



Trabajo Original

Short-term branched-chain amino acid supplementation does not enhance vertical jump in professional volleyball players. A double-blind, controlled, randomized study *La suplementación con BCAA no mejora el salto vertical en los jugadores de voleibol profesionales. Estudio doble ciego, controlado y aleatorizado*

Juan Pedro Martín-Martínez¹, Julio Calleja-González^{2,3}, José Carmelo Adsuar Sala¹, Santiago Gómez-Pomares¹, Jorge Carlos-Vivas¹ and Jorge Pérez-Gómez¹

¹Faculty of Sport Sciences. Universidad de Extremadura. Cáceres, Spain. ²Physical Education and Sport Department. Faculty of Education and Sport. Universidad del País Vasco (UPV/EHU). Vitoria, Spain. ³Faculty of Kinesiology. University of Zagreb. Zagreb, Croacia

Abstract

To the best of the author's knowledge, no previous studies have described the effect of branched-chain amino acids (BCAA) on vertical performance during a week in professional volleyball players. This study assessed BCAA supplementation for a week, aiming to improve vertical jump performance in male professional volleyball players. Twelve male volleyballers were randomly assigned to a BCAA group (n = 6) or a control group (n = 6). The BCAA group ingested 21 g over a week, 7 g per day on Monday, Wednesday, and Friday, before a volleyball training session, while the control group drank a placebo drink. Participants performed 8 maximal countermovement jumps (CMJ); the 3 CMJs on Monday and Wednesday were evaluated after warm-up, after plyometric training, and at the end of the training session; and the 2 CMJs on Friday were evaluated after warm-up, and at the end of the training session. Compared with baseline, no significant differences in CMJ over the week were observed in BCAA or control group, neither between groups. The results indicated that 21 g of BCAA supplementation over a week did not improve vertical jump performance in professional volleyball players.

Keywords:

Countermovement jump. Ergogenic aids. Supplements. Volleyball.

Resumen

Hasta donde los autores saben, no se han descrito estudios previos sobre el efecto de los aminoácidos ramificados (BCAA) en el rendimiento vertical durante una semana en jugadores de voleibol profesionales. Este artículo estudió la suplementación de BCAA durante una semana con el objeto de mejorar el rendimiento del salto vertical en jugadores de voleibol profesionales masculinos. Doce jugadores de voleibol masculinos se asignaron aleatoriamente a un grupo con BCAA (n = 6) o a un grupo de control (n = 6). El grupo con BCAA ingirió 21 g en una semana, 7 g por día los lunes, miércoles y viernes antes de la sesión de entrenamiento de voleibol, mientras que el grupo de control bebió una bebida placebo. Los participantes realizaron 8 saltos máximos de contramovimiento (CMJ); los 3 CMJ de lunes y miércoles se evaluaron después del calentamiento y del entrenamiento pliométrico, y al final de la sesión de entrenamiento; los 2 CMJ del viernes se evaluaron después del calentamiento y al final de la sesión de entrenamiento. En comparación con el valor inicial, no se observaron diferencias significativas en los CMJ a lo largo de la semana, ni en el grupo BCAA ni en el grupo control, tampoco hubo diferencias entre grupos. Los resultados indicaron que 21 g de BCAA administrados durante una semana no mejoraron el rendimiento del salto vertical en jugadores de voleibol profesionales.

Palabras clave:

Salto de contramovimiento. Ayudas ergogénicas. Suplementos. Voleibol.

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Correspondence:

Jorge Pérez-Gómez. Facultad Ciencias del Deporte. Universidad de Extremadura. Avda de la Universidad, s/n. 10071 Cáceres, Spain
e-mail: Jorgepg100@gmail.com

INTRODUCTION

Vertical jump (VJ) performance is important for success in many sports (1), specifically in volleyball, where attack players need to gain great height to hit the ball over the blocking defensive players and vice versa (2). Jumps are repeated many times during a volleyball match, and may vary according to jump type or player position—per set, middle players performed 3-19 block jumps, outside players 1-15 spike jumps, and setter players 11-21 jumps in an international men's volleyball competition (3). Average jump frequency during matches in young elite volleyball players is 62 jumps/h for boys and 42 jumps/h for girls (4). A volleyball match has been shown to induce a temporary reduction in lower limb strength (5), so it is fundamental to maintain the players' physical condition in order to be successful in a game, given that some physical characteristics, physiological attributes, are essential in volleyball (6). Thus, the use of ergogenic nutritional supplements is becoming inseparable from volleyball (7).

Among them, BCAAs are essential amino compounds of leucine, isoleucine, and valine (8) that may decrease some biochemical markers related to muscle soreness (9), stimulate recovery of muscle protein synthesis (10), reduce central fatigue (11), and improve physical performance (12). For this reason, recovery strategies are commonly utilized in volleyball despite limited scientific confirmation to support their effectiveness in facilitating optimal recovery (13). The benefits of BCAA intake have been observed in endurance or resistance sports (14). Improvement in strength performance has also been seen in animals (15).

Most of the times improvement was associated with chronic BCAA supplementation (16-18). In particular, BCAA supplementation during 10 weeks improved sprint performance in cyclists (18), whereas in another study 6 weeks of leucine supplementation significantly improved endurance and upper body power output in canoeists (16). Also, in untrained healthy subjects chronic BCAA supplementation for 30 days improved physical fitness (17). However, to our knowledge, not many studies have evaluated acute BCAA supplementation (19). Also, the benefits of acute BCAA supplementation are unclear, even though a systematic review was published this year (20). In some cases, when BCAAs were taken during a marathon a significant improvement in running performance was observed in "slower" runners, while no significant effects on performance were seen in the "faster" runners (19).

To our knowledge, few studies have analysed the effect of BCAA supplementation on vertical jump performance (21,22), and these studies found no influence on vertical jump performance. Thus, the main purpose of this study was to investigate the effect of acute BCAA supplementation on vertical jump performance in professional volleyball players.

METHODS

PARTICIPANTS

Twelve male professional volleyball players involved in training practice, 8 h a week for at least 12 years, volunteered to participate in this double-blind, placebo-controlled study, and gave their written consent. They were randomly assigned to a BCAA group ($n = 6$; age = 23.8 ± 2.2 yrs; body mass = 84.5 ± 15.1 kg; height = 190.8 ± 13.0 cm) or a placebo group ($n = 6$; age = 25.3 ± 5.1 yrs; body mass = 84.9 ± 13.9 kg; height = 185.7 ± 14.0 cm). The tests were carried out in the spring months (from February to April of 2016).

All participants were advised to take no drugs or medications before or during this study, and to keep their regular dietary habits. None of the players had any injuries before or during the intervention period. They had no history of previous endocrine disorders. The experimental procedures, and their associated risks and benefits were explained prior to the medical examination. The study was approved by the Ethics Committee at Universidad de Extremadura (118/2016), and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki (2008), with the Fortaleza update (23).

EXPERIMENTAL PROTOCOL AND EVALUATION PROGRAM

This study was performed with a double-blind, placebo-controlled design in order to analyze the effects of 21 g of oral supplementation of BCCA, 7 g per day on Monday, Wednesday and Friday, on VJ performance. The experiment was carried out in a usual week of volleyball training, with three training sessions per week plus the competitive game in the weekend. Each training session has the same parts: warm-up, plyometric training, technical and tactical drills, and cool-down (Fig. 1). Placebo and BCAA double-blind supplementation were randomly distributed,

Warm-up	CMJ test	BBCA or Placebo	Plyometric training	CMJ test	Technical-tactical drills	CMJ test	Cool-down
15'			15'		60'		15'

Figure 1.

Parts of the volleyball training session, when the vertical jump was measured and the supplement was taken (CMJ: countermovement jump; BCAA: branched-chain amino acid).

and administered three times, 7 g each time, during a week. Each dose contained either leucine, isoleucine and valine (BCAA) or a watermelon-flavored drink with no sugar added (placebo). The BCAA supplement (Amix, Almoradi (Alicante), Spain) contained a 2:1:1 ratio for leucine, isoleucine and valine. BCAAs were mixed in 500 mL of water. The placebo was made with 500 mL of a watermelon-flavored beverage. During the study none of the participants reported any side effects such as intestinal dysfunction. The BCAA dose was based on individual body mass.

All participants attended the laboratory (9.00 a.m.) for testing at two specific time points during the study: 1) at baseline (T1), and 2) post-treatment (T2-T1). The BCAA group ingested one capsule per day, while the players in the CG took a placebo pill identical to that given in the other group. Both groups took their dose every morning on an empty stomach from T1 to the last day of T2). The control group served as baseline or “standard” condition since no supplements were involved.

All players were informed on proper food tracking by trained dieticians/nutritionists.

COUNTERMOVEMENT JUMP PERFORMANCE

Participants started in a standing position, with their feet placed shoulder-width apart, on the centre of the force platform, and were asked to jump as high as possible with a rapid countermovement jump (CMJ) after a standard warm-up. Hands were kept on the hips throughout the execution of the jump. Subjects were instructed to jump the highest they could. The app, My jump, for iPhone

6 (Apple Inc., USA) was used to calculate the height of CMJs with an iPhone 6 mobile phone, which has a high-velocity camera of 240 Hz, and a quality of 720 p HD. How to record every CMJ and measure the height of each CMJ with the My Jump app was described previously (24).

STATISTICAL ANALYSES

Data are presented as mean ± SD. Firstly, Shapiro-Wilk tests (< 50) were performed on the values of the study parameters to decide between parametric or non-parametric data. Secondly, the homoscedasticity of the variables was analyzed using the Levene test. Differences were determined using a 2-way, repeated measures ANOVA (group 2, time 8). For significant differences LSD post-hoc, pair-wise comparisons were used. Effect sizes among participants were calculated using the partial eta squared test (η^2p). Since this measure is likely to overestimate effect sizes, values were interpreted according to Ferguson (25), who indicates there has been no effect if $0 \leq \eta^2p < 0.05$; a minimum effect if $0.05 \leq \eta^2p < 0.26$; a moderate effect if $0.26 \leq \eta^2p < 0.64$; and a strong effect if $\eta^2p \geq 0.64$. Analyses were performed using the SPSS software, version 24.0 (SPSS, Inc, Chicago, Illinois, USA), and statistical significance was set at $p \leq 0.05$.

RESULTS

CMJ height is presented in figure 2. There were no differences in vertical jump performance between groups, and the post-hoc

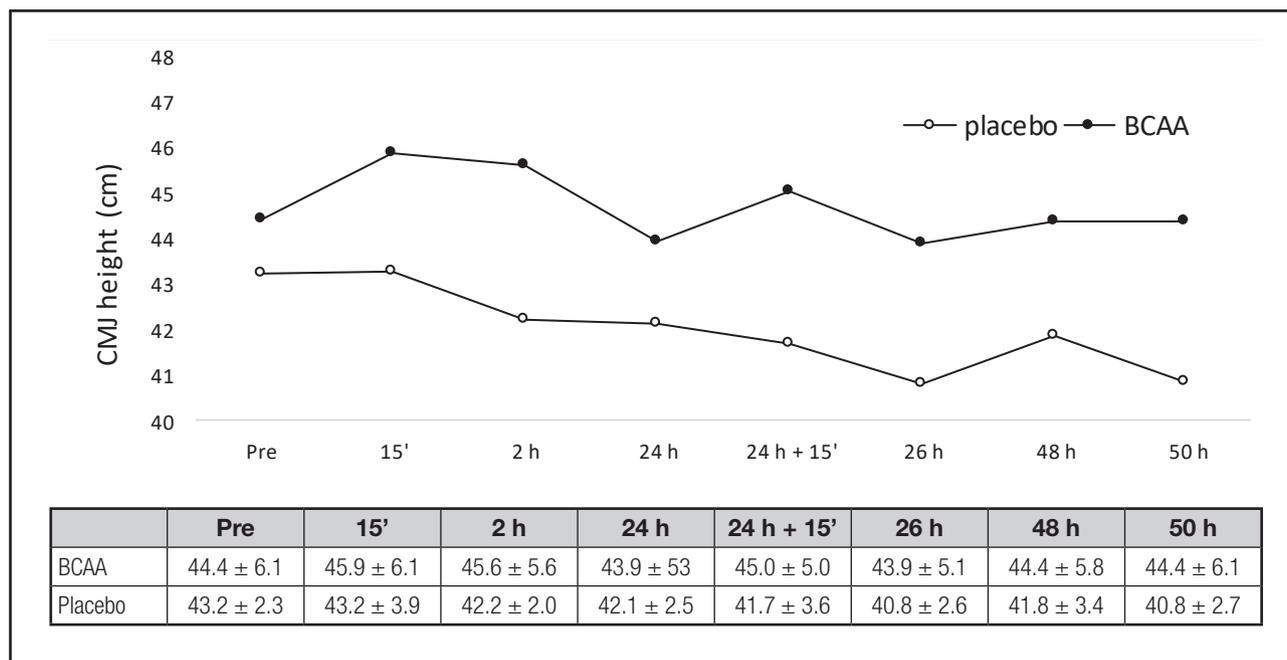


Figure 2. Comparison of the countermovement jump (CMJ) height (mean ± SD) between the branched-chain amino acid (BCAA) group and the placebo group. Baseline measures (Pre).

analysis did not show any significant differences in jump performance between the BCAA group and the placebo group from pre-test to 50 hours afterwards.

DISCUSSION

This study aimed to investigate the effect of acute BCAA supplementation on vertical jump performance in professional volleyball players. The main results show that administering 7 g of BCAA every 24 hours, 3 times in a week, was not enough to enhance the maximal anaerobic power as measured by vertical jump in professional volleyball players as compared to a placebo group. Dietary supplementation appears to be widely used in sport with a considerable proportion of athletes consuming supplements with low levels of scientific evidence, occupying amino acids/BCAA-based supplements the second position (37 %) (26).

Our results are in accordance with previous studies that observed no improvement in VJ performance after BCAA supplementation (21) or a diet rich in BCAAs (22). Portier et al. (22) showed that the ingestion of a diet rich in BCAAs in sailors preserved, 33 hours later, memory performance and decreased feelings of fatigue; however, no change in any physical performance measure, VJ or handgrip, were observed at the end of the race between the BCAA and the control group. Howatson et al. (21) observed that BCAA supplementation before and following resistance exercise reduced muscle damage and accelerated recovery in resistance trained males; however, vertical jump performance was not different between the BCAA and the placebo groups.

We consider that the amount of BCAAs administered was enough to improve performance; previous studies have shown that 5.5-5 g of BCAAs per participant before resistance exercise reduced the delayed-onset muscle soreness (27). In our study, 7 g of BCAAs were consumed and CMJ height performance was maintained over the week. Another study administered a higher amount of BCAAs, 20 g per day, with no positive effect on vertical jump performance in the next four days (21).

Most of the studies that observed a positive effect of BCAAs on physical performance included chronic BCAA supplementation (16-18). Sprint performance in cyclists was achieved after 10 weeks of BCAA supplementation (18); improvement in endurance and power in canoeists was reached with 6 weeks of leucine supplementation (16). Also in untrained participants a physical fitness improvement was obtained after a month of BCAA supplementation (17). So, more studies are needed to elucidate if acute BCAA administration can improve vertical jump performance.

It is known that BCAAs can reduce muscle soreness, muscle damage, and inflammation (28), and improve the recovery of muscle function (21), so one reason that could explain why in our study there is no difference in CMJ performance could be that training sessions load did not cause significant muscle damage in our volleyball players, so there was no benefit of taking BCAA oral supplementation. In this way, previous research has included protocols to produce high muscle damage (27); however, our vol-

leyball players had an official competition at the end of the study, so we could not apply excessive training.

Future research might consider to administer BCAAs in volleyball players after an exhausting training protocol outside the season, in order to see the possible benefits of BCAAs on vertical jump performance.

Limitations of the study may include a lack of dietary control in all participants, which may lead to differences in protein ingestion between groups, and thus explain why the control group were able to maintain their vertical jump performance at the same level as the BCAA group. We asked players to keep their habitual food intake prior to the study, but we did not control it.

CONCLUSION

In conclusion, 7 g of BCAA every 24 hours, 3 times a week, did not improve maximal anaerobic power in professional volleyballers.

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