β-Hydroxy β-Methylbutyrate (HMB) Supplementation Effects on Body Mass and Performance in Elite Male Rugby Union Players

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Abstract

McIntosh, ND, Love, TD, Haszard, J, Osborne, H, and Black, KE. β-hydroxy β-methylbutyrate (HMB) supplementation effects on body mass and performance in elite male rugby union players. *J Strength Cond Res* 32(1): 19–26, 2018– Preseason is characterized by high training volumes with short recovery periods β-hydroxy β-methylbutyrate (HMB) has been postulated to assist with recovery. β-hydroxy β-methylbutyrate has been shown to improve strength and body composition among untrained groups; the benefits of HMB among trained populations are unclear because of the methodologies employed. This randomized control trail determined the effects of 11 weeks HMB supplementation on body mass and performance measures in 27 elite rugby players. β-hydroxy β-methylbutyrate group (n = 13), mean ± *SD* age 20.3 ± 1.2 years, body mass 99.6 ± 9.1 kg; placebo group (n = 14), age 21.9 ± 2.8 years body mass 99.4 ± 13.9 kg for placebo. During the supplementation period, body mass increased with HMB 0.57 ± 2.60 kg but decreased with placebo 1.39 ± 2.02 kg (p = 0.029). There were no significant differences in any of the 4 strength variables ($p > 0.05$). However, on the yo-yo intermittent recovery test (YoYo IR-1), the placebo group improved 4.0 ± 2.8 levels but HMB decreased 2.0 ± 3.0 levels (p = 0.003). The results of this study suggest that HMB could be beneficial for gaining or maintaining body mass during periods of increased training load. However, it appears that HMB may be detrimental to intermittent running ability in this group although further research is required before firm conclusions can be made. Only 6 participants on HMB managed to complete both YoYo IR-1 tests because of injury, a larger sample size is required to fully investigate this potentially negative effect. Further, the mechanisms behind this decrement in performance cannot be fully explained and requires further biochemical and psychological investigation.

Key Words team sports, ergogenic aid, strength, running

Introduction

Rugby union is a sport that requires high intensity sprints interspersed with short recovery periods. Alongside this, strength and power are required for tackling and line breaks (5,7). Preseason rugby training is a period of approximately 11–12 weeks where players return from the off-season and are expected to optimize conditioning including improving strength, body composition, and intermittent high intensity running performance. During preseason, the high training volume and intensity of the training sessions may lead to incomplete recovery and adaptation to training (27). Preseason training for rugby includes both resistance exercise and high intensity running including rapid decelerations, which is likely to cause muscle damage (11). Therefore, nutritional interventions or supplements that may aid recovery between training sessions and improve strength or body composition may be beneficial at this time.

β-hydroxy β-methylbutyrate (HMB), a metabolite of leucine, has been proposed to increase lean body mass, decrease fat mass, improve strength, and $\dot{V}O_2$peak (32). It is believed to exert its effects by improving recovery between training sessions because it is thought to attenuate muscle damage (33). This would then lead to improved quality of training in subsequent exercise sessions leading to an overall improvement in high intensity aerobic training (25). Research specifically on high intensity intermittent exercise has shown that HMB may enhance the training adaptation further by increasing mitochondrial biogenesis, improving oxidative energy capacity and efficiency (18). Therefore, HMB could be a beneficial supplement for athletes during periods of

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heavy training where training sessions occur multiple times a day, such as rugby players during preseason training.

β-hydroxy β-methylbutyrate is also a precursor for muscle cell cholesterol formation and promotes muscle protein synthesis (32), thereby improving muscular function (21). Data from untrained participants undertaking resistance training in combination with HMB supplementation show greater strength gains and improvements in body composition than resistance training alone (32). In comparison, the studies with trained participants have shown varying degrees of efficacy (32). This has led many to believe that the efficacy of HMB is reduced in trained individuals because they are already adapted to a training stimulus; therefore, the efficiency of the pathways is already close to optimal (32). Given that HMB may mediate its actions via the attenuation of muscle protein breakdown (9,13,14,20,21), it has been proposed that the amount of protein degradation is insufficient in trained populations for meaningful differences with HMB to be seen (11,32). Indeed, a lack of training stimulus may be the potential reason some studies have not found a significant effect of HMB supplementation on body composition or performance among trained participants (15,22). Some studies appear to have not timed the HMB supplementation to coincide with an increase in training load, whereas others have not supervised the training program and therefore the participants may not have adhered to the intervention sufficiently to see the most beneficial results (15).

Other study designs have usually only used a short supplementation period, generally less than 6 weeks (16,31). It is possible that although beneficial effects have been seen with acute supplementation (2 weeks) in untrained participants (24) that this duration of supplementation is not sufficient for trained athletes. Finally, it is possible that the training and testing protocols used by these studies are not specific enough to each other or the participants usual training to elicit a true effect of HMB (23). This is particularly true for the only previous study investigating HMB supplementation and rugby players (23). O'Connor and Crowe tested anaerobic capacity via a cycle test (23). Rugby does not involve cycling exercises and therefore such a test is not sport specific, which may limit the interpretation of results.

Therefore, if HMB supplementation were to be beneficial for elite athletes then it would seem that the start of preseason, a training period during which workload is high, would be the best opportunity for beneficial effects. Further a training protocol that is designed and implemented by the respective team coaches and including tests which players are familiar with should be followed to enhance the applicability of the findings.

Therefore, this study investigated the effects of 11 weeks HMB supplementation during preseason training on body mass and performance in elite rugby union players using a standard battery of preseason rugby fitness tests.

Methods

Experimental Approach to the Problem

This was a 2-arm, double-blinded, placebo-controlled parallel-group study design. Participants were recruited and randomly assigned ID numbers; these ID numbers were then randomly assigned to either placebo or HMB by a researcher who had no contact with the participants throughout the intervention period. Upon completion of data entry, the statistician completed statistical analysis on group A and B, and then after statistical analysis, the identification of A and B assignment as HMB and placebo was revealed. In line with previous research regarding optimal dosing, participants were randomized to receive 3 $g \cdot d^{-1}$ of either Ca-HMB (Reactiv Supplements, Auckland, New Zealand), which has previously been shown to be an effective dose (21) or a placebo (corn flour; Edmonds Ltd, Auckland, New Zealand) for the 11 weeks of preseason training. During this supplementation period, participants undertook an exercise training program devised by their rugby academy strength and conditioning coaches.

Subjects

Ethical approval for the study was granted by the University of Otago Human Ethics Committee. All the participants received both an oral and written explanation of the study before providing written informed consent. All participants were older than 18 years (age range 18–27 years).

There were 37 players in the initial squad from which recruitment would take place; therefore, it was determined that if 28 players were recruited (14 in each group), this would be sufficient to detect a difference in body weight change of 2.7 kg between groups, with 90% power and a significance level of 0.05. This was calculated using a standard deviation of 11 kg (26) and a within-person correlation of 0.98 (from unpublished data).

Participants were recruited in January and February of 2014. Thirty-two males from a regional-representative-level rugby academy volunteered to participate in the study. Volunteers were recruited via e-mail and asked to attend an information evening where eligibility was assessed and written informed consent was obtained. Participants were deemed ineligible to participate if they were already supplementing with HMB ($n = 1$) or had a preexisting medical condition, which limited their ability to train. Of the 31 participants eligible for the study, 4 were excluded during the first week of the study because of: leaving the academy for reasons unrelated to the study ($n = 3$) or inability to train at 3 consecutive sessions ($n = 1$). The baseline data for the 27 participants (placebo = 14 participants; HMB = 13 participants) who completed the study are shown in Table 1. Of the 14 in the placebo group, 7 were forwards, and of the 13 in the HMB group, 8 were forwards. There was no significant difference between groups for age (placebo 21.9 ± 2.8 years, HMB 20.3 ± 1.2 years), body mass (placebo: 99.4 ± 13.9 kg, HMB: 99.6 ± 9.1 kg), percent body fat (placebo 10.0 ± 2.1%, HMB 9.1 ± 1.7%), and height (placebo 1.87 ± 0.07 m, HMB 1.87 ± 0.06 m) Mean +/− SD at baseline.

Table 1. Baseline mean (*SD*) age, weight, number (%) ethnicity, and percent compliance for the β-hydroxy β-methylbutyrate and placebo groups.*

	HMB ($n = 13$)	Placebo ($n = 14$)
Age (y)	20.3 (1.2)	21.9 (2.8)
Weight (kg)	99.6 (9.1)	99.4 (13.9)
Ethnicity, n (%)		
Maori	3 (21.4)	1 (7.7)
New Zealand European	8 (57.1)	6 (46.2)
Pacific Island	2 (14.2)	3 (23.1)
Unreported/Other	1 (7.1)	3 (23.1)
Compliance (%)	94	95

*Data presented as number (%).

Procedures

Participants were provided with instructions on how to complete a food diary. During week 1 and 9 of the study, participants completed a 3-random-day weighed food diary. The information was then entered and analyzed using *Kai-culator* dietary analysis software (Department of Human Nutrition, University of Otago, Dunedin, New Zealand).

All participants undertook resistance training at the High Performance Sport New Zealand training center in Dunedin, New Zealand. The training program was devised by the academy strength and conditioning coaches with the focus being hypertrophy and consisted of 4 training sessions per week (1 upper body, 1 lower body, and 2 full body sessions) that took place between 6 AM and 8 AM on Monday, Tuesday, Thursday, and Friday. In every weight session, the first movement completed was an Olympic lift (4 × sets), hang snatch, hang clean, power clean, or high pull. After an Olympic component was completed, players then had 3 more primary lifts to complete (4 × sets) for each lift (full body–squats, bench press, bench pull; lower body–stiff-legged deadlift, front squats, barbell split squats or box squats, barbell step ups, close-grip bench press; upper body–military press, pull-ups, dumbbell bench press). The rep range during the training block for the primary lifts was 3–6 reps with cluster sets (3 reps, 10-second rest; 2 reps, 10-second rest, 1 rep = 1 set). For each of the primary lifts, players were on a strict rest period. They would complete a lift every 3 minute, so 30 second to lift and 2.30 second of rest. Quality of movement and hitting the prescribed weight and reps were paramount.

Once the players completed their 4 primary lifts, they would have 3 secondary lifts that were to be completed. These lifts were movements that could be completed in a super set nature. Focus on upper-body dumbbell push/pull posterior chain bases movements and core. Higher volume 3–4 sets of 8–12 reps was programed for the secondary lifts.

The participants were familiar with all exercises with progressive overload between sessions. Each resistance training session was supervised by the investigator to ensure protocol adherence. Additionally, participants had 4 field-based training sessions per week for fitness and skills development. These sessions included running, line drills, and tackling. Supplements for each player were divided into 2 containers per day. Each container held 1.5 g of either HMB or placebo. Supplementation commenced the day after baseline testing and ceased the day before posttesting. Participants received their supplements from the investigator each morning at the resistance training sessions. They were instructed to consume one at training (observed by the investigator) and one in the evening. To increase compliance, text messages were sent each evening to remind players to consume their supplements. They were asked to return any containers from previous days and verbally confirming their adherence and reporting any adverse events. On Tuesdays and Fridays, participants received 2 and 3 days' worth of supplements respectively to cover their nontraining days. Compliance was recorded by counting the number of empty containers returned and/or verbal confirmation. In the final week of the study, but before retesting, participants were asked which treatment group they believed they were allocated to. If a participant did not suspect one group over the other, they were recorded as "unsure" and not included in the analysis. Participants were allocated into a "believed HMB" or a "believed placebo" group based on their perceived group.

Body Composition and Exercise Performance Testing

As with the training protocol, the testing protocol used in this study was similar to the academy protocol and thus was familiar for all participants. All testing was undertaken during the week before the start of supplementation and at the end of the supplementation period. Upon arrival at each training session, participants were weighed (BWB-800P; Tanita Corporation, IL, USA) and skinfold measurements were undertaken by a Level 1 International Society for the Advancement of Kinanthropometry (ISAK)-accredited dietitian with calipers (Holtain Ltd., Crosswell, United Kingdom) and tape measures (Lufkin Executive Thinline, W606PM). Skinfolds were taken at the subscapular, biceps, triceps, quadriceps, calf, supraspinale, iliac crest, and abdominal sites using ISAK protocol, and measurements were recorded (technical error of measurement = 1.0%). Percent body fat was calculated from these measures using the equations of Durnin and Womersley (6). Squats, cleans, bench press, and weighted pull-ups were the exercises chosen to assess strength. Each exercise had its own criteria to be

Table 2. Mean (*SD*) body composition and exercise performance measurements for β-hydroxy β-methylbutyrate and placebo groups.

	HMB ($n = 13$)			Placebo ($n = 14$)				
	n	Pretest	Posttest	*n*	Pretest	Posttest	Effect size*	*p*
Body weight (kg)	13	99.6 (9.1)	100.1 (8.2)	14	99.4 (13.9)	98.0 (13.5)	2.0 (0.2, 3.7)	0.029
Skinfold sum (mm)	12	75.0 (20.9)	66.3 (10.6)	11	87.5 (24.7)	76.5 (21.9)	−1.9 (−9.2, 5.4)	0.585
Bench press (kg)	9	123.3 (15.4)	127.2 (12.5)	10	124.8 (14.9)	127.5 (12.5)	0.8 (−2.9, 4.5)	0.638
Squat† (kg)	5	162.5 (18.5)	174.0 (15.2)	7	167.1 (27.9)	175.0 (32.8)	3.8 (−9.7, 17.2)	0.540
Clean (kg)	7	107.5 (12.3)	110.7 (11.0)	6	105.8 (9.8)	107.5 (8.2)	2.0 (−4.7, 8.6)	0.524
Weighted pull-up (kg)	8	135.0 (12.7)	138.1 (12.1)	11	135.4 (11.1)	136.4 (10.3)	2.1 (−2.0, 6.2)	0.292
Yo-yo test (m)	6	1800 (212)	1720 (202)	8	1745 (529)	1905 (525)	−237 (−378, −97)	0.003

*This is the effect size for HMB compared with control.
†One participant in the HMB group suffered a leg injury that prevented lower-body training for 4 weeks. They were excluded from analyses involving the lower body.

deemed as an eligible lift in accordance with the New Zealand Rugby Football Union protocols. Each participant was tested by the strength and conditioning team for consistency and was accompanied by 2 spotters for safety. Weighted pull-ups were performed with a weighted dip belt around the waist and a shoulder-width pronated grip of the bar. A spotter placed their arm in front of the thighs and the participant was not allowed to touch their thighs against the spotters arm during the pull-up. The final weight completed was the weight attached to the belt plus the players' body mass.

Participants were asked to perform a 1–5 repetition maximum in the training centre and a 1RM was obtained from the New Zealand Rugby Union (NZRU) prediction tables; these tables use the formulas derived by Mayhew, Ware, and Prinster (19). Aerobic fitness was assessed on an indoor artificial turf with a "yo-yo intermittent recovery test" (YoYo IR-1), a test commonly used by New Zealand rugby clubs to quantify player fitness and has previously been described (17). Results of the YoYo IR-1 were then used to calculate $\dot{V}O_2$max using the equations described by Bangsbo (2).

Statistical Analyses

Analysis of covariance (ANCOVA) is the preferred approach to analyzing controlled trials with baseline and follow-up measures (30). Therefore, ANCOVA was used to test for differences between groups (placebo vs. HMB) for body weight, sum of skinfolds, and performance measures adjusted for baseline values of the measure (Stata 12.1; Stata corp., College Station, USA). Fisher's exact tests were used to assess if the injury rates for each outcome were different between groups. Significance was set at $p \leq 0.05$.

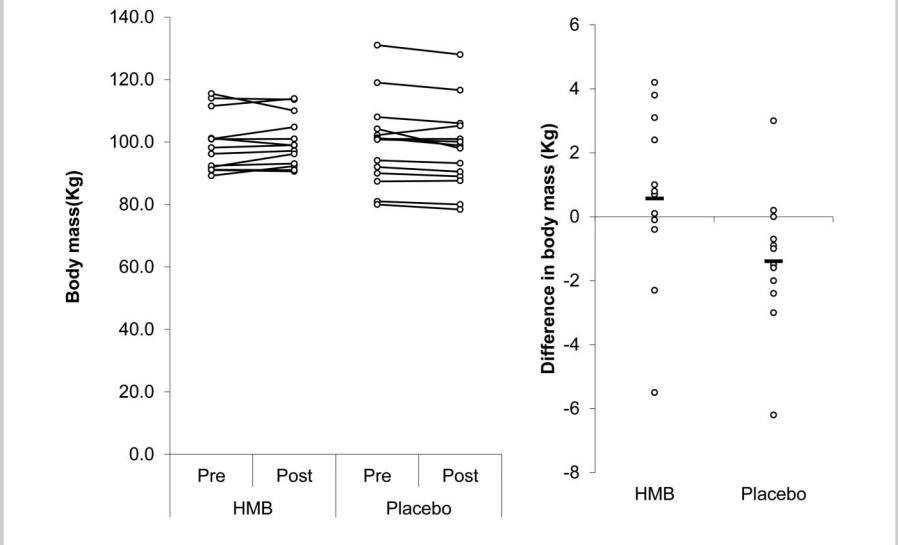

Figure 1. Individual and mean for change in body mass (kg) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo.

Results

Twenty-seven rugby players were recruited and randomized to receive either HMB ($n = 13$) or placebo ($n = 14$). Nearly all participants had some missing data ($n = 19$). Two participants were missing all performance

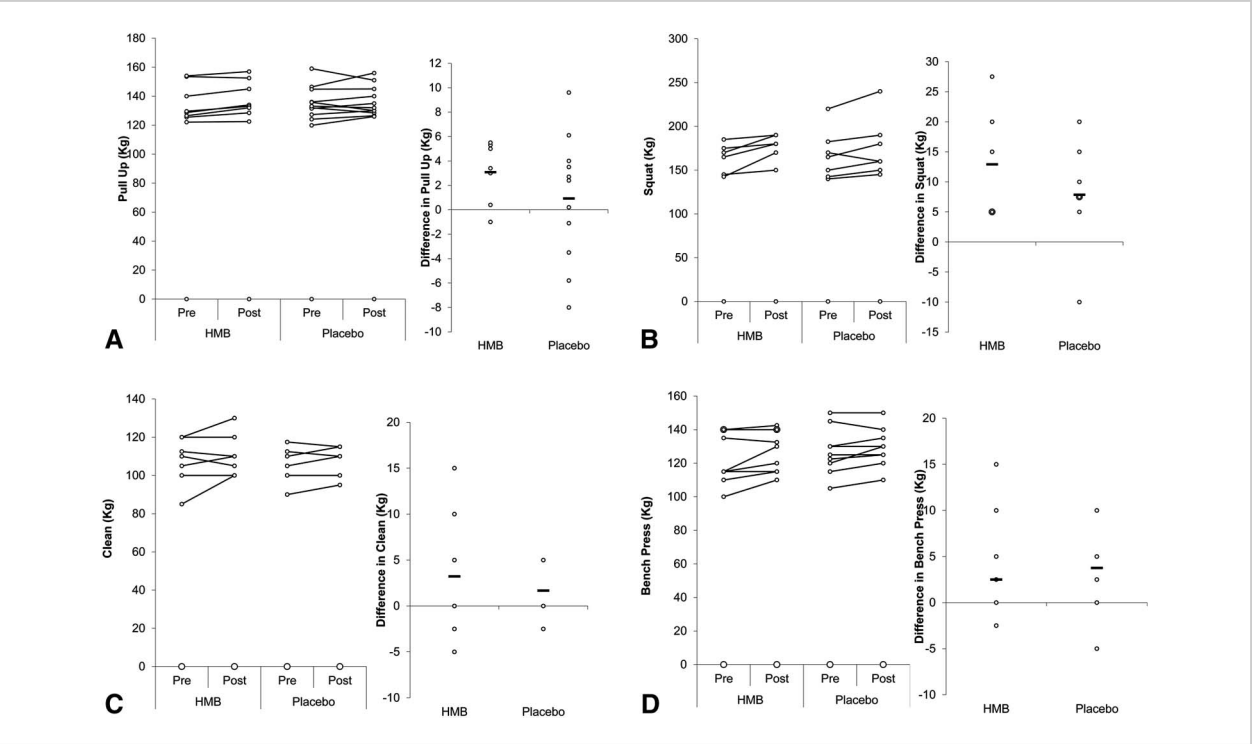

Figure 2. A) Individual and mean for change in weighted pull-up (kg) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo. B) Individual and mean for change in squat (kg) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo. C) Individual and mean for change in clean (kg) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo. D) Individual and mean for change in bench press (kg) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo.

measures, both initial and final; one participant was missing all final performance measures and 2 participants were missing all baseline performance measures. This reduced the sample sizes for the performance measures to HMB $n = 5$ and placebo $n = 6$; however, body weight was collected for the entire sample. Further missing data were activity specific, with some participants unable to complete some activities but still able to carry out others. All missing data are attributed to injury. Mean age of the players was 21.1 ($SD = 2.3$) years, ranging from 18.2 to 27.3 years.

Body Composition

A significant difference was obtained for the final body weight between HMB compared with placebo after adjusting for baseline values ($p = 0.029$) with the HMB group gaining 0.57 ± 2.60 kg, whereas the placebo group lost 1.39 ± 2.02 kg (Figure 1). No significant differences existed between groups for changes in skinfold measurements ($p = 0.585$), see Table 2. If converted to percent body fat, the changes in skinfolds would represent <1% over the intervention period (HMB −0.78 ± 0.93% and placebo −0.95 ± 0.75%); this change was not significantly different between groups ($p = 0.652$).

Exercise Performance

There were no significant differences in any of the 4 strength variables between the 2 groups (Table 2; all $p > 0.05$). For bench press, 5/8 (62.5%) improved on HMB and 6/9 (66.7%) improved on placebo. Fifty percent (3/6) increased their clean performance on placebo and 3/7 (42.8%) improved with HMB. All 5 (100%) participants who completed both squat tests on HMB improved, whereas 6/7 (85.7%) improved on placebo. Seven of 11 (63.6%) players improved their weighted pull-up performance on placebo and 7 of 8 (87.5%) participants improved on HMB, see Figure 2. Total weight lifted was calculated by the adding up all the weight lifted in the bench press, squat, pull-up, and clean. The placebo group had a mean weight lifted at baseline ($n = 9$) of 543 ± 56 kg (baseline weight lifted for the 8 participants that competed the study was 542 ± 60 kg) and the mean at follow-up ($n = 8$) of was 531 ± 76 kg. The HMB group had a baseline ($n = 9$) mean weight lifted of 530 ± 49 kg and at follow-up ($n = 9$) 539 ± 38 kg. Only 6 participants on placebo and 5 participants in the HMB group completed all lifts at both time points.

A significant difference was observed between the groups in the YoYo IR-1 test with the placebo group achieving an additional 4.0 ± 2.8 levels (160 ± 111 meters), whereas the HMB group achieved 2.0 ± 3.0 levels less (80 ± 19 meters) than their baseline test. On average, the HMB group achieved 5.9 levels lower than the placebo group at follow-up after taking baseline level into account ($p = 0.003$). A total

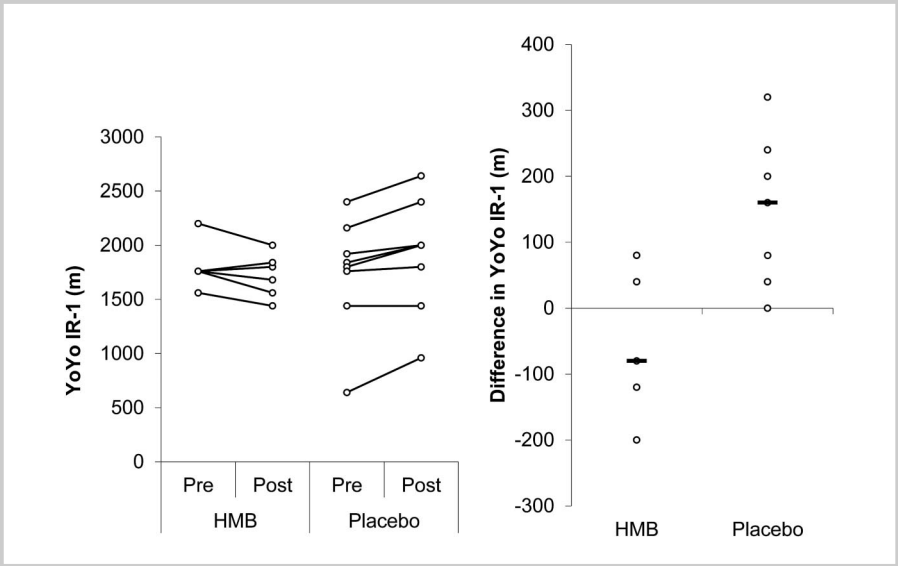

Figure 3. Individual and mean for change in YoYo IR-1 (m) from presupplementation to postsupplementation for β-hydroxy β-methylbutyrate and placebo.

of 4 players on HMB performed worse at the end of the study compared with everyone on the placebo improving performance (Figure 3). When these results were used to calculate differences in $\dot{V}O_2max$, there was a significant difference with HMB having a lower level by 2 $ml \cdot kg^{-1} \cdot min^{-1}$ (95% CI: −3, −1; $p = 0.003$) than placebo.

Dietary Intakes

At baseline, 10 players on placebo and 8 on HMB completed at least 1 day of food record; at the end of the intervention, 11 players in both groups completed at least one day of food diary. This meant that at least one day at the start and end was completed by 8 players on placebo and 7 on HMB at both time points. There were no significant differences in energy, protein, carbohydrate, or fat at either baseline or the end (all $p > 0.05$).

The 15 players that completed a food diary at baseline and end of the intervention showed a significant increase in energy over time (mean = 974 kJ; $p = 0.030$). However, there was no significant change in protein (mean = 23 g, $p = 0.197$), carbohydrate (mean = 32 g, $p = 0.304$), or fat (mean = 22 g, $p = 0.059$). There were no significant differences between the groups over time for energy (Intervention compared with control: 1,106 kJ; 95% CI: −1,177 kJ, 3,391 kJ; $p = 0.312$), protein (Intervention compared with control 15 g; 95% CI: −50 g, 79 g; $p = 0.632$), carbohydrate (Intervention compared with control 39 g; 95% CI: −76 g, 153 g; $p = 0.474$), or fat (Intervention compared with control 0 g; 95% CI: −30 g, 30 g; $p = 0.973$).

Injury Rates

The risk of injury is highest during preseason training (8,12). Unfortunately, there was a high incidence of injury in the current study, which reduced the sample size available for final analyses. A Fisher's exact test showed that there were no significant differences in the injury rates between both groups for all measurements.

Nine participants believed that they were on HMB (4 of these were in the placebo group). There was no difference between the groups in belief of supplementation ($p = 0.635$). The 7 variables for body composition and exercise performance were re-examined comparing between those that believed that they were on HMB and those that believed they were on placebo or were not sure. Belief of supplementation showed no effect on any of the variables (all $p > 0.05$).

Harms

During the 11-week supplementation period, no adverse events were recorded from Ca-HMB supplementation.

Discussion

The results of this study suggest that 11 weeks of HMB supplementation does not influence strength or injury incidence in elite athletes during preseason training.

Body mass increased with HMB supplementation and decreased in the placebo group during the 11-week period, without any significant changes in the sum of skinfolds. β-hydroxy β-methylbutyrate supplementation is reported to reduce muscle protein breakdown, which is an important component of protein balance. Although greater emphasis is placed on protein synthesis than protein breakdown in terms of nutritional interventions and hypertrophy, we did not directly measure lean body mass, but saw no changes in skinfolds to support significant hypertrophy and body fat loss was occurring.

Preseason training objectives include strength improvements; however, there were no statistically significant time × group effects for any of the strength tests across the 11-week supplementation period. This is in contrast to Nissen et al. (21) and Wilson et al. (32) who all observed a statistically significant increase in at least one strength measure. Differences between the present study and previous studies may be because of the training load. The low-volume, high intensity training program in the previous studies was designed to give them enough rest between sessions; thus, strength gains were predicted for both groups assuming adequate diet and sleep. However, in the current study, several participants reported fatigue and inadequate rest

between sessions. The final week of the study coincided with the squad (participants) completing 3 full, 80-minute games in the space of 8 days. Although participants were not training in this week, they informally reported feeling extremely fatigued and many acquired musculoskeletal injuries that resulted in them being unable to perform posttest exercises. For this reason, sample sizes were very low for the measures of exercise performance after the intervention period and this will have reduced the power and it may be this lack of recovery that may explain an absence of a training effect and consequently any intervention effect.

However, there appears to be a detrimental effect on YoYo IR-1 performance.

Although the number of participants who completed the YoYo IR-1 test at the start and end of the supplementation period was small ($n = 6$ HMB), 4 of them had decrements in performance of which 2 completed 5 less level postsupplementation compared with the presupplementation testing. Previous research has shown good reliability for the YoYo IR-1 with a coefficient of variation of 4.9% in trained participants (2). The decreased performance seen with HMB in the present study is greater than this, suggesting that it is a real decrement in performance; however, because of the small sample size, the estimated effect of HMB on performance may not be representative of the wider rugby-playing population. Previous research has shown that elite rugby players cover 1,564 m (1) which is a shorter distance than was seen in the present study probably reflecting the highly trained nature of our participants. Because the difference between elite and subelite rugby players has been reported as approximately 90 m (5.5%) (1) and the difference in the current study between those on placebo and those on HMB was 240 m, this suggests that such a decrement in performance is of practical importance if indeed it is representative beyond this group. Although it should be noted that even at the end of the intervention, the HMB group covered a greater distance than the elite rugby players in the previous research. Interestingly, the administration of leucine and other amino acids has been shown to enhance mitochondrial protein synthesis (4,29), and given that HMB is a metabolite of leucine, it has also been postulated to exert a positive effect on mitochondrial biogenesis (10,28). Surprisingly, despite HMB previously being linked to enhanced mitochondrial biogenesis; in the current study, estimated $\dot{V}O_2$max decreased in the HMB group although this finding may be partly influenced by the changes in body mass between groups and limitations of prediction equations.

However, it is possible that the HMB supplementation had allowed the players to exert more effort during the 3 matches completed in the week before posttesting. This may have meant that they were more fatigued during the posttesting Yo-Yo test than the placebo group, and this may therefore explain the decrements in performance seen with the HMB group. Similarly, albeit not significant, the HMB group did have a greater increase in total weight lifted than the placebo group and it could be that there was some carry over in terms of muscle soreness and damage from the strength to the YoYo IR-1 test. This may have led to the early termination of the YoYo IR-1 test, either because of muscle soreness and/or psychological factors. Although HMB has been shown to reduce muscle soreness and muscle damage by attenuating muscle protein breakdown, it was not consumed on the day of testing and it is therefore possible that this effect was not seen. This may have meant that the HMB group was more susceptible to feelings of fatigue and soreness in the legs during the YoYo IR-1 test because they were unfamiliar with it because of the beneficial HMB effects during training.

Although this finding is concerning, further research is required before firm conclusions can be made. Firstly only 6 participants on HMB managed to complete both YoYo IR-1 tests because of injury preventing the undertaking the second test, a larger sample size is required to fully investigate this potentially negative effect. Secondly, the mechanisms causing this decrease in time to fatigue cannot be fully explained and need further investigation with biochemical and psychological measures.

One advantage of the present study was the recording and monitoring of injuries and asking participants to report any side effects. The injury rates were high in the current study but were not different between groups. Further analysis shows a trend toward lower-body injuries for both groups, which is consistent with previous data on injury locations in New Zealand rugby union players (3).

This study is one of the longest supplementation periods of HMB in elite athletes. Secondly, the athletes involved in this study could be classed as elite athletes because they were playing in the New Zealand Rugby Union regional competition and the training and testing protocols were all designed by the teams trainers and coaches with standards determined by the New Zealand Rugby Union, meaning all participants were familiar with all movements required before the initial testing. The timing of the intervention meant that it coincided with increases in training volume, i.e., preseason and therefore the time period when it would be expected HMB would have the greatest effect.

Despite these strengths, the study has some limitations. The high injury rate reflects the study's pragmatic nature and reduces the statistical power. The lack of biochemical measures and determinants of fatigue mean that no underlying mechanism for the reduction in YoYo IR-1 performance with HMB supplementation could be concluded.

Practical Applications

β-hydroxy β-methylbutyrate supplementation in elite well-trained athletes needs to be carefully considered during preseason training because no positive effects on strength parameters were observed and intermittent sprint performance was reduced.

Acknowledgments

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