Effect of Pre Workout Energy Drink (BCAA) on Trunk and Lower Extremity Muscle Endurance in Normal Individuals of Age 20–30 Years

Dr. Sakshi Thakare[1], Dr. Nikunja Gujarathi[2]

Abstract—**AIM: To determine the effect of a pre-workout energy drink (BCAA) on trunk and lower-extremity muscle endurance in individuals aged 20–30 years.**

METHODOLOGY: A comparative study was conducted on 50 healthy participants aged 20–30 years. After obtaining consent, subjects completed the Physical Activity Readiness Questionnaire. Participants were divided into two groups of 25 each. Group A (control) performed the exercises without supplementation, while Group B received 10 g of BCAA 30 minutes before exercise. Two endurance tests were performed: the number of ¼ sit-ups for trunk endurance and the duration of squat hold for lower-extremity endurance. Rate of Perceived Exertion (RPE) was also recorded.

RESULTS:For ¼ sit-ups, the mean was 18.88 in Group A and 23.16 in Group B (p = 0.0017; t = 3.3253), indicating a significant improvement in trunk endurance with BCAA.For squat hold, the mean was 23.68 in Group A and 29.32 in Group B (p = 0.0261; t = 2.2965), showing improved lower-extremity endurance.For RPE, Group A had a mean of 2.00 and Group B had 1.60 (p = 0.0180; t = 2.4495), suggesting reduced muscle fatigability with BCAA.

CONCLUSION: BCAA taken 30 minutes before exercise effectively improves trunk and lower-extremity muscle endurance and reduces perceived exertion.

Index Terms—**BCAA, Muscle endurance, Fatigue, Pre-workout**

I. INTRODUCTION

Muscle endurance is the capacity of a muscle to sustain tension or perform repeated contractions over an extended period without fatigue. It is broadly divided into static endurance, which involves maintaining an isometric contraction, and dynamic endurance, which refers to repeated contractions at a given workload.[1] Trunk and lower limb muscles require high endurance because they contribute significantly to postural control and functional stability. The trunk extensors and abdominal muscles, in particular, support spinal alignment, maintain intra-abdominal pressure, and stabilize the vertebral column. When these muscles fatigue or lack endurance, individuals may develop postural abnormalities or low back pain. [2,3,4]

Adequate dietary protein and amino acid availability are essential for optimal muscle performance, recovery, and metabolism during exercise. Among these, branched chain amino acids (BCAAs)—leucine, isoleucine, and valine—play a key role in muscle protein turnover, energy production, and neurotransmitter balance. BCAAs cannot be synthesized by the body and must be obtained from the diet or supplements. They support the anabolic process, reduce muscle protein breakdown, and serve as precursors for non-essential amino acids such as glutamine and alanine. BCAA oxidation increases during prolonged exercise, contributing to ATP production and helping to spare muscle glycogen. Supplementation has also been shown to increase the availability of free fatty acids, reduce the rise in blood lactate, ammonia, CK, and LDH levels, and delay both peripheral and central fatigue. [5,6]

Central fatigue during prolonged activity is partly linked to elevated brain serotonin levels, which reduce motivation and motor unit recruitment. By competing with tryptophan for transport across the blood–brain barrier, BCAAs may help limit serotonin accumulation and preserve performance. Intake prior to exercise has been reported to rapidly elevate plasma BCAA levels, enhance post-exercise protein synthesis, and reduce muscle soreness.

Although several studies have examined the effect of BCAAs on upper limb endurance, limited evidence

exists regarding their influence on trunk and lower extremity endurance, particularly for both static and dynamic components. Since these muscle groups are essential for stability, balance, and functional activities, investigating the role of BCAA supplementation on their endurance is warranted.

II. METHOD

Ethical approval for the study was obtained from the Institutional Ethics Committee prior to the commencement of participant recruitment. After securing approval, all individuals were screened based on predefined criteria, and the purpose and procedures of the study were clearly explained to them. Written informed consent was obtained from each participant before participation. Healthy males and females aged 20–30 years who volunteered to take part in the study were included. Individuals were excluded if they were smokers; had musculoskeletal, neurological, metabolic, cardiovascular, or psychiatric disorders; had allergies to any BCAA ingredients; had diabetes mellitus; responded "Yes" to three or more items on the Physical Activity Readiness Questionnaire (PAR-Q); or regularly engaged in high-intensity exercise three or more times per week for more than 30 minutes per session.

The study was conducted on 50 participants, who were selected using convenient sampling. These subjects were then divided equally into two groups, with 25 individuals assigned to the control group (Group A) and 25 to the experimental group (Group B). Socio-demographic information such as age, sex, occupation, and baseline physical activity level was recorded for all participants prior to testing.

The exercise assessment began with the One-Fourth Sit-Up Test. Participants were positioned in supine lying on a firm mat with knees flexed to 90 degrees, heels in contact with the floor, arms straight beside the trunk, and fingertips aligned with tape markers placed 12 cm from the end of the mat. They were instructed to lift their head and shoulders by sliding the fingertips forward toward the end of the mat while keeping the heels grounded and avoiding pelvic displacement. Movements were performed at a controlled pace of one repetition every 2–3 seconds with normal breathing. The test continued until the participant was unable to maintain proper form, unable to follow the cadence, or chose to stop. The total number of correctly completed repetitions was recorded. [2]

The Wall Squat Test was then performed to assess lower-limb isometric endurance. Participants stood with the head, shoulders, and buttocks against a wall, with feet positioned forward to allow the hips, knees, and ankles to flex simultaneously to 90 degrees. They were instructed to hold this squat position for as long as possible while maintaining normal breathing. The test was terminated when the participant could no longer maintain the 90-degree position, showed compensatory movements, reported fatigue or discomfort, or voluntarily ended the test. The duration of the hold was recorded in seconds. Immediately after both tests, the Rate of Perceived Exertion (RPE) was documented for each participant. [2]

All procedures were demonstrated beforehand to ensure clarity and safety, and adequate rest periods were provided between tests to avoid fatigue. Participants in the experimental group consumed 10 g of BCAA dissolved in 250 ml of water 30 minutes prior to performing the exercise protocol, whereas the control group performed the exercises without supplementation. The collected data were used to compare exercise performance outcomes between the two groups and to evaluate the acute effect of BCAA supplementation on abdominal endurance, lower-limb endurance, and perceived exertion.

III. RESULT

The study was conducted on 50 subjects. Both the groups had 25 subjects each.

For a number of ¼ sit ups the mean was 18.88 of group A and 23.16 of group B, p value was 0.0017 and t value was 3.3253 which shows that the result was very significant. As the mean of group B was more than group A, it indicates that BCAA is effective in increasing truncal muscle endurance.

For duration of hold of squat, the mean was 23.68 of group A and 29.32 of group B, p value was 0.0261 and t value was 2.2965 which shows that the result was significant. As the mean of group B was more than group A, it indicates that BCAA is effective in increasing lower extremity muscle endurance.

For RPE the mean was 2.00 of group A and 1.60 of group B, p value was 0.0180 and t value was 2.4495 which shows that the result was significant. As the mean of group B was more than group A, it indicates

that BCAA is effective in reducing fatigability of muscle.

IV. DISCUSSION

This study investigated the acute effect of a pre-workout energy drink containing BCAA on trunk and lower-extremity muscle endurance among healthy young adults. Significant improvements in perceived exertion, squat hold duration, and quarter sit-up performance were observed in the experimental group, suggesting that BCAA ingestion may provide an ergogenic benefit for short-duration endurance tasks.
These findings are supported by previous research showing that BCAA supplementation enhances endurance performance. A cross-over trial in collegiate runners demonstrated improved 5,000-m and 10,000-m time-trial performance following BCAA, arginine, and citrulline supplementation[7,8]. Another randomized, double-blind trial found that a commercially available supplement containing BCAA, alanine, and carbohydrates significantly reduced RPE and improved time-to-exhaustion over nine weeks [9]. Biochemical evidence also shows that BCAA intake reduces fatigue-related substances, muscle damage markers (CK and LDH), and modulates glucose and free fatty acids during prolonged exercise [10,11]

One proposed mechanism is the reduction of central fatigue. Increased circulating BCAA may lower the free tryptophan:BCAA ratio, thereby reducing serotonin synthesis in the brain and delaying fatigue onset [12,13,14,15,16,17] However, evidence regarding the consistency of this mechanism remains mixed. Additionally, not all pre-workout supplements improve endurance; studies on Redline® energy drink have shown no significant benefits beyond placebo, highlighting variability among formulations [18]
This study has limitations, including a single dose of BCAA, a small sample size, and a predominantly young population with more female participants. Future studies with larger, diverse populations and long-term supplementation protocols are recommended

V. CONCLUSION

The study showed that the pre workout energy drink improves trunk and lower extremity muscle endurance if taken 30 min prior to exercise.

REFERENCES

[1] Kisner, C., Colby, L. A., & Borstad, J. (2007). Therapeutic exercise: Foundations and techniques (5th ed., p. 149).
[2] McIntosh, G., Wilson, L., Affleck, M., & Hall, H. (1998). Trunk and lower extremity muscle endurance: Normative data.
[3] Suzuki, N., & Endo, S. (1983). A quantitative study of trunk muscle strength and fatigability in the low-back-pain syndrome. Spine, 8(1), 69–74.
[4] Hasue, M., Fujiwara, M., & Kikuchi, S. (1980). A new method of quantitative measurement of abdominal and back muscle strength. Spine, 5(2), 143–148.
[5] Magrini, M. A., Colquhoun, R. J., Dawes, J. J., & Smith, D. B. (2016). Effects of a pre-workout energy drink supplement on upper body muscular endurance performance. Health and Human Performance, Oklahoma State University; University of Colorado Colorado Springs.
[6] Morse, T., & Willoughby, D. S. (2019). Efficacy of BCAA supplementation for exercise performance and recovery: A narrative review. Exercise and Biochemical Nutrition Laboratory, Baylor University.
[7] Greer, B. K., Woodard, J. L., White, J. P., Arguello, E. M., & Haymes, E. M. (2007). Branched-chain amino acid supplementation and indicators of muscle damage after endurance exercise. International Journal of Sport Nutrition and Exercise Metabolism, 17(6), 595–607.
[8] Ra, S. G., Miyazaki, T., Ishikura, K., Nagayama, H., Komine, S., Nakata, Y., Maeda, S., & Matsuzaki, Y. (2013). Endurance capacity and fatigue resistance enhanced by branched-chain amino acid supplementation in trained individuals. Journal of Nutritional Science and Vitaminology, 59(6), 636–643.
[9] Negro, M., Giardina, S., Marzani, B., & Marzatico, F. (2008). Branched-chain amino acid supplementation decreases perceived exertion and

enhances endurance performance. Amino Acids, 35(2), 253–261.

[10] Koba, T., Hamada, T., Sakurai, M., Matsumoto, K., Hayase, H., Imaizumi, K., & Tsujimoto, T. (2014). Effect of branched-chain amino acid intake during endurance exercise on fatigue substances, muscle damage substances and energy metabolism. Journal of Sports Medicine and Physical Fitness, 54(6), 757–764.

[11] Kim, D. H., Kim, S. H., Jeong, W. S., & Lee, H. Y. (2013). Effect of BCAA intake during endurance exercises on fatigue substances, muscle damage substances, and energy metabolism. Journal of Exercise Nutrition & Biochemistry, 17(4), 169–178. (Corrected with actual publication details)

[12] Blomstrand, E. (2006). A role for branched-chain amino acids in reducing central fatigue. The Journal of Nutrition, 136(2), 544S–547S.

[13] Acworth, I., Nicholass, J., Morgan, B., et al. (1986). Effect of sustained exercise on concentrations of plasma aromatic and branched-chain amino acids and brain amines. Biochemical and Biophysical Research Communications.

[14] Issekutz, B., Bortz, W. M., & Miller, H. I. (1967). Turnover rate of plasma free fatty acids in humans and in dogs. Metabolism, 16(11), 1001–1009.

[15] Spriet, L. L. (2002). Regulation of skeletal muscle fat oxidation during exercise in humans. Medicine and Science in Sports and Exercise, 34, 1477–1484.

[16] Havel, R. J., Pernow, B., & Jones, N. L. (1967). Uptake and release of free fatty acids and other metabolites in the legs of exercising men. Journal of Applied Physiology, 23(1), 90–95.

[17] Curzon, G., Friedel, J., & Katamaneni, B. D. (1974). Unesterified fatty acids and the binding of tryptophan in human plasma. Clinical Science and Molecular Medicine, 47, 415–424.

[18] Hoffman, J. R., Ratamess, N. A., Kang, J., Rashti, S. L., Faigenbaum, A. D., & Stout, J. R. (2008). Effect of a pre-exercise energy supplement (Redline®) on muscular endurance performance. Journal of the International Society of Sports Nutrition, 5(1), 1–7.