recuperation approach (Spaccarotella & Andzel, 2011). This study shows that consuming watermelon juice affects the recovery state

of young karate athletes from the West Java Student Education and Training Center. Supplementation with this juice may affect the findings. This method of administration adds another benefit, namely hydration for the athlete. The impression of recuperation is influenced by this hydration (Dow et al., 2019).

The process of replenishing fluids and electrolytes lost through sweating or restoring general fluid balance is called hydration or rehydration (Armstrong, 2007). In addition, various recovery measures, such as hydration, are viable options for athletes to perform post-competition/training (Crowther et al., 2017).

Karate requires a lot of action in punches and kicks. To answer this question, karate fighters must employ explosive moves. During the anaerobic cycle assay, eating l-citrulline resulted in a considerable increase in explosive power (Glenn et al., 2016). This study, however, yielded different outcomes. There was no significant difference between athletes who ingested watermelon juice containing l-citrulline and those who did not for peak and mean peak power values. These findings differ from earlier research in which watermelon supplementation for seven days boosted peak power production, and overall effort accomplished (Bailey et al., 2016).

The peak and mean peak power results in this study also do not corroborate earlier findings that nitric oxide, which is found in watermelon juice, can help athletes with closely linked activities such as muscular contraction, blood flow, and maximal oxygen consumption during exercise (Jones et al., 2018). As well, this nitric oxide precursor has been described to improve performance in maximum strength and durability (Trexler et al., 2019); however, this is not consistent with the findings of our investigation.

CONCLUSION

Watermelon juice consumption has been found to affect the recovery state of young karate athletes. Therefore, it can be utilized as a method to improve the perception of recovery for both athletes, according to the findings of this research. On the other hand, the anaerobic ability of young athletes was not affected by watermelon juice. Therefore, in terms of athlete recovery, the findings of this study imply that watermelon juice supplements may be used to accelerate the recov-

ery process.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

REFERENCES

- Arazi, H., & Izadi, M. (2017). Physical and physiological profile of Iranian world-class karate athletes. *Biomedical Human Kinetics*, 9(1), 115–123.
- Armstrong, L. E. (2007). Assessing hydration status: the elusive gold standard. *Journal of the American College of Nutrition*, 26(sup5), 575S–584S.
- Bailey, S. J., Blackwell, J. R., Williams, E., Vanhatalo, A., Wylie, L. J., Winyard, P. G., & Jones, A. M. (2016). Two weeks of watermelon juice supplementation improves nitric oxide bioavailability but not endurance exercise performance in humans. *Nitric Oxide*, 59, 10–20. <https://doi.org/10.1016/j.niox.2016.06.008>
- Besco, R., Sureda, A., Tur, J. A., & Pons, A. (2012). The effect of nitric-oxide-related supplements on human performance. *Sports Medicine*, 42(2), 99–117.
- Blohm, K., Beidler, J., Rosen, P., Kressler, J., & Hong, M. Y. (2020). Effect of acute watermelon juice supplementation on post-submaximal exercise heart rate recovery, blood lactate, blood pressure, blood glucose and muscle soreness in healthy non-athletic men and women. *International Journal of Food Sciences and Nutrition*, 71(4), 482–489. <https://doi.org/10.1080/09637486.2019.1675604>
- Burke, L. M., & Cox, G. R. (2009). Nutrition in combat sports. In *Combat sports medicine* (pp. 1–20). Springer.
- Castañeda-Babarro, A., Marqués-Jiménez, D., Calleja-González, J., Viribay, A., León-Guereño, P., & Mielgo-Ayuso, J. (2020). Effect of listening to music on wingate anaerobic test performance. A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, 17(12), 1–20. <https://doi.org/10.3390/ijerph17124564>
- Cribb, P. J., Williams, A. D., Carey, M. F., & Hayes, A. (2006). The effect of whey isolate and resistance training on strength, body composition, and plasma glutamine. *International Journal of Sport Nutrition and Exercise Metabolism*, 16(5), 494–509.
- Crowther, F., Sealey, R., Crowe, M., Edwards, A., & Halson, S. (2017). Team sport athletes' perceptions and use of recovery strategies: a mixed-methods survey study. *BMC Sports Science, Medicine and Rehabilitation*, 9(1), 1–10.

- Dow, K., Pritchett, R., Roemer, K., & Pritchett, K. (2019). Chocolate milk as a post-exercise recovery aid in division II collegiate volleyball players. *Women in Sport and Physical Activity Journal*, 27(1), 45–51.
- Evans, S. R. (2010). Clinical trial structures. *Journal of Experimental Stroke & Translational Medicine*, 3(1), 8–18. <https://doi.org/10.6030/1939-067x-3.1.8>
- Figuerola, A., Wong, A., Jaime, S. J., & Gonzales, J. U. (2017). Influence of L-citrulline and watermelon supplementation on vascular function and exercise performance. *Current Opinion in Clinical Nutrition and Metabolic Care*, 20(1), 92–98. <https://doi.org/10.1097/MCO.0000000000000340>
- Glenn, J. M., Gray, M., Gualano, B., & Roschel, H. (2016). The Ergogenic Effects of Supplemental Nutritional AIDs on Anaerobic Performance in Female Athletes. *Strength and Conditioning Journal*, 38(2), 105–120. <https://doi.org/10.1519/SSC.0000000000000207>
- Gonzalez, A. M., & Trexler, E. T. (2020). Effects of Citrulline Supplementation on Exercise Performance in Humans: A Review of the Current Literature. *Journal of Strength and Conditioning Research*, 34(5), 1480–1495. <https://doi.org/10.1519/JSC.00000000000003426>
- Heidari, J., Beckmann, J., Bertollo, M., Brink, M., Kalus, K. W., Robazza, C., & Kellmann, M. (2019). Multidimensional monitoring of recovery status and implications for performance. *International Journal of Sports Physiology and Performance*, 14(1), 2–8.
- Jones, A. M., Thompson, C., Wylie, L. J., & Vanhatalo, A. (2018). Dietary nitrate and physical performance. *Annual Review of Nutrition*, 38, 303–328.
- Laurent, C. M., Green, J. M., Bishop, P. A., Sjökvist, J., Schumacker, R. E., Richardson, M. T., & Curtner-Smith, M. (2011). A practical approach to monitoring recovery: development of a perceived recovery status scale. *The Journal of Strength & Conditioning Research*, 25(3), 620–628.
- Martínez-Sánchez, A., Ramos-Campo, D. J., Fernández-Lobato, B., Rubio-Arias, J. A., Alacid, F., & Aguayo, E. (2017). Biochemical, physiological, and performance response of a functional watermelon juice enriched in L-citrulline during a half-marathon race. *Food & Nutrition Research*, 61(1). <https://doi.org/10.1080/16546628.2017.1330098>
- Nicol, C., Avela, J., & Komi, P. V. (2006). The stretch-shortening cycle. *Sports Medicine*, 36(11), 977–999.
- Petróczi, A., & Naughton, D. P. (2010). Potentially fatal new trend in performance enhancement: a cautionary note on nitrite. *Journal of the International Society of Sports Nutrition*, 7(1), 1–7.
- Piantadosi, S. (2017). *Clinical trials: a methodologic perspective*. John Wiley & Sons.