damaging bout of exercise was seen [64]. Correia et al. [65] found that HMB-FA improved the recovery of exercise capacity, as measured by 30 maximal isokinetic knee extensions at 120º/s, 24 hours following seven sets of 20 muscle-damaging drop jumps. Several other studies in competitive athletes have shown promising effects of HMB on indirect markers of muscle damage. Eslami et al. [66] saw that HMB attenuated CK and LDH responses when taken during an intense training period in competitive soccer players, and these findings were supported in a group of professional soccer players taking 3 g of HMB-FA [67]. In trained wrestlers, HMB-FA attenuated CK and LDH following a simulated wrestling protocol while improving metrics of perceived recovery compared to a placebo [68]. A recently published meta-analysis [69] pooled the results from 10 randomized controlled trials with 324 total participants examined the impact of HMB supplementation on muscle damage markers, finding that when 3 g of HMB per day is supplemented for longer than six weeks, HMB significantly attenuated CK and LDH responses following muscle-damaging exercise. However, additional studies comparing HMB-Ca to HMB-FA form are needed to determine if there are any differences.

7. Acute dosing of HMB

Several investigations have studied the effects of HMB when taken acutely as opposed to after chronic loading periods. Wilkinson et al. [28] reported significant increases in myofibrillar muscle protein synthesis (MPS) following consumption of a 3.42 g dose of HMB-FA, which increased intramuscular anabolic signaling (mTOR, p70s6k) comparable to 3.42 g of leucine in healthy males. HMB-FA stimulated MPS to a similar extent to leucine, but HMB-FA was also found to decrease muscle protein breakdown when taken acutely. Later, a bolus of 3 g of HMB-Ca was also shown to increase mTORc1 signaling and MPS rates in a study by the same group [42]. When taken before a workout, Townsend et al. [29] gave only 1 g of HMB-FA to trained males before a heavy lower body workout consisting of the squat, deadlift, and split squat, and found increased IGF-1 and GH plasma concentrations measured at 30 min and & 1 hour post exercise. Thus, HMB-FA may alter the GH/IGF-1 axis through similar pathways as arginine and lysine [70–72]; leucine has also been demonstrated to stimulate modest increases in GH concentrations [73].

Regarding immune responses, a higher percentage of monocytes expressing the complement receptor type 3 (CR3) along with elevated macrophage inhibitory protein-1β (MIP-1β) were seen following ingestion of 1 g of HMB-FA in a high-intensity resistance exercise protocol with or without cold-water immersion (CWI) therapy post workout [74]. This marker (CR3), measured by flow cytometry, specifies monocytes that enter the site of muscle damage to begin repair. These data may suggest that HMB-FA alters immune cell mobilization and adhesion mechanisms during tissue repair and recovery. Furthermore, using the same dose of HMB-FA and exercise protocol, HMB-FA and HMB-FA + CWI decreased expression of tumor necrosis factor receptor-1 (TNFR1), and attenuated tumor necrosis factor alpha (TNF-α) cytokine levels in the HMB-FA fed groups [75]. In summary, it appears that HMB can provide a beneficial physiological effect when consumed both acutely and chronically in humans.