

## I. HMB Human, Animal, and In Vitro Reference List

1. **Abumrad, NN, and Rathmacher, JA.** Manuscript clarification exercise-induced muscle damage is not attenuated by Maximuscle  $\beta$ -hydroxy- $\beta$ -methylbutyrate-1000™ supplementation. *J. Strength Cond. Res.* 25:1-2, 2011.  
Ref Type: Letter to the Editor
2. **Abumrad, NN, Molina, PE, Rathmacher, JA, and Nissen, S.** Injury, body composition, and nitrogen metabolism in the surgical patient. *Quality of the Body Cell Mass - Body Composition in the Third Millennium*, 291-305, 2000.  
Ref Type: Review
3. **Albert FJ, Morente-Sanchez J, Ortega FB, Castillo MJ and Gutierrez A.** Usefulness of beta-hydroxy-beta-methylbutyrate (HMB) supplementation in different sports: An update and practical implications. *Nutr. Hosp.* 32:20-33, 2015  
Ref Type: Review
4. **Almada, A, Kreider, R, Ferreira, M, Wilson, M, Grindstaff, P, Plisk, S, Reinhardy, J, and Cantler, E.** Effects of Calcium  $\beta$ -HMB supplementation with or without creatine during training on strength and sprint capacity. *FASEB J.* 11:A374. 1997.  
Ref Type: Abstract
5. **Alon, T, Bagchi, D, and Preuss, HG.** Supplementing with beta-hydroxy-beta-methylbutyrate (HMB) to build and maintain muscle mass: a review. *Res. Commun. Mol. Pathol. Pharmacol.* 111:139-151, 2002.  
Ref Type: Review
6. **Alway SE, Pereira SL, Edens NK, Hao Y, and Bennett BT.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) enhances the proliferation of satellite cells in fast muscles of aged rats during recovery from disuse atrophy. *Exp. Gerontol.* 48:973-984, 2013.
7. **Argiles JM, Campos N, Lopez-Pedrosa JM, Rueda R and Rodriguez-Manas L.** Skeletal muscle regulates metabolism via interorgan crosstalk: Roles in health and disease. *J. Am. Med. Dir. Assoc.* 17:789-796, 2016.  
Ref Type: Review
8. **Armstrong DG, Hanft JR, Driver VR, Smith AP, Lazaro-Martinez JL, Reyzelman AM, Furst GJ, Vayser DJ, Cervantes HL, Snyder RJ, Moore MF, May PE, Nelson JL, Baggs GE and Voss AC.** Effect of oral nutritional supplementation on wound healing in diabetic foot ulcers: a prospective randomized controlled trial. *Diabet. Med.* 31:1069-1077, 2014.
9. **Aversa Z, Almadari N, Castellero E, Muscaritoli M, Fanelli FR and Hasselgren PO.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) prevents dexamethasone induced myotube atrophy. *Biochem. Biophys. Res. Commun.* 432:739-743, 2012.
10. **Aversa Z, Bonetto A, Costelli P, Minero VG, Penna F, Baccino FM, Lucia S, Rossi Fanelli F and Muscaritoli M.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) attenuates muscle and body weight loss in experimental cancer cachexia. *Int. J. Oncol.* 38:713-720, 2011.
11. **Baier S, Johannsen D, Abumrad NN, Rathmacher JA, Nissen SL, and Flakoll PJ.** Year-long changes in lean body mass in elderly men and women supplemented with a nutritional cocktail of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB), arginine, and lysine. *JPEN* 33:71-82, 2009.
12. **Baptista IL, Silva WJ, Artioli GG, Guilherme JP, Leal ML, Aoki MS, Miyabara EH, and Moriscot AS.** Leucine and HMB differentially modulate proteasome system in skeletal muscle under different sarcopenic conditions. *PLoSOne* 10:e76752, 2013.

13. **Barillaro C, Liperoti R, Martone AM, Onder G and Landi F.** The new metabolic treatments for sarcopenia. *Aging Clin. Exp. Res.* 25: 119-127, 2013.  
Ref Type: Review
14. **Baxter JH, Carlos JL, Thurmond J, Rehani RN, Bultman J, and Frost D.** Dietary toxicity of calcium beta-hydroxy-beta-methyl butyrate (CaHMB). *Food Chem. Toxicol.* 43:1731-1741, 2005.
15. **Baxter, JH, Mukerji, P, Voss, AC, Tisdale, MJ, and Wheeler, KB.** Attenuating protein degradation and enhancing protein synthesis in skeletal muscle in stressed animal model. *Med. Sci. Sports Exerc.* 38, S550-S551. 2006.  
Ref Type: Abstract
16. **Baxter JH, Phillips RR, Dowlati L, Goehring, KC and Johns PW.** Direct determination of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) in liquid nutritional products. *Food Anal. Methods* 4:341-346, 2011.  
Ref Type: Analytical Method
17. **Beaudart C, Dawson A, Shaw SC, Harvey NC, Kanis JA, Binkley N, Reginster JY, Chapurlat R, Chan DC, Bruyère O, Rizzoli R, Cooper C, Dennison EM and the IOF-ESCEO Sarcopenia Working Group.** Nutrition and physical activity in the prevention and treatment of sarcopenia: systematic review. *Osteoporos. Int.* DOI 10.1007/s00198-017-3980-9
18. **Berk L, James J, Schwartz A, Hug E, Mahadevan A, Samuels M and Kachnic L.** A randomized, double-blind, placebo-controlled trial of a  $\beta$ -hydroxyl  $\beta$ -methyl butyrate, glutamine, and arginine mixture for treatment of cancer cachexia (RTOG 0122). *Support. Care Cancer* 16:1179-1188, 2008.
19. **Berton L, Bano G, Carraro S, Veronese N, Pizzato S, Bolzetta F, De RM, Valmorbida E, De R, I, Perissinotto E, Coin A, Manzato E and Sergi G.** Effect of Oral Beta-hydroxy-beta-methylbutyrate (HMB) supplementation on physical performance in healthy old women over 65 years: An open label randomized controlled trial. *PLoS One* 10: e0141757, 2015.
20. **Berwid, SJ and Ostaszewski, P.** The effect of sodium ascorbate, trolox and 3-hydroxy-3-methylbutyrate on apoptosis induced by oxidative stress in C2C12 cells without dystrophin. In *Energy and protein metabolism and nutrition*, EAAP publication No. 124, eds. I. Ortigues-Marty, N. Miraux, and W. Brand-Williams. pp 393-394, 2007.
21. **Bohn AM, Betts S and Schwenk TL.** Creatine and other nonsteroidal strength-enhancing aids. *Curr. Sports Med. Rep.* 1:239-245, 2002.  
Ref Type: Review
22. **Borack MS and Volpi E.** Efficacy and safety of leucine supplementation in the elderly. *J. Nutr.* 146(Suppl):2625S-2629S, 2016.  
Ref Type: Review
23. **Breitman I, Saraf N, Kakade M, Yellumhanthi K, White M, Hackett JA and Clements RH.** The effects of an amino acid supplement on glucose homeostasis, inflammatory markers, and incretins after laparoscopic gastric bypass. *J. Am. Coll. Surg.* 212:617-627, 2011.
24. **Brioche T, Pagano AF, Py G and Chopard A.** Muscle wasting and aging: Experimental models, fatty infiltrations, and prevention. *Mol. Aspects Med.* 50:56-87, 2016.  
Ref Type: Review
25. **Bruckbauer A and Zemel MB.** Effect of dairy consumption on SIRT1 and metabolic risk in humans. *FASEB J.* 25:329.2, 2011.

Ref Type: Abstract

26. **Bruckbauer A and Zemel MB.** Effects of dairy consumption on SIRT1 and mitochondrial biogenesis in adipocytes and muscle cells. *Nutr. & Metab. (London)* 8:91, 2011.
27. **Bruckbauer A, Zemel MB, Thorpe T, Akula MR, Stuckey AC, Osborne D, Martin EB, Kennel S and Wall JS.** Synergistic effects of leucine and resveratrol on insulin sensitivity and fat metabolism in adipocytes and mice. *Nutr. Metab. (London)* 9:77, 2012.
28. **Bruckbauer A and Zemel MB.** Synergistic effects of metformin, resveratrol, and hydroxymethylbutyrate on insulin sensitivity. *Diabetes Metab Syndr Obes* 6: 93-102, 2013.
29. **Bruckbauer A and Zemel MB.** Synergistic effects of polyphenols and methylxanthines with Leucine on AMPK/Sirtuin-mediated metabolism in muscle cells and adipocytes. *PLoS One* 9: e89166, 2014.
30. **Buyse J, Swennen Q, Goddeeris BM, Vandemaele F, Klasing KC, Baumgartner M and Niewold TA.** Dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation influences performance differently after immunization in broiler chickens. In Energy and protein metabolism and nutrition, EAAP publication No. 124, eds. I. Ortigues-Marty, N. Miraux, and W. Brand-Williams. pp 399-400, 2007.
31. **Buyse J, Swennen Q, Vandemaele F, Klasing KC, Niewold TA, Baumgartner M and Goddeeris BM.** Dietary beta-hydroxy-beta-methylbutyrate supplementation influences performance differently after immunization in broiler chickens. *J. Anim. Physiol. a. Anim. Nutr. (Berl)* 93:512-519, 2009.
32. **Byrd PL, Mehta PM, DeVita P, Dyck D and Hickner, RC.** Changes in muscle soreness and strength following downhill running: Effects of creatine, HMB, and Betagen supplementation, *Med. & Sci. in Sports & Exer.* 31:S263, 1999.  
Ref Type: Abstract
33. **Caperuto EC, Tomatieli RV, Colquhoun A, Seelaender MCL and Rosa, LFBPC.** Beta-hydroxy-beta-methylbutyrate supplementation affects Walker 256 tumor-bearing rats in a time-dependent manner, *Clin. Nutr.* 26:117-122, 2007.
34. **Chen W, Wang R, Xionf XL, Wan HF, Xu J and Peng J.** Influence of in ovo injection of disaccharides, glutamine and  $\beta$ -hydroxy- $\beta$ -methylbutyrate on the development of small intestine in duck embryos and neonates. *Br. Poult. Sci.* 51:592-601, 2010.
35. **Cheng W, Phillips B and Abumrad N.**  $\beta$ -Hydroxy  $\beta$ -methyl butyrate increases fatty acid oxidation by muscle cells. *FASEB J.* 11:A381, 1997.  
Ref Type: Abstract
36. **Cheng W, Phillips B, and Abumrad N.** Effect of HMB on Fuel Utilization, Membrane Stability and Creatine Kinase Content of Cultured Muscle Cells. *FASEB J.* 12:A950, 1998.  
Ref Type: Abstract
37. **Cherniack EP, Florez HJ and Troen BR.** Emerging therapies to treat frailty syndrome in the elderly. *Altern. Med. Rev.* 12:246-258, 2007.  
Ref Type: Review
38. **Cherniack, EP.** Ergogenic dietary aids for the elderly. *Nutrition* 28:225-229, 2012.  
Ref Type: Review
39. **Chlopicka J, Wandas P and Zachwieja Z.** Dietary supplements selected by young people exercising in fitness rooms in Kraków and Environs. *Roczn. Pzh.* 58:185-189, 2007.  
Ref Type: Review

40. **Clark RH, Feleke G, Din M, Yasmin T, Singh G, Khan F and Rathmacher JA.** Nutritional treatment for acquired immunodeficiency virus-associated wasting using  $\beta$ -hydroxy- $\beta$ -methylbutyrate, glutamine and arginine: A randomized, double-blind, placebo-controlled study. *JPEN* 24(3):133-139, 2000.
41. **Clark RH, Feleke M, Din M, Yasmin T, Khan F, Powers R, Rathmacher JA, Nissen SL, Fuller JC Jr and Abumrad NN.** Effect of an amino acid mixture containing  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) in HIV related wasting. *Int. Conf. AIDS.* 12, 839-840, 1998.  
Ref Type: Abstract
42. **Clarkson PM and Rawson ES.** Nutritional supplements to increase muscle mass. *Crit. Rev. Food Sci. Nutr.* 39:317-328, 1999.  
Ref Type: Review
43. **Clements RH, Saraf N, Kakade M, Yellumhanthi K, White M and Hackett JA.** Nutritional effect of oral supplement enriched in beta-hydroxy-beta-methylbutyrate, glutamine and arginine on resting metabolic rate after laparoscopic gastric bypass. *Surg. Endosc.* 25:1376-1382, 2011.
44. **Close GL, Hamilton DL, Philp A, Burke LM and Morton JP.** New strategies in sport nutrition to increase exercise performance. *Free Radic. Biol. Med.* 98:144-158, 2016.  
Ref Type: Review
45. **Coelho CW and Carvalho T.** Effects of HMB supplementation on LDL-cholesterol, strength, and body composition of patients with hypercholesterolemia, *Med. & Sci. in Sports & Exer.* 33:S340, 2001.  
Ref Type: Abstract
46. **Cohen DD.** *The effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) and resistance training on changes in body composition during positive and negative energy balance - a randomized double-blind study.* London, England: M.Sc. Thesis, St. Bartholomew's and Royal London School of Medicine and Dentistry - Queen Mary and Westfield College, University of London, 1998.  
Ref Type: Thesis
47. **Crowe MJ, O'Connor DM and Lukins JE.** The effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) and HMB/creatine supplementation on indices of health in highly trained athletes. *Int. J. Sport Nutr. And Exer. Metab.* 13:184-197, 2003.
48. **Cruz-Jentoft AJ, Landi F, Schneider SM, Zuniga C, Arai H, Boirie Y, Chen LK, Fielding RA, Martin FC, Michel JP, Sieber C, Stout JR, Studenski SA, Vellas B, Woo J, Zamboni M and Cederholm T.** Prevalence of and interventions for sarcopenia in ageing adults: a systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). *Age Ageing* 43: 748-759, 2014.  
Ref Type: Review
49. **Daré LR, Dias DV, Rosa Junior GM, Bueno CR, Buchaim RL, Rodrigues Ade C and Andreo JC.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate in masticatory muscles of rats. *J. Anat.* 226:40-46, 2015.
50. **Davis GS, Lowery RP, Duncan NM, Sikorski E, Rathmacher JA, Baier SM, Morrison TJ, Dunsmore KA, Naimo MA, Walters J, Joy J, Wilson SMC and Wilson JM.** The effects of beta-hydroxy-beta-methylbutyrate free acid supplementation on muscle damage, hormonal status, and performance following a high volume 2-week overreaching cycle. *J. Int. Soc. Sports Nutr.* 9(Suppl. 1):P4, 2012.  
Ref Type: Abstract

51. **Deane CS, Wilkinson DJ, Phillips BE, Smith K, Etheridge T and Atherton PJ.** “Nutraceuticals” in relation to human skeletal muscle and exercise. *Am. J. Physiol. Endocrin. and Metab.* (in press), 2017.  
Ref Type: Review
52. **Deshpande P, Jie Z, Subbarayan R, Mamidi VK, Chunduri RH, Das T and Shreeram S.** Development and validation of LC-MS/MS method for the estimation of beta-hydroxy-beta-methylbutyrate in rat plasma and its application to pharmacokinetic studies. *Biomed. Chromatogr.* 27: 142-147, 2013.  
Ref Type: Analytical Method
53. **Deutz NEP, Pereira SL, Hays NP, Oliver JS, Edens NK, Evans CM and Wolfe RR.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on lean body mass during 10 days of bed rest in older adults. *Clin. Nutr.* 32:704-712, 2013.
54. **Deutz NE, Matheson EM, Matarese LE, Luo M, Baggs GE, Nelson JL, Hegazi RA, Tappenden KA and Ziegler TR.** Readmission and mortality in malnourished, older, hospitalized adults treated with a specialized oral nutritional supplement: A randomized clinical trial. *Clin Nutr* 35:18-26, 2016.
55. **Duan Y, Li F, Li Y, Tang Y, Kong X, Feng Z, Anthony TG, Watford M, Hou Y, Wu G and Yin Y.** The role of leucine and its metabolites in protein and energy metabolism. *Amino Acids* 48:41-51, 2016.  
Ref Type: Review
56. **Dunsmore KA, Lowery RP, Duncan NM, Davis GS, Rathmacher JA, Baier SM, Sikorski E, Morrison TJ and Naimo MA, Walters J, Wilson SMC and Wilson JM.** Effects of 12 weeks of beta-hydroxy-beta-methylbutyrate free acid gel supplementation on muscle mass, strength, and power in resistance trained individuals. *J. Int. Soc. Sports Nutr.* 9(Suppl. 1):P5, 2012.  
Ref Type: Abstract
57. **Durkalec-Michalski K and Jeszka J.** The efficacy of a  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation on physical capacity, body composition and biochemical markers in elite rowers: a randomized, double-blind, placebo-controlled crossover study. *J. Int. Soc. Sports Nutr.* 12:31, 2015.
58. **Durkalec-Michalski K and Jeszka J.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on aerobic capacity and body composition in trained athletes. *J. Strength Cond. Res.* 30:2617-2626, 2016.
59. **Ehling S and Reddy TM.** Investigation of the presence of beta-hydroxy-beta-methylbutyric acid and alpha-hydroxyisocaproic acid in bovine whole milk and fermented dairy products by a validated liquid chromatography-mass spectrometry method. *J. Agric. Food. Chem.* 62: 1506-1511, 2014.  
Ref Type: Analytical Method
60. **Ekinci O, Yanik S, Terzioglu BB, Yilmaz AE, Dokuyucu A and Erdem S.** Effect of Calcium beta-Hydroxy-beta-Methylbutyrate (CaHMB), Vitamin D, and Protein Supplementation on Postoperative Immobilization in Malnourished Older Adult Patients With Hip Fracture: A Randomized Controlled Study. *Nutr. Clin. Pract.* 31:829-835, 2016.
61. **Eley HL, Russell ST and Tisdale MJ.** Attenuation of depression of muscle protein synthesis induced by lipopolysaccharide, tumor necrosis factor and angiotensin II by  $\beta$ -hydroxy- $\beta$ -methylbutyrate. *Am. J. Physiol. Endocrinol. Metab.* 295:E1409-E1416, 2008.
62. **Eley HL, Russell ST and Tisdale MJ.** Mechanism of attenuation of muscle protein degradation induced by Tumor Necrosis Factor Alpha and Angiotensin II by beta-hydroxy-beta-methylbutyrate. *Am. J. Physiol. Endocrinol. Metab.* 295:E1417-E1426, 2008.

63. **Eley HL, Russell ST, Baxter JH, Mukherji P and Tisdale MJ.** Signaling pathways initiated by  $\beta$ -hydroxy- $\beta$ -methylbutyrate to attenuate the depression of protein synthesis in skeletal muscle in response to cachectic stimuli. *Am. J. Physiol. Endocrinol. Metab.* 293:E923-E931, 2007.
64. **Ellis AC, Patterson M, Dudenbostel T, Calhoun D and Gower B.** Effects of 6-month supplementation with  $\beta$ -hydroxy- $\beta$ -methylbutyrate, glutamine and arginine on vascular endothelial function in older adults. *Eur. J. Clin. Nutr.* 70:269-273, 2016.
65. **Escalante G, Alencar M, Haddock B and Harvey P.** The effects of phosphatidic acid supplementation on strength, body composition, muscular endurance, power, agility, and vertical jump in resistance trained men. *J. Int. Soc. Sports Nutr.* 13:24, 2016.
66. **Faramarzi M, Nuri R and Banitalebi E.** The effect of short-term combination of HMB (beta-hydroxy-beta-methylbutyrate) and creatine supplementation on anaerobic performance and muscle injury markers in soccer players. *Brazilian J. Boimotricity* 3:366-375, 2009.
67. **Ferreira HR, Rodacki AL, Gill P, Tanhoffer R, Filho JF and Claudio LC.** The effects of supplementation of HMB on inflammatory markers in high performance athletes. *J. Exer. Physiol.* 16:53-63, 2013.
68. **Field AE, Austin SB, Camargo CA, Jr., Taylor CB, Striegel-Moore RH, Loud KJ and Colditz GA.** Exposure to the mass media, body shape concerns, and use of supplements to improve weight and shape among male and female adolescents. *Pediatrics* 116: e214-e220, 2005.  
Ref Type: Review
69. **Fitschen PJ, Wilson GJ, Wilson JW and Wilund KR.** Efficacy of  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation in elderly and clinical populations. *Nutrition* 29:29-36, 2013.  
Ref Type: Review
70. **Fitschen PJ, Biruete A, Jeong J and Wilund KR.** Efficacy of beta-hydroxy-beta-methylbutyrate supplementation in maintenance hemodialysis patients. *Hemodial. Int.* 21:107-116.
71. **Flakoll P, Baier, S, Abumrad, NN, Rathmacher, JA and Nissen, S.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate, Arginine, and Lysine on Body Composition in Elderly Men and Women. International Nutrition and Aging Conference, St Louis, May 6-7, 2005. *J. Nutr. Health and Aging* 9(2), 2005  
Ref Type: Abstract
72. **Flakoll P, Sharp R, Baier S, Levenhagen D, Carr C and Nissen S.** Effect of beta-hydroxy-beta-methylbutyrate, arginine, and lysine supplementation on strength, functionality, body composition, and protein metabolism in elderly women. *Nutr.* 20:445-451, 2004.
73. **Flummer C, Kristensen NB and Theil PK.** Body composition of piglets from sows fed the leucine metabolite beta-hydroxy beta-methyl butyrate in late gestation. *J. Anim. Sci.* 90 Suppl 4: 442-444, 2012.
74. **Flummer C and Theil PK.** Effect of beta-hydroxy beta-methyl butyrate supplementation of sows in late gestation and lactation on sow production of colostrum and milk and piglet performance. *J. Anim. Sci.* 90 Suppl 4: 372-374, 2012.
75. **Flummer C, Lyby H, Storli KS, Bjerre-Harpoth V, Nielsen BM, Kramer M, Rojen BA, Kristensen NB and Theil PK.** Effects of beta-hydroxy beta-methyl butyrate supplementation to sows in late gestation on absorption and hepatic metabolism of glucose and amino acids during transition. *J. Anim. Sci.* 90 Suppl 4: 146-148, 2015.

76. **Foye OT.** *The biochemical and molecular effects of amnionic nutrient administration, "in ovo feeding" on intestinal development and function and carbohydrate metabolism in turkey embryos and poults.* Ph.D. Dissertation, North Carolina State University, Raleigh, NC, 2005.  
Ref Type: Dissertation
77. **Foye OT, Ferket PR and Uni Z.** The effects of in ovo feeding arginine, beta-hydroxy-beta-methyl-butyrate, and protein on jejunal digestive and absorptive activity in embryonic and neonatal turkey poults. *Poultry Sci.* 86:2343-2349, 2007.
78. **Foye OT, Uni Z, and Ferket PR.** Effect of in ovo feeding egg white protein, beta-hydroxy-beta-methylbutyrate, and carbohydrates on glycogen status and neonatal growth of turkeys. *Poultry Sci.* 85:1185-1192, 2006.
79. **Fuller JC Jr and Nissen S.** Decreasing male broiler mortality by feeding the leucine catabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate, *Poultry Sci.* 73:93, 1994.  
Ref Type: Abstract
80. **Fuller JC Jr, Baier S, Flakol PJ, Nissen SL, Abumrad NN and Rathmacher JA.** Vitamin D status affects strength gains in older adults supplemented with a combination of  $\beta$ -hydroxy- $\beta$ -methylbutyrate, arginine and lysine: A cohort study. *JPEN* 35:757-762, 2011.
81. **Fuller JC Jr, Sharp RL, Angus HF, Baier SM, and Rathmacher JA.** Free acid gel form of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) improves HMB clearance from plasma in humans compared to the calcium HMB salt. *Br. J. Nutr.* 105:367-372, 2011.
82. **Fuller JC, Jr., Arp LH, Diehl LM, Landin KL, Baier SM and Rathmacher JA.** Subchronic toxicity of  $\beta$ -hydroxy- $\beta$ -methylbutyric free acid in Sprague-Dawley rats. *Food Chem Toxicol* 67: 145-153, 2014.
83. **Fuller JC, Sharp RL, Angus HF, Khoo PY and Rathmacher JA.** Comparison of availability and plasma clearance rates of beta-hydroxy-beta-methylbutyrate delivery in the free acid and calcium salt forms. *Br. J. Nutr.* 114:1403-1409, 2015.
84. **Gallagher PM, Carrithers JA, Godard MP, Schulze KE and Trappe SW.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate ingestion, Part I: Effects on strength and fat free mass. *Med. & Sci. in Sports & Exer.* 32(12):2109-2115, 2000.
85. **Gallagher PM, Carrithers JA, Godard MP, Schulze KE and Trappe SW.** Beta-hydroxy-beta-methylbutyrate ingestion, part II: effects on hematology, hepatic and renal function. *Med. & Sci. in Sports & Exer.* 32:2116-2119, 2000.
86. **Gatnau R, Zimmerman DR, Nissen SL, Wannemuehler M and Ewan RC.** Effect of excess dietary leucine and leucine catabolites on growth and immune response in weanling pigs, *J. Anim. Sci.* 73:159-165, 1995.
87. **Gerlinger-Romero F, Guimarões-Ferreira, L, Giannocco, G and Nunes MT.** Chronic supplementation of beta-hydroxy-beta methylbutyrate (HMB $\beta$ ) increases the activity of the GH/IGF-I axis and induces hyperinsulinemia in rats. *Growth Hormone IGF Res.* 21:57-62, 2011.
88. **Gerlinger-Romero F, Guimaraes-Ferreira L, Yonamine CY, Salgueiro RB, Nunes MT.** Effects of beta-hydroxy-beta-methylbutyrate (HMB) on the expression of ubiquitin ligases, protein synthesis pathways and contractile function in extensor digitorum longus (EDL) of fed and fasting rats. *J. Physiol. Sci.* , 2017.
89. **Giron MD, Vilchez JD, Shreeram S, Salto R, Manzano M, Cabrera E, Campos N, Edens NK, Rueda R and Lopez-Pedrosa JM.** beta-Hydroxy-beta-methylbutyrate (HMB) normalizes dexamethasone-induced autophagy-lysosomal pathway in skeletal muscle. *PLoS One* 10: e0117520, 2015.

90. **Giron MD, Vilchez JD, Salto R, Manzano M, Sevillano N, Campos N, Argiles JM, Rueda R and Lopez-Pedrosa JM.** Conversion of leucine to beta-hydroxy-beta-methylbutyrate by alpha-keto isocaproate dioxygenase is required for a potent stimulation of protein synthesis in L6 rat myotubes. *J Cachexia Sarcopenia Muscle* 7: 68-78, 2016.
91. **Gonzalez AM, Fragala MS, Jajtner AR, Townsend JR, Wells AJ, Beyer KS, Boone CH, Pruna GJ, Mangine GT, Bohner JD, Fukuda DH, Stout JR and Hoffman JR.** Effects of beta-Hydroxy-beta-methylbutyrate free acid and cold water immersion on expression of CR3 and MIP-1beta following resistance exercise. *Am J Physiol Regul Integr Comp Physiol* 306: R483-R489, 2014.
92. **Gonzalez AM, Stout JR, Jajtner AR, Townsend JR, Wells AJ, Beyer KS, Boone CH, Pruna GJ, Mangine GT, Scanlon TM, Bohner JD, Oliveira LP, Fragala MS and Hoffman JR.** Effects of beta-hydroxy-beta-methylbutyrate free acid and cold water immersion on post-exercise markers of muscle damage. *Amino Acids* 46: 1501-1511, 2014.
93. **Hankosky ER, Sherrill LK, Ruvola LA, Haake RM, Kim T, Hammerslag LR, Kougias DG, Juraska JM and Gulley JM.** Effects of beta-hydroxy-beta-methyl butyrate on working memory and cognitive flexibility in an animal model of aging. *Nutr. Neurosci.* 2016.
94. **Hao Y, Jackson JR, Wang Y, Edens N, Pereira SL, and Alway SE.** Beta-hydroxy-beta-methylbutyrate reduces myonuclear apoptosis during recovery from hind limb suspension-induced muscle fiber atrophy in aged rats. *Am. J. Physiol. Regul. Integr. Comp. Physiol.* 301:R701-R715, 2011.
95. **Hasselgren PO.** beta-Hydroxy-beta-methylbutyrate (HMB) and prevention of muscle wasting. *Metabolism* 63: 5-8, 2014.  
Ref Type: Review
96. **He X, Duan Y, Yao K, Li F, Hou Y, Wu G and Yin Y.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate, mitochondrial biogenesis, and skeletal muscle health. *Amino Acids* 48:653-664.  
Ref Type: Review
97. **Henning PC, Park BS, Lee SR, Wilson JM, Park YM, Arjmandi BH, Grant SC, Rathmacher JA and Kim JS.** B-Hydroxy- $\beta$ -methylbutyrate (HMB) improves muscle mass and protein turnover in male mice during a 6-week catabolic condition. *Med. & Sci. in Sports & Exer.* 43:137, 2011.  
Ref Type: Abstract
98. **Henning PC, Park BS and Kim JS.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate improves bone properties and attenuates the depression of protein synthesis during a simulated sustained operation. *Mil Med* 179:679-685, 2014.
99. **Hickson M.** Nutritional interventions in sarcopenia: a critical review. *Proc Nutr. Soc.* 74:378-386, 2015.  
Ref Type: Review
100. **Hill DS, Hossain T, Phillips BP, Rankin D, Rathmacher JA, Loughna PL, Williams JP, Smith K, Szewczyk NJ and Atherton PJ.** Acute anabolic effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) in human skeletal muscle. *J. Cachexia Sarcopenia Muscle* 2:255, 2011.  
Ref Type: Abstract
101. **Hill DS, Szewczyk N, Brookfield R, Loughna P, Rathmacher J, Rennie MJ and Atherton PJ.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) stimulates mammalian target of rapamycin complex 1 (mTORc1) signaling via a phosphatidylinositol-3-kinase (PI3K)-dependent pathway. *FASEB J.* 25:1059.10, 2011.  
Ref Type: Abstract



102. **Hoffman JR, Cooper J, Wendell M, Im J and Kang J.** Effects of beta-hydroxy beta-methylbutyrate on power performance and indices of muscle damage and stress during high-intensity training. *J. Strength. Cond. Res.* 18:747-752, 2004.
103. **Hoffman JR, Gepner Y, Stout JR, Hoffman MW, Ben-Dov D, Funk S, Daimont I, Jajtner AR, Townsend JR, Church DD, Shelef I, Rosen P, Avital G, Chen Y, Frankel H, Ostfeld I.** HMB attenuates the cytokine response during sustained military training. *Nutrition Res.* 36:553-563, 2016.
104. **Hoffman JR, Gepner Y, Stout JR, Hoffman MW, Ben-Dov D, Funk S, Daimont I, Jajtner AJ, Townsend JR, Shelef I, Avital G, Chen Y, Frankel H, Ostfeld I.** HMB supplementation may affect cytokine and inflammatory response during high intensity military training. *Med. Sci. Sports Exerc.* 48(5 Suppl 1):164, 2016.  
Ref Type: Abstract
105. **Holeczek M, Muthny T, Kovarik M and Sispera L.** Effect of beta-hydroxy-beta-methylbutyrate (HMB) on protein metabolism in whole body and in selected tissues. *Food Chem. Toxicol.* 47:255-259, 2009.
106. **Hsieh LC, Chien SL, Huang MS, Tseng HF and Chang CK.** Anti-inflammatory and anticatabolic effects of short-term beta-hydroxy-beta-methylbutyrate supplementation on chronic obstructive pulmonary disease patients in intensive care unit. *Asia Pac. J. Clin. Nutr.* 15:544-550, 2006.
107. **Hsieh LC, Chow CJ, Chang WC, Liu TH and Chang CK.** Effect  $\beta$ -hydroxy- $\beta$ -methylbutyrate on protein metabolism in bed-ridden elderly receiving tube feeding. *Asia Pac. J. Clin. Nutr.* 19(2):200-208, 2010.
108. **Hung W, Liu TH, Chen CY and Chang CK.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation during energy restriction in female judo athletes. *J. Exer. Sci. Fit.* 8:50-53, 2010.
109. **Huss AR, Deliephan A, Fuller JC, Jr., and Jones CK.** Coating dog kibble with a commercial liquid acidifier reduces the risk of *Salmonella* cross-contamination. *J. Anim. Sci.* 94(Suppl. 2): 102, 2016.  
Ref Type: Abstract
110. **Huss AR, Fuller JC, Jr., Centrella, W, Marshall DL, Deliephan A, and Jones CK.** Mitigation of Salmonella on pet food kibbles using liquid and powdered 3-hydroxy-3-methylbutyric acid. Under review, 2017.
111. **Imai T, Matsuura K, Asada Y, Sagai S, Katagiri K, Ishida E, Saito D, Sadayasu R, Wada H and Saijo S.** Effect of HMB/Arg/Gln on the prevention of radiation dermatitis in head and neck cancer patients treated with concurrent chemoradiotherapy. *Jpn J Clin Oncol* 44: 422-427, 2014.
112. **Jank M, Ostaszewski P, Rosochacki S, Wilczak J and Balasinska B.** Effect of 3-hydroxy-3-methylbutyrate (HMB) on muscle cathepsins and calpain activities during the post-dexamethasone recovery period in young rats. *Polish J. of Vet. Sci.* 3:213-218, 2000.
113. **Jank M, Ostaszewski P, Rosochacki SJ, Wilczak J and Balasińska B.** Leucine metabolite 3-hydroxy-3-methylbutyrate (HMB) does not affect muscle cathepsin and calpain activities during impaired post-dexamethasone recovery in old rats. *Polish J. Vet. Sci.* 4:71-76, 2001.
114. **Jówko E, Ostaszewski P, Jank M, Sacharuk J, Zieniewicz A, Wilczak J and Nissen S.** Creatine and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) additively increases lean body mass and muscle strength during a weight training program. *Nutr.* 17:558-566, 2001.
115. **Joyner MJ.** Over-the-counter supplements and strength training. *Exer. & Sports Sci. Rev.* 28:2-3, 2000.

Ref Type: Review

116. **Kao M, Columbus DA, Suryawan A, Steinhoff-Wagner J, Hernandez-Garcia A, Nguyen HV, Fiorotto ML and Davis TA.** Enteral beta-hydroxy-beta-methylbutyrate supplementation increases protein synthesis in skeletal muscle of neonatal pigs. *Am. J. Physiol. Endocrinol. Metab.* 310: E1072-E1084, 2016.
117. **Kendall KL, Stout JR, Smith AE, Fukuda DH, Moon JR, Rea ML, Cramer JT and Johnson CD.**  $\beta$ -Hydroxy- $\beta$ -Methylbutyrate (HMB) supplementation and resistance training (RT) may improve body composition and muscle function in healthy elderly men (66–78 years): A 24-week study. *FASEB J.* 25:lb230, 2011.  
Ref Type: Abstract
118. **Kim JS, Henning PC, Park BS, Lee SR, Bakhshalian N, Masad IS, Wilson JM, Park YM, Arjmandi BH and Grant SC.**  $\beta$ -Hydroxy- $\beta$ -Methylbutyrate (HMB) improves body composition and myofiber dimensions in mice during normal physical conditioning not during catabolic conditions. *FASEB J.* 25:1126.1, 2011.  
Ref Type: Abstract
119. **Kim JS, Park YM, Lee SR, Wilson JM, Henning PC, Masad IS, Ugrinowitsch C, Arjmandi BH and Grant SC.** Effects of HMB on myofiber dimension and myogenic response in old Sprague-Dawley female rats during 10-week resistance training. *FASEB J.* 24:1058.8, 2010.  
Ref Type: Abstract
120. **Kim JS, Wilson JM, and Lee SR.** Dietary implications on mechanisms of sarcopenia: roles of protein, amino acids and antioxidants. *J. Nutr. Biochem.* 21:1-13, 2010.  
Ref Type: Review
121. **Kim JS, Park YM, Lee SR, Masad IS, Khamoui AV, Jo E, Park BS, Arjmandi BH, Panton LB, Lee WJ and Grant SC.** beta-Hydroxy-beta-methylbutyrate did not enhance high intensity resistance training-induced improvements in myofiber dimensions and myogenic capacity in aged female rats. *Mol. Cells* 34: 439-448, 2012.
122. **Kim JS, Khamoui AV, Jo E, Park BS and Lee WJ.** beta-Hydroxy-beta-methylbutyrate as a countermeasure for cancer cachexia: a cellular and molecular rationale. *Anticancer Agents Med. Chem.* 13: 1188-1196, 2013.  
Ref Type: Review
123. **Kimura K, Cheng XW, Inoue A, Hu L, Koike T and Kuzuya M.** beta-Hydroxy-beta-methylbutyrate facilitates PI3K/Akt-dependent mammalian target of rapamycin and FoxO1/3a phosphorylations and alleviates tumor necrosis factor alpha/interferon gamma-induced MuRF-1 expression in C2C12 cells. *Nutr. Res.* 34: 368-374, 2014.
124. **Knitter AE.** *The effects of HMB on muscle damage after and recovery following a 20 km run.* M.S. Thesis, Iowa State University, 1998.  
Ref Type: Thesis
125. **Knitter A, Panton L, Peterson A, Rathmacher JA and Sharp R.** The effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on muscle damage following a 20 kilometer run. *FASEB J.* 12:A854, 1998.  
Ref Type: Abstract
126. **Knitter A, Panton L, Rathmacher JA, Peterson A and Sharp R.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on muscle damage after a prolonged run. *J. Appl. Physiol.* 89:1340-1344, 2000.
127. **Kornasio R, Riederer I, Butler-Browne G, Mouly V, Uni Z and Halevy O.** Beta-hydroxy-beta-methylbutyrate (HMB) stimulates myogenic cell proliferation, differentiation

and survival via the MAPK/ERK and PI3K/Akt pathways. *Biochim. Biophys. Acta.* 1793:755-763, 2009.

128. **Kougias DG, Nolan SO, Koss WA, Kim T, Hankosky ER, Gulley JM and Juraska JM.** Beta-hydroxy-beta-methylbutyrate ameliorates aging effects in the dendritic tree of pyramidal neurons in the medial prefrontal cortex of both male and female rats. *Neurobiol. Aging* 40:78-85, 2016.
129. **Kougias DG, Hankosky ER, Gulley JM and Juraska JM.** Beta-hydroxy-beta-methylbutyrate (HMB) ameliorates age-related deficits in water maze performance, especially in male rats. *Physiol. & Behav.* 170:93-99, 2017.
130. **Kovarik M, Muthny T, Sispera L and Holecek M.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate treatment in different types of skeletal muscle of intact and septic rats. *J. Physiol. Biochem.* 66:311-319, 2010.
131. **Kovarik M, Muthny T, Sispera L and Holecek M.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate treatment on protein metabolism in skeletal muscle of septic rat, *Clin. Nutr.* 2(S2):155, 2007.  
Ref Type: Abstract
132. **Kraemer WJ, Hatfield DL, Volek JS, Fragala MS, Vingren JL, Anderson JM, Spiering BA, Thomas GA, Ho JY, Quann EE, Izquierdo M, Hakkinen K and Maresh CM.** Effects of amino acids supplement on physiological adaptations to resistance training. *Med. & Sci. in Sports & Exer.* 41:1111-1121, 2009.
133. **Kraemer WJ, Hatfield DL, Comstock BA, Fragala MS, Davitt PM, Cortis C, Wilson JM, Lee EC, Newton RU, Dunn-Lewis C, Hakkinen K, Szivak TK, Hooper DR, Flanagan SD, Looney DP, White MT, Volek JS and Maresh CM.** Influence of HMB supplementation and resistance training on cytokine responses to resistance exercise. *J Am Coll Nutr* 33: 247-255, 2014.
134. **Krakowski L, Krzyzanowski J, Wrona Z, Kostro K and Siwicki AK.** The influence of nonspecific immunostimulation of pregnant sows on the immunological value of colostrum. *Vet. Immunol. Immunopath.* 87:89-95, 2002.
135. **Kreider R, Ferreira M, Wilson and Almada A.** Effects of Calcium  $\beta$ -HMB supplementation with or without creatine during training on body composition alterations. *FASEB J.* 11:A374, 1997.  
Ref Type: Abstract
136. **Kreider R, Ferreira M, Wilson M and Almada A.** Effects of calcium beta-hydroxy-beta-methylbutyrate (HMB) supplementation during resistance-training on markers of catabolism, body composition and strength. *Int J Sports Med* 20:503-509, 1999.
137. **Kreider R, Ferreira M, Wilson M, Grindstaff P, Plisk S, Reinhardy J, Cantler E and Almada A.** Hematological and metabolic effects of calcium  $\beta$ -HMB supplementation during resistance-training. 1998 Southeast American College of Sports Medicine Conference, 1998.  
Ref Type: Abstract
138. **Kreider RB, Wilborn CD, Taylor L, Campbell B, Almada AL, Collins R, Cooke M, Earnest CP, Greenwood M, Kalman DS, Kerksick CM, Kleiner SM, Leutholtz B, Lopez H, Lowery LM, Mendel R, Smith A, Spano M, Wildman R, Willoughby DS, Ziegenfuss TN and Antonio J.** ISSN exercise & sports nutrition review: research & recommendations. *J. Int. Soc. Sports Nutr.* 7:7, 2010.  
Ref Type: Review
139. **Kreider RB.** Dietary supplements and the promotion of muscle growth with resistance exercise. *Sports Med.* 27:97-110, 1999.  
Ref Type: Review

140. **Kreider, RB, Ferreira, M, Greenwood, M, Wilson, M, Grindstaff, P, Plisk, S, Reinhardy, J, Cantler, E and Almada, AL.** Effects of calcium  $\beta$ -HMB supplementation during training on markers of catabolism, body composition, strength and sprint performance. *J. Exer. Physiol.* 3:48-59, 2000.
141. **Kuczera D, Paro de Oliveira HH, Fonseca Guimaraes FS, de LC, Alves L, Machado AF, Coelho I, Yamaguchi A, Donatti L, Naliwaiko K, Fernandes LC and Nunes EA.** Bax/Bcl-2 protein expression ratio and leukocyte function are related to reduction of Walker-256 tumor growth after beta-hydroxy-beta-methylbutyrate (HMB) administration in Wistar rats. *Nutr. Cancer* 64:286-293, 2012.
142. **Kuhlman G.** *The modulation of T-lymphocyte subsets and lymphocyte blastogenesis by leucine and leucine metabolites.* Ph.D. dissertation, Iowa State University, Ames, IA, 1989.  
Ref Type: Dissertation
143. **Kuhls DA, Rathmacher JA, Musngi MD, Frisch D, Barber A, MacIntyre AD, Coates JE, Browder TD, Eubanks P and Fildes JJ.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate improves nitrogen balance in critically injured adult trauma patients. *J. Trauma* 59(2):522, 2005.  
Ref Type: Abstract
144. **Kuhls DA, Rathmacher JA, Musngi MD, Frisch DA, Nielson J, Barber A, MacIntyre AD, Coates JE and Fildes JJ.** Beta-hydroxy-beta-methylbutyrate supplementation in critically ill trauma patients. *J. Trauma* 62:125-131, 2007.
145. **Kuo YH, Weng YW, Lin CL, Chang CK and Hung W.** Effect of 14 days HMB supplement on osteoclastogenesis related protein expression and bone metabolism regulate cytokines level in healthy college male. *Med. Sci. Sports Med.* 48(5 Suppl 1):54, 2016.  
Ref Type: Abstract
146. **Kuriyan R, Lokesh DP, Selvam S, Jayakumar J, Philip MG, Shreeram S and Kurpad AV.** The relationship of endogenous plasma concentrations of beta-hydroxy beta-methyl butyrate (HMB) to age and total appendicular lean mass in humans. *Exp. Gerontol.* 81:13-18, 2016.
147. **Lamboley CR, Royer D and Dionne IJ.** Effects of beta-hydroxy-beta-methylbutyrate on aerobic-performance components and body composition in college students. *Int. J. Sport Nutr. Exerc. Metab.* 17:56-69, 2007.
148. **Landi F, Calvani R, Tosato M, Martone AM, Ortolani E, Saveria G, D'Angelo E, Sisto A and Marzetti E.** Protein intake and muscle health in old age: From biological plausibility to clinical evidence. *Nutrients* 8:295, 2016.  
**Article Type:** Review
149. **Lee AJ, Beno DW, Zhang X, Shapiro R, Mason M, Mason-Bright T, Surber B and Edens NK.** A  $^{14}\text{C}$ -leucine absorption, distribution, metabolism and excretion (ADME) study in adult Sprague-Dawley rat reveals  $\beta$ -hydroxy- $\beta$ -methylbutyrate as a metabolite. *Amino Acids* 47:917-924, 2015.
150. **Levenhagen DK, Carr C, Vaughan S and Flakoll PJ.** Arginine, lysine, and  $\beta$ -hydroxymethylbutyrate (HMB) supplementation enhances the efficiency of protein synthesis in elderly females. *Am. J. Clin. Nutr.* 75:411S-412S, 2002.  
Ref Type: Abstract
151. **Levenhagen DK, Carr C, Vaughan, S and Flakoll PJ.** Arginine, lysine, and  $\beta$ -hydroxymethylbutyrate (HMB) supplementation enhances the efficiency of protein synthesis in elderly females. *JPEN* 26:S10, 2002.  
Ref Type: Abstract

152. **Levenhagen DK, Vaughan SR, Niedernhofer E, Carr C and Flakoll PJ.** Dietary supplementation of arginine, lysine and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) to blunt loss of muscle, strength and functionality in elderly females. *FASEB J.* 15:A277, 2001.  
Ref Type: Abstract
153. **Li P and Gaitlin III DM.** Evaluation of  $\beta$ -hydroxy- $\beta$ -methylbutyrate for hybrid striped bass *Morone chrysops* x *M. saxatilis*. *J. Appl. Aquacult.* 19: 77-88, 2007.
154. **Liang C, Bruckbauer A and Zemel MB.** Leucine modulation of sirtuins and AMPK in adipocytes and myotubes. *FASEB J.* 26:251.3, 2012.  
Ref Type: Abstract
155. **Lowery RP, Joy JM, Rathmacher JA, Baier SM, Fuller J, Jr., Shelley MC, Jäger R, Purpura M, Wilson SM and Wilson JM.** Interaction of beta-hydroxy-beta-methylbutyrate free acid (HMB-FA) and adenosine triphosphate (ATP) on muscle mass, strength, and power in resistance trained individuals. *J. Strength Cond. Res.* 30:1843-1854, 2016.
156. **Luckose F1, Pandey MC, Radhakrishna K.** Effects of amino acid derivatives on physical, mental, and physiological activities. *Crit. Rev. Food Sci. Nutr.* 55:1793-1807, 2015.  
Ref Type: Review
157. **Macchi MB, Turner MJ, Rathmacher JA and Vukovich MD.** Influence of coingestion of glucose on  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) metabolism in humans, *FASEB J.* 13:A909, 1999.  
Ref Type: Abstract
158. **Manjarrez-Montes-de-Oca R, Torres-Vaca M, Gonzalez-Gallego J and vejar-Ordenes I.** [beta-hydroxy-beta-methylbutyrate as a dietary supplement (I): metabolism and toxicity]. *Nutr. Hosp.* 31:590-596, 2015.  
Ref Type: Review
159. **Manjarrez-Montes-de-Oca R, Torres-Vaca M, Gonzalez-Gallego J and vejar-Ordenes I.** [beta-hydroxy-beta-methylbutyrate as a dietary supplement (II): cell and molecular mechanism of action]. *Nutr. Hosp.* 31: 597-605,2015.  
Ref Type: Review
160. **Manzano M, Giron MD, Salto R, Sevillano N, Rueda R and Lopez-Pedrosa JM.** Is  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) the bioactive metabolite of L-leucine in muscle? Molecular evidence and potential implications. Abstract P267. 31<sup>st</sup> ESPEN Congress, Vienna, Austria, 2009.  
Ref Type: Abstract
161. **Marcora S, Lemmey A and Maddison P.** Dietary treatment of rheumatoid cachexia with beta-hydroxy-beta-methylbutyrate, glutamine and arginine: a randomised controlled trial. *Clin Nutr* 24:442-454, 2005.
162. **Martone AM, Lattanzio F, Abbatecola AM, Carpia DL, Tosato M, Marzetti E, Calvani R, Onder G and Landi F.** Treating sarcopenia in older and oldest old. *Curr. Pharm. Des.* 21: 1715-1722, 2015.  
Ref Type: Review
163. **May, PE, Barber A, D'Olimpio JT, Hourihane A, and Abumrad NN.** Reversal of cancer-related wasting using oral supplementation with a combination of  $\beta$ -hydroxy- $\beta$ -methylbutyrate, arginine, and glutamine, *Am. J. Surgery* 183:471-479, 2002.
164. **McIntosh ND, Love TD, Haszard J, Osborne H and Black KE.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) supplementation effects on body mass and performance in elite male rugby union players. *J. Strength Cond. Res.* (in press), 2017.

165. **Mero A.** Leucine Supplementation and Intensive Training. *Sports Med* 27(6): 347-358, 1999.  
Ref Type: Review
166. **Miller P, Sandberg L and Fuller JC Jr.** The effect of intensive training and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on the physiological response to exercise in horses. *FASEB J.* 11: A290, 1997.  
Ref Type: Abstract
167. **Miller P, Sandberg L and Fuller JC Jr.** The effects of supplemental  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on training and racing thoroughbreds. *Equine Sports Med.* 23-24, 1998.  
Ref Type: Abstract
168. **Miramonti AA, Stout JR, Fukuda DH, Robinson EH, Wang R, La Monica MB and Hoffman JR.** Effects of 4 weeks of high-intensity interval training and beta-hydroxy-beta-methylbutyric free acid supplementation on the onset of neuromuscular fatigue. *J. Strength Cond. Res.* 30: 626-634, 2016.
169. **Mirza KA, Pereira SL, Voss AC and Tisdale MJ.** Comparison of the anticatabolic effects of leucine and Ca-beta-hydroxy-beta-methylbutyrate in experimental models of cancer cachexia. *Nutr* 30: 807-813, 2014.
170. **Mobley CB, Fox CD, Ferguson BS, Amin RH, Dalbo VJ, Baier S, Rathmacher JA, Wilson JM and Roberts MD.** L-leucine, beta-hydroxy-beta-methylbutyric acid (HMB) and creatine monohydrate prevent myostatin-induced Akirin-1/Mighty mRNA down-regulation and myotube atrophy. *J Int Soc Sports Nutr* 11: 38, 2014.
171. **Mochamat, Cuhls H, Marinova M, Kaasa S, Stieber C, Conrad R, Radbruch L and Mücke M.** A systematic review on the role of vitamins, minerals, proteins, and other supplements for the treatment of cachexia in cancer: a European Palliative Care Research Centre cachexia project. *J. Cachexia, Sarcopenia and Muscle* 2016.  
Ref Type: Review
172. **Molfino A, Gioia G, Rossi FF and Muscaritoli M.** Beta-hydroxy-beta-methylbutyrate supplementation in health and disease: a systematic review of randomized trials. *Amino Acids* 45: 1273-1292, 2013.  
Ref Type: Review
173. **Moore DT, Ferket PR and Mozdziak PE.** The effect of early nutrition on satellite cell dynamics in the young turkey. *Poultry Sci.* 84:748-756, 2005.
174. **Moore DT.** *Influence of early nutrition on muscle development in the poult.* Ph.D. Dissertation, North Carolina State University, Raleigh, NC, 2005.  
Ref Type: Dissertation
175. **Moschini M.** *Effect of supplementing the leucine metabolite HMB on composition of goat's milk.* M.S. Thesis, Iowa State University, 1993.  
Ref Type: Thesis
176. **Moschini M, Rathmacher J, Faidley TD, Sultan J and Nissen S.** Effect of feeding  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on leucine and fat metabolism in mammary gland, *FASEB J.* 7:A70, 1993.  
Ref Type: Abstract
177. **Munroe M, Pincu Y, Merritt J, Cobert A, Brander R, Jensen T, Rhodes J and Boppart MD.** Impact of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on age-related functional deficits in mice. *Exper. Gerontol.* 87:57-66, 2017.

178. **Neighbors KL, Ransone JW, Jacobson BH and LeFavi RG.** Effects of dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate on body composition in collegiate football players, *Med. & Sci. in Sports & Exer.* 32:S60, 2000.  
Ref Type: Abstract
179. **Nishizaki K, Ikegami H, Tanaka Y, Imai R and Matsumura H.** Effects of supplementation with a combination of beta-hydroxy-beta-methyl butyrate, L-arginine, and L-glutamine on postoperative recovery of quadriceps muscle strength after total knee arthroplasty. *Asia Pac J Clin Nutr* 24: 412-420, 2015.
180. **Nissen S, Faidley TD, Zimmerman DR, Izzard R and Fisher CT.** Colostral milk fat percentage and pig performance are enhanced by feeding the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate to sows. *Anim. Sci.* 72:2331-2337, 1994.
181. **Nissen S, Fuller JC Jr, Sell J, Ferket PR and Rives DV.** The effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on growth, mortality and carcass qualities of broiler chickens. *Poultry Sci.* 73:137-155, 1994.
182. **Nissen S, Morrical, D and Fuller JC Jr.** The effects of the leucine catabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on the growth and health of growing lambs. *J. Anim. Sci.* 77(Suppl. 1):243,1994.  
Ref Type: Abstract
183. **Nissen S, Panton L, Fuller J Jr, Rice D and Sharp R.** Effect of feeding  $\beta$ -hydroxy- $\beta$ -methyl butyrate (HMB) on body composition and strength of women. *FASEB J.* 11:A150, 1997.  
Ref Type: Abstract
184. **Nissen S, Panton L, Sharp RL, Vukovich M, Trappe SW and Fuller JC Jr.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) supplementation in humans is safe and may decrease cardiovascular risk factors. *J. Nutr.* 130:1937-1945, 2000.
185. **Nissen S, Panton L, Wilhelm R and Fuller JC Jr.** Effect of  $\beta$ -hydroxy- $\beta$ -methyl butyrate (HMB) supplementation on strength and body composition of trained and untrained males undergoing intense resistance training. *FASEB J.* 10:A287, 1996.  
Ref Type: Abstract
186. **Nissen S, Sharp R, Ray M, Rathmacher JA, Rice J, Fuller JC Jr, Connelly AS and Abumrad NN.** Effect of the leucine metabolite  $\beta$ -hydroxy  $\beta$ -methylbutyrate on muscle metabolism during resistance-exercise training. *J. Appl. Physiol.* 81(5):2095-2104, 1996.
187. **Nissen S, Van Koevering M and Webb, D.** Analysis of  $\beta$ -hydroxy- $\beta$ -methyl butyrate in plasma by gas chromatography and mass spectrometry. *Anal. Biochem.* 188:17-19, 1990.  
Ref Type: Analytical Method
188. **Nissen SL and Abumrad NN.** Nutritional role of the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB). *J. Nutr. Biochem.* 8:300-311, 1997.  
Ref Type: Review
189. **Nissen SL and Sharp RL.** Effect of dietary supplements on lean mass and strength gains with resistance exercise: a meta-analysis. *J. Appl. Physiol.* 94:651-659, 2003.  
Ref Type: Meta-Analysis
190. **Nissen SL, Clark RH, Feleke G, Din M, Yasmin T, Singh G, Khan F, Rathmacher JA and Abumrad NN.** Effect of supplemental  $\beta$ -hydroxy  $\beta$ -methylbutyrate (HMB), glutamine, and arginine on skeletal muscle mass in AIDS patients. *JPEN* 23:S7, 1999.  
Ref Type: Abstract

191. **Nissen SL, Flakoll PJ and Abumrad NN.** Method of promoting nitrogen retention in humans. *U S Patent* 5,348,979:1-8, 1994.  
Ref Type: Patent
192. **Nissen SL.** Method for improving a human's perception of his emotional state. *U S Patent* 6,291,525:1-7, 2001.  
Ref Type: Patent
193. **Nissen SL.** Feed compositions for domestic animals containing hydroxymethylbutyrate. *U S Patent* 5,087,472:1-8, 1992.  
Ref Type: Patent
194. **Nissen SL.** Method for increasing the aerobic capacity of muscle. *U S Patent* 6,103,764:1-5, 2000.  
Ref Type: Patent
195. **Nissen SL.** Method of enhancing immune response of mammals. *U S Patent* 4,992,470:1-6, 1991.  
Ref Type: Patent
196. **Nissen SL.** Method of raising meat producing animals to increase lean tissue development. *U S Patent* 5,028,440:1-10, 1991.  
Ref Type: Patent
197. **Nissen SL.** Method of reducing blood levels of total cholesterol and low-density lipoprotein cholesterol. *U S Patent* 5,360,613:1-10, 1994.  
Ref Type: Patent
198. **Nissen SL and Abumrad N.** Composition comprising  $\beta$ -hydroxy- $\beta$ -methylbutyric acid and at least one amino acid and methods of use. *U S Patent* 6,031,000:1-10, 2000.  
Ref Type: Patent
199. **Nissen SL.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate. In J.A. Driskell (Ed.) *Sports Nutrition: Fats and Proteins* Ch. 12, Boca Raton: CRC Press, pp 221-241, 2007.  
Ref Type: Review
200. **Noh KK, Chung KW, Choi YJ, Park MH, Jang EJ, Park CH, Yoon C, Kim ND, Kim MK and Chung HY.** beta-Hydroxy beta-methylbutyrate improves dexamethasone-induced muscle atrophy by modulating the muscle degradation pathway in SD rat. *PLoS One* 9: e102947, 2014.
201. **Nonnecke B, Franklin ST and Nissen S.** Leucine and its catabolites alter mitogen-stimulated DNA synthesis by bovine lymphocytes. *J. Nutr.* 121:1665-1672, 1991.
202. **Nunan D, Howatson G and van Someren KA.** Exercise-induced muscle damage is not attenuated by beta-hydroxy-beta-methylbutyrate and alpha-ketoisocaproic acid supplementation. *J. Strength Cond. Res.* 24:531-537, 2010.
203. **Nunes EA, Kuczera D, Brito GA, Bonatto SJ, Yamazaki RK, Tanhoffer RA, Mund RC, Kryczyk M and Fernandes LC.** Beta-hydroxy-beta-methylbutyrate supplementation reduces tumor growth and tumor cell proliferation ex vivo and prevents cachexia in Walker 256 tumor-bearing rats by modifying nuclear factor-kappaB expression. *Nutr. Res.* 28:487-493, 2008.
204. **Nunes EA, Lomax AR, Noakes PS, Miles EA, Fernandes LC and Calder PC.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate modifies human peripheral blood mononuclear cell proliferation and cytokine production in vitro. *Nutr.* 27:92-99, 2011.
205. **Nunes EA, Goncalves-Neto LM, Ferreira FB, dos S Santos C, Fernandes LC, Boschero AC, Calder PC and Rafacho A.** Glucose intolerance induced by glucocorticoid excess is further



- impaired by co-administration with beta-hydroxy-beta-methylbutyrate in rats. *Appl. Physiol. Nutr. Metab.* 38: 1137-1146, 2013.
206. **O'Connor DM and Crowe MJ.** Effects of beta-hydroxy-beta-methylbutyrate and creatine monohydrate supplementation on the aerobic and anaerobic capacity of highly trained athletes. *J. Sports Med. Phys. Fitness* 43:64-68, 2003.
207. **O'Connor DM and Crowe MJ.** Effects of six weeks of beta-hydroxy-beta-methylbutyrate (HMB) and HMB/creatine supplementation on strength, power, and anthropometry of highly trained athletes. *J. Strength Cond. Res.* 21:419-423, 2007.
208. **Ogura, Y, Yuki, N, Sukegane, A, Nishi, T, Miyake, Y, Sato, H, Miyamoto, C, and Mihara, C.** Treatment of pressure ulcers in patients with declining renal function using arginine, glutamine, and  $\beta$ -hydroxy- $\beta$ -methylbutyrate. *J. Wound Care* 24:478-482, 2015.
209. **Olveira G, Olveira C, Dona E, Palenque FJ, Porrás N, Dorado A, Godoy AM, Rubio-Martinez E, Rojo-Martinez G and Martín-Valero R.** Oral supplement enriched in HMB combined with pulmonary rehabilitation improves body composition and health related quality of life in patients with bronchiectasis (Prospective, Randomised Study). *Clin. Nutr.* 35: 1015-1022, 2016.
210. **Orzechowski A, Ostaszewski P, Brodnicka A, Wilczak M, Jank M, Balasinska B, Mrowczynska A and Ploszaj T.** Whole body antioxidant status in young growing rats induced by dexamethasone and the effect of 3-hydroxy-3-methylbutyrate (HMB) treatment on recovery after dexamethasone treatment. *J. Anim. Sci.* 76(Suppl. 1):137, 1998.  
Ref Type: Abstract
211. **Ostaszewski P, Balasinska B, Podgurniak M and Barej, W. Kwas** 3-hydroxy-3-methylbutyrate (HMB) w reakcjach immunologicznych alergii pokarmowej u świń morskich. *Medycyna Wet.* 51:100-102, 1995.
212. **Ostaszewski P, Grzelkowska K, Balasinska B, Barej W and Nissen S.** Effects of 3-hydroxy-3-methylbutyrate and 2-oxoisocaproate on body composition and cholesterol metabolism in rabbits. *VII Symposium on Protein Metabolism and Nutrition, Vale de Santarim* 162, 1995.  
Ref Type: Abstract
213. **Ostaszewski P, Grzelkowska K, Motyl T, Balasinska B, Barej W and Nissen S.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate and 2-oxoisocaproate affect body composition and cholesterol concentration in rabbits, *J. Anim. Physiol. a. Anim. Nutr.* 79:135-145, 1998.
214. **Ostaszewski P, Kostiuk S, Balasińska B, Jank M, Papet I and Glomot F.** The leucine metabolite 3-hydroxy-3-methylbutyrate (HMB) modifies protein turnover in muscles of laboratory rats and domestic chickens in vitro. *J. Anim. Physiol. a. Anim. Nutr.* 84:1-8, 2000.
215. **Ostaszewski P, Kostiuk S, Balasinska B, Papet I, Glomot F and Nissen S.** The effect of the leucine metabolite 3-hydroxy 3-methyl butyrate (HMB) on muscle protein synthesis and protein breakdown in chick and rat muscle. *J. Anim. Sci.* 74:138, 1996.  
Ref Type: Abstract
216. **Ostaszewski P, Kowalska A, Szarska E, Szpotanski P, Cywinska A, Balasinska B and Sadkowski T.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate and  $\gamma$ -oryzanol on blood biochemical markers in exercising Thoroughbred race horses. *J. Equine Vet. Sci.* 32:542-551, 2012.
217. **Ostaszewski P, Kozłowska E, Siwicki AK, Krzyzanowski J, Fuller JC Jr and Nissen S.** The immunomodulating activity of dietary 3-hydroxy-3-methylbutyrate (HMB) in weanling pigs. *J. Anim. Sci.* 76(Suppl. 1):136, 1998.  
Ref Type: Abstract

218. **Ostaszewski P, Papet I, Nissen S, Glomot F, Grizard J and Amal M.** Dietary supplementation of 3-hydroxy-3-methyl butyrate improves catch-up growth in underfed lambs. *Ann. Zootech.* 43:308, 1994.  
Ref Type: Abstract
219. **Ostaszewski P, Siwicki AK, Skrzek Z, Balasinska B, Fuller JC Jr and Nissen S.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) fed in the water enhances immune response in young broilers, *Poultry Sci.* 77:(Suppl. 1):26, 1998.  
Ref Type: Abstract
220. **Paddon-Jones D, Keech A and Jenkins D.** Short-term beta-hydroxy-beta-methylbutyrate supplementation does not reduce symptoms of eccentric muscle damage. *Int. J. Sport Nutr. Exerc. Metab.* 11:443-451, 2001.
221. **Palisin T and Stacy JJ.** Beta-hydroxy-beta-Methylbutyrate and its use in athletics. *Curr. Sports Med. Rep.* 4: 220-223, 2005.  
Ref Type: Review
222. **Panton L, Rathmacher J, Fuller J, Gammon J, Cannon L, Stettler S, and Nissen S.** Effect of  $\beta$ -hydroxy  $\beta$ -methylbutyrate (HMB) and resistance training on strength and functional ability in the elderly. *Med. & Sci. in Sports & Exer.* 30:S194, 1998.  
Ref Type: Abstract
223. **Panton LB, Rathmacher JA, Baier S and Nissen S.** Nutritional supplementation of the leucine metabolite  $\beta$ -hydroxy  $\beta$ -methylbutyrate (HMB) during resistance training. *Nutr.* 16:734-739, 2000.
224. **Papet I, Ostaszewski P, Glomot F, Obled C, Faure M, Bayle G, Nissen S, Arnal M and Grizard J.** The effect of a high dose of 3-hydroxy-3-methylbutyrate on protein metabolism in growing lambs. *Br. J. Nutr.* 77:885-896, 1997.
225. **Park BS, Henning PC, Lee SR, Wilson JM, Park YM, Jo E, Khamoui AV, Zourdos MC and Kim JS.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) improves myogenesis and maintains strength in male mice during a 6-week catabolic condition. *FASEB J.* 25:1105.6, 2011.  
Ref Type: Abstract
226. **Park YM, Lee SR, Wilson JM, Henning PC, Grant SC, Arjmandi BH, Rathmacher JA and Kim JS.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on myogenesis in old rats during resistance training. *Med. & Sci. in Sports & Exer.* 43:145, 2011.  
Ref Type: Abstract
227. **Park YM, Lee SR, Wilson JM, Henning PC, Ugrinowitsch C, Zourdos MC, Arjmandi BH, Rathmacher JA and Kim JS.** Effects of HMB on muscle IGF-I and MGF mRNA expression in aged female rats during 10-week resistance training. *FASEB J.* 24:621.4, 2010.  
Ref Type: Abstract
228. **Park BS, Henning PC, Grant SC, Lee WJ, Lee SR, Arjmandi BH and Kim JS.** HMB attenuates muscle loss during sustained energy deficit induced by calorie restriction and endurance exercise. *Metabolism* 62: 1718-1729, 2013.
229. **Payne ET, Yasuda N, Bourgeois JM, Devries MC, Rodriguez MC, Yousuf J and Tarnopolsky MA.** Nutritional therapy improves function and complements corticosteroid intervention in *mdx* mice. *Muscle & Nerve* 33:66-77, 2006.
230. **Peterson A, Qureshi MA, Ferket PR and Fuller J.** *In vitro* exposure with  $\beta$ -hydroxy- $\beta$ -methyl butyrate enhances macrophage growth and function. *Poultry Sci.* 75:7, 1996.  
Ref Type: Abstract

231. **Peterson A, Qureshi MA, Ferket PR and Fuller J.**  $\beta$ -Hydroxy- $\beta$ -methyl butyrate is a positive modulator of chicken macrophage growth and function. *Poultry Sci.* 75:139, 1996.  
Ref Type: Abstract
232. **Peterson AL, Qureshi MA, Ferket PR and Fuller J.** Enhancement of cellular and humoral immunity by  $\beta$ -hydroxy- $\beta$ -methyl butyrate in young broilers. *Poultry Sci.* 76:114, 1997.  
Ref Type: Abstract
233. **Peterson AL.** *In vitro and in vivo effects of HMB on cellular and humoral immune response in broilers.* M.S. Thesis, North Carolina State University, Raleigh, NC, 1997.  
Ref Type: Thesis
234. **Peterson AL, Qureshi MA, Ferket PR and Fuller JC Jr.** In vitro exposure with  $\beta$ -hydroxy- $\beta$ -methylbutyrate enhances chicken macrophage growth and function. *Vet. Immunol. Immunopath.* 67:67-78, 1999.
235. **Peterson AL, Qureshi MA, Ferket PR and JC Fuller JC Jr.** Enhancement of cellular and humoral immunity in young broilers by the dietary supplementation of  $\beta$ -hydroxy- $\beta$ -methylbutyrate. *Immunopharm. Immunotox.* 21:307-330, 1999.
236. **Phillips SM.** Nutritional supplements in support of resistance exercise to counter age-related sarcopenia. *Adv Nutr* 6: 6452-6460, 2015.  
Ref Type: Review
237. **Pimentel GD, Rosa JC, Lira FS, Zanchi NE, Ropelle ER, Oyama LM, do Nascimento CMO, de Mello MT, Tufik, S and Santos RVT.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) supplementation stimulates skeletal muscle hypertrophy in rats via the mTOR pathway. *Nutr. Metab.(London)* 8:11, 2011.
238. **Pinheiro CH, Gerlinger-Romero F, Guimarães-Ferreira L, de Souza-Jr AL, Vitzel KF, Nachbar RT, Nunes MT and Curi R.** Metabolic and functional effects of beta-hydroxy-beta-methylbutyrate (HMB) supplementation in skeletal muscle. *Eur. J. Appl. Physiol.* 112:2531-2537, 2012.
239. **Pittler MH and Ernst E.** Dietary supplements for body-weight reduction: a systematic review. *Am. J. Clin. Nutr.* 79:529-536, 2004.  
Ref Type: Review
240. **Portal S, Eliakim A, Nemet D, Halevy O and Zadik Z.** Effect of HMB supplementation on body composition, fitness, hormonal profile and muscle damage indices. *J. Pediatr. Endocrinol. Metab* 23:641-650, 2010.  
Ref Type: Review
241. **Portal S, Zadik Z, Rabinowitz J, Pilz-Burstein R, Adler-Portal D, Meckel Y, Cooper D, Eliakim A and Nemet D.** The effect of HMB supplementation on body composition, fitness, hormonal and inflammatory mediators in elite adolescent volleyball players: a prospective randomized, double-blind, placebo-controlled study. *Eur. J. Appl. Physiol.* 111:2261-2269, 2011.
242. **Qiao X, Zhang HJ, Wu SG, Yue HY, Zuo JJ, Feng DY and Qi GH.** Effect of beta-hydroxy-beta-methylbutyrate calcium on growth, blood parameters, and carcass qualities of broiler chickens. *Poult Sci* 92: 753-759, 2013.
243. **Rahman, A, Wilund, K, Fitschen, PJ, Jeejeebhoy, K, Agarwala, R, Drover, JW, and Mourtzakis, M.** Elderly persons with ICU-acquired weakness: The potential role for  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) supplementation? *JPEN* 38:567-575, 2014.  
Ref Type: Review

244. **Ramachandran S, Ehling S, Sheeram S and Reddy TM.** Development and validation of a high-throughput LC-MS/MS method for the analysis of endogenous hydroxy-methylbutyrate in human plasma. *Biomed. Chromatog.* (in Press), 2017.  
Ref Type: Analytical Method
245. **Ransone J, Neighbors K, Lefavi R and Chromiak J.** The effect of beta-hydroxy beta-methylbutyrate on muscular strength and body composition in collegiate football players. *J. Strength Cond. Res.* 17:34-39, 2003.
246. **Ransone JW, Neighbors KL, Adams TB, Jacobson BH and LeFavi RG.** The effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation on muscular strength in collegiate athletes during a strenuous exercise program, *Med. & Sci. in Sports & Exer.* 32:S61, 2000.  
Ref Type: Abstract
247. **Rathmacher JA, Nissen S, Feleke G, Din M, Clark R, Yasmin , Singh G, Khan F and Abumrad N.** Effect of withdrawal of beta-hydroxy beta-methylbutyrate, glutamine, and arginine on body composition in AIDS patients. *JPEN* 24:S12, 2000.  
Ref Type: Abstract
248. **Rathmacher JA, Nissen S, Panton L, Clark RH, Eubanks MP, Barber AE, D'Olimpio J and Abumrad NN.** Supplementation with a combination of beta-hydroxy-beta-methylbutyrate (HMB), arginine, and glutamine is safe and could improve hematological parameters. *JPEN* 28:65-75, 2004.
249. **Rathmacher JA, Nissen SL, Panton L, Fuller JC Jr, Clark R H, Singh G and Abumrad NN.** Safety of a nutritional mixture of  $\beta$ -hydroxy  $\beta$ -methylbutyrate (HMB), glutamine and arginine in healthy young adults and patients with AIDS. *JPEN* 23:S10, 1999.  
Ref Type: Abstract
250. **Rathmacher JA, Zachwieja JJ, Smith SR, Lovejoy JL and Bray GA.** The effect of the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate on lean body mass and muscle strength during prolonged bedrest. *FASEB J.* 13:A909, 1999.  
Ref Type: Abstract
251. **Rathmacher J, Fuller J, Jr., Baier S, Nissen S and Abumrad N.** Nutritional intervention for improving muscular function and strength. *U S Patent* 8,815,280: 1-22, 2014.  
Ref Type: Patent
252. **Redd MJ, Hoffman JR, Gepner Y, Stout JR, Hoffman MW, Ben-Dov D, Funk S, Church DD, Avital G, Chen Y, Frankel H and Ostfeld I.** The effect of HMB ingestion on the IGF-I and IGF binding protein response to high intensity military training. *Growth Horm. IGF Res.*, 2016.
253. **Rice DE, Sharp R, Rathmacher J, Ray M, Abumrad NN and Nissen SL.** Role of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) during acute exercise-induced proteolysis. *Med. & Sci. in Sports & Exer.* 27:S220, 1995.  
Ref Type: Abstract
254. **Rittig N, Bach E, Thomsen HH, Moller AB, Hansen J, Johannsen M, Jensen E, Serena A, Jorgensen JO, Richelsen B, Jessen N and Moller N.** Anabolic effects of leucine-rich whey protein, carbohydrate, and soy protein with and without beta-hydroxy-beta-methylbutyrate (HMB) during fasting-induced catabolism: A human randomized crossover trial. *Clin Nutr* 2016.
255. **Robinson EH, Stout JR, Miramonti AA, Fukuda DH, Wang R, Townsend JR, Mangine GT, Fragala MS and Hoffman JR.** High-intensity interval training and beta-hydroxy-beta-methylbutyric free acid improves aerobic power and metabolic thresholds. *J Int Soc Sports Nutr* 11: 16, 2014.

256. **Rowlands DS and Thomson JS.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation during resistance training on strength, body composition, and muscle damage in trained and untrained young men: A meta-analysis. *J. Strength Cond. Res.* 23:836-846, 2009.  
Ref Type: Meta-Analysis
257. **Russ DW, Acksel C, Boyd IM, Maynard J, McCorkle KW, Edens NK and Garvey SM.** Dietary HMB and beta-alanine co-supplementation does not improve in situ muscle function in sedentary, aged male rats. *Appl. Physiol. Nutr. Metab.* 40:1294-1301, 2015.
258. **Russell ST and Tisdale MJ.** Mechanism of attenuation by beta-hydroxy-beta-methylbutyrate of muscle protein degradation induced by lipopolysaccharide. *Mol. Cell. Biochem.* 330:171-179, 2009.
259. **Salto, R, Vilchez, JD, Girón MD, Cabrera E, Campos N, Manzano, M, Rueda R, López-Pedrosa JM.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) promotes neurite outgrowth in Neuro2a cells. *PLOS One* 10(8):e0135614, 2015.
260. **Sandberg JL.** *The effect of intensive training and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on the physiological response to exercise in horses.* M.S. Thesis, Iowa State University, 1998.  
Ref Type: Thesis
261. **Sandberg L, Miller P and Fuller JC Jr.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on the physiological response to exercise and conditioning in horses, *J. Anim. Sci.* 75:(Suppl. 1):198, 1997.  
Ref Type: Abstract
262. **Sandberg L, Miller P and Fuller JC Jr.** The effect of intensive training and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on muscle glycogen concentrations in the horse. *J. Anim. Sci.* 76(Suppl. 1):175, 1998.  
Ref Type: Abstract
263. **Santos-Fandila A, Zafra-Gomez A, Barranco A, Navalon A, Rueda R and Ramirez M.** Quantitative determination of beta-hydroxymethylbutyrate and leucine in culture media and microdialysates from rat brain by UHPLC-tandem mass spectrometry. *Anal Bioanal Chem* 406: 2863-2872, 2014.  
Ref Type: Analytical Method
264. **Schnuck JK, Johnson MA, Gould LM, Gannon NP and Vaughan RA.** Acute beta-Hydroxy-beta-Methyl Butyrate Suppresses Regulators of Mitochondrial Biogenesis and Lipid Oxidation While Increasing Lipid Content in Myotubes. *Lipids* 51:1127-1136, 2016.
265. **Seker D, Ergil J, Ozkan D, Akinci M, Yalcindag A, Ginis Z, Seker G and Arik E.** The effects of supplementation with a mixture of arginine, glutamine, and beta-hydroxy beta-methylbutyrate on the healing of colon anastomoses. *Acta. Chir. Belg.* 113: 444-448, 2013.
266. **Sharawy MH, El-Awady MS, Megahed N and Gameil NM.** The ergogenic supplement beta-hydroxy-beta-methylbutyrate (HMB) attenuates insulin resistance through suppressing GLUT-2 in rat liver. *Can. J. Physiol. Pharmacol.* 94:488-497, 2016.
267. **Shirato M, Tsuchiya Y, Sato T, Hamano S, Gushiken T, Kimura N and Ochi E.** Effects of combined beta-hydroxy-beta-methylbutyrate (HMB) and whey protein ingestion on symptoms of eccentric exercise-induced muscle damage. *J. Int. Soc. Sports Nutr.* 13: 7, 2016.
268. **Shreeram S, Johns PW, Subramaniam S, Ramesh S, Vaidyanathan V, Puthan JK, Mandal S, Mamidi VK and Gelling RW.** The relative bioavailability of the calcium salt of beta-hydroxy-beta-methylbutyrate is greater than that of the free fatty acid form in rats. *J. Nutr.* 144: 1549-1555, 2014.

269. **Shreeram S, Ramesh S, Puthan JK, Balakrishnan G, Subramanian R, Reddy MT and Pereira SL.** Age associated decline in the conversion of leucine to beta-hydroxy-beta-methylbutyrate in rats. *Exp. Gerontol.* 80: 6-11, 2016.
270. **Sikorski E, Wilson JM, Lowery RP, Duncan NM, Davis GS, Rathmacher JA, Baier SM, Naimo MA, Wilson SMC, Dunsmore KA, Walters J, Joy J and Morrison TJ.** The acute effects of a free acid beta-hydroxy-beta-methylbutyrate supplement on muscle damage following resistance training: a randomized, double-blind, placebo-controlled study. *J. Int. Soc. Sports Nutr.* 9(Suppl. 1):P27, 2012.  
Ref Type: Abstract
271. **Singh G, Clark RH, Feleke G, Din M, Yasmin T, Kahan F, Rathmacher JA, Nissen SL and Abumrad NN.** Improvement in immune status in wasting AIDS patients by providing muscle and immune tissue-specific nutrition. Presented at the 6<sup>th</sup> Conference on Retroviruses and Opportunistic Infections (Abstract 702), 1999.  
Ref Type: Abstract
272. **Sipahi S, Gungor O, Gunduz M, Cilci M, Demirci MC and Tamer A.** The effect of oral supplementation of beta-hydroxy-beta-methylbutyrate, arginine and glutamine on wound healing: a retrospective analysis of diabetic haemodialysis patients. *BMC Nephrology* 14:8, 2013.
273. **Siwicki AK, Fuller J Jr, Nissen S, Ostaszewski P and Studnicka M.** In vitro effects of beta-hydroxy-beta-methylbutyrate (HMB) on cell-mediated immunity in fish. *Vet. Immunol. Immunopathol.* 76:191-197, 2000.
274. **Siwicki AK, Fuller JC Jr, Nissen S, Morand M, Pozet F, Vincent F and Kazun B.** Effect of HMB ( $\beta$ -hydroxy- $\beta$ -methylbutyrate) on in vitro proliferative responses of Sheatfish (*Silurus glanis*) and catfish (*Ictalurus melas*) lymphocytes stimulated by mitogens. *Acta. Vet. Brno* 73:119-122, 2004.
275. **Siwicki AK, Morand M, Fuller J Jr, Nissen S, Goryczko K, Ostaszewski P, Kazun K and Glombski E.** Influence of feeding the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on the nonspecific cellular and humoral defence mechanisms of rainbow trout (*Oncorhynchus mykiss*). *J. Appl. Ichthyol.* 19:44-48, 2003.
276. **Siwicki AK, Morand M, Fuller JC Jr, Nissen S, Kazun K and Glombski E.** Influence of HMB ( $\beta$ -hydroxy- $\beta$ -methylbutyrate) on antibody secreting cells (ASC) after in vitro and in vivo immunization with the anti-*Yersinia ruckeri* vaccine of rainbow trout (*Oncorhynchus mykiss*). *Vet. Res.* 32:491-498, 2001.
277. **Siwicki AK, Morand M, Fuller JC Jr, Nissen S., Kazun KI, Glabski E and Ostaszewski P.** Influence of 3-hydroxy-3-methylbutyrate (HMB) on specific cellular immune response after *in vitro* and *in vivo* immunization with *Yersinia ruckeri* antigen. *J. Anim. Sci.* 76(Suppl. 1):136, 1998.  
Ref Type: Abstract
278. **Siwicki AK, Morand M, Goryczko K, Ostaszewski P, Fuller JC Jr and Nissen S.** Immunomodulating effect of 3-hydroxy-3-methylbutyrate (HMB) on the nonspecific cellular and humoral defense mechanisms in rainbow trout (*Oncorhynchus mykiss*). *J. Anim. Sci.* 76(Suppl. 1):137, 1998.  
Ref Type: Abstract
279. **Siwicki AK, Ostaszewski P, Fuller JC Jr, Nissen S and Studnicka M.** *In vitro* effects of 3-hydroxy-3-methylbutyrate (HMB) on measures of immune function and immunocompetence in fish. *J. Anim. Sci.* 76(Suppl. 1):136, 1998.  
Ref Type: Abstract

280. **Siwicki AK, Zakes Z, Fuller JC Jr, Nissen S, Kazum K and Glabski E.** The influence of HMB on cell-mediated immunity in tench *Tinca tinca* (L.): in vitro and in vivo study. *Aquaculture Int.* 14:153-161, 2006.
281. **Siwicki AK, Zakes Z, Fuller JC Jr, Nissen S, Trapkowska S, Glabski E, Kazum K, Kowalska A and Terech-Majewska E.** The effect of feeding the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on cell mediated immunity and protection against *Yersinia ruckeri* in pikeperch (*Sander lucioperca*). *Aquaculture Res.* 36:16-21, 2005.
282. **Slater G, Jenkins D, Logan P, Lee H, Vukovich MD, Rathmacher JA and Hahn AG.**  $\beta$ -Hydroxy  $\beta$ -methylbutyrate (HMB) supplementation does not affect changes in strength or body composition during resistance training in trained men. *Int. J. Sport Nutr. Exerc. Metab.* 11:384-396, 2001.
283. **Slater GJ, Logan PA, Boston T, Gore CJ, Stenhouse A and Hahn AG.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) supplementation does not influence the urinary testosterone:epitestosterone ratio in healthy males. *J. Sci. Med. Sport* 3:79-83, 2000.
284. **Slater, GJ and Jenkins, D.** Beta-hydroxy-beta-methylbutyrate (HMB) supplementation and the promotion of muscle growth and strength. *Sports Med.* 30:105-116, 2000.  
Ref Type: Review
285. **Sliwa E, Adaszek Ł, Tatara M and Dobrowolski P.** Short- and long-term consequences on biochemical markers after fundectomy in pigs supplemented with 3-hydroxy-3-methylbutyrate and alpha-ketoglutarate, *Berliner und Munchener Tierarztliche Wochenschrift* 123:397-405, 2010.
286. **Smith AE, Stout JR, Kendall KL, Fukuda DH, Moon JR, Rea ML, Johnson CD and Cramer JT.** Effect of  $\beta$ -hydroxy- $\beta$ -Methylbutyrate (HMB) and resistance training on body composition and functionality in elderly women (65–89 yrs). *FASEB J.* 25:1b229, 2011.  
Ref Type: Abstract
287. **Smith HJ, Mukerji P and Tisdale MJ.** Attenuation of proteasome-induced proteolysis in skeletal muscle by  $\beta$ -hydroxy- $\beta$ -methylbutyrate in cancer-induced muscle loss. *Cancer Res.* 65:277-283, 2005.
288. **Smith HJ, Wyke SM and Tisdale MJ.** Mechanism of the attenuation of proteolysis-inducing factor stimulated protein degradation in muscle by beta-hydroxy-beta-methylbutyrate. *Cancer Res.* 64:8731-8735, 2004.
289. **Soares, JMC, Povoas S, Neuparth, MJ and Duarte, JA.** The effects of beta-hydroxy-beta-methylbutyrate (HMB) on muscle atrophy induced by immobilization. *Med. & Sci. in Sports & Exerc.* 33:140, 2001.  
Ref Type: Abstract
290. **Sousa MF, Abumrad NN, Martins C, Nissen S and Riella MC.** Calcium  $\beta$ -hydroxy- $\beta$ -methylbutyrate. Potential role as a phosphate binder in uremia: In vitro study. *Nephron* 72:391-394, 1996.
291. **Stancliffe RA, Eades M, Smart K and Zemel MB.** Role of mTOR and  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) in leucine stimulation of muscle mitochondrial biogenesis and fatty acid oxidation. *FASEB J.* 25:606.1, 2011.  
Ref Type: Abstract
292. **Stancliffe RA and Zemel MB.** Role of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) in leucine stimulation of muscle mitochondrial biogenesis. *FASEB J.* 26:251.6, 2012.  
Ref Type: Abstract

293. **Stout JR, Smith-Ryan AE, Fukuda DH, Kendall KL, Moon JR, Hoffman JR, Wilson JM, Oliver JS and Mustad VA.** Effect of calcium beta-hydroxy-beta-methylbutyrate (CaHMB) with and without resistance training in men and women 65+yrs: a randomized, double-blind pilot trial. *Exp. Gerontol.* 48:1303-1310, 2013.
294. **Stout JR, Fukuda DH, Kendall KL, Smith-Ryan AE, Moon JR and Hoffman JR.** beta-Hydroxy-beta-methylbutyrate (HMB) supplementation and resistance exercise significantly reduce abdominal adiposity in healthy elderly men. *Exp. Gerontol.* 64:33-34, 2015.
295. **Sundberg, P.** *Transmission and immune response studies of toxigenic Pasteurella multocida.* Ph.D. Dissertation, Iowa State University, 1996.  
Ref Type: Dissertation
296. **Supinski GS and Callahan LA.** beta-hydroxy-beta-methylbutyrate (HMB) prevents sepsis-induced diaphragm dysfunction in mice. *Respir. Physiol. Neurobiol.* 196: 63-68, 2014.
297. **Swietlicka I, Muszynski S, Tomaszewska E, Dobrowolski P, Kwasniewska A, Swietlicki M, Skic A and Golacki K.** Prenatally administered HMB modifies the enamel surface roughness in spiny mice offspring: An atomic force microscopy study. *Arch. Oral. Biol.* 70:24-31, 2016.
298. **Szczesniak KA, Ostaszewski P, Fuller JC, Jr., Ciecierska A and Sadkowski T.** Dietary supplementation of beta-hydroxy-beta-methylbutyrate in animals - a review. *J. Anim. Physiol. Anim. Nutr. (Berl)* 99:405-417, 2015.  
Ref Type: Review
299. **Szczesniak KA, Ciecierska A, Ostaszewski P and Sadkowski T.** Characterisation of equine satellite cell transcriptomic profile response to beta-hydroxy-beta-methylbutyrate (HMB). *Br. J. Nutr.* 116:1315-1325, 2016
300. **Tako E, Ferket PR and Uni Z.** Effects of in ovo feeding of carbohydrates and beta-hydroxy-beta-methylbutyrate on the development of chicken intestine. *Poultry Sci.* 83:2023-2028, 2004.
301. **Talleyrand V.** *Effects of beta-hydroxy-beta-methyl butyrate on immune function in calves.* M.S. Thesis, Iowa State University, 1995.  
Ref Type: Thesis
302. **Talleyrand V, Dorn A, Frank D, Roth J and Nissen S.** Effect of feeding  $\beta$ -hydroxy- $\beta$ -methylbutyrate on immune function in stressed calves, *FASEB J.* 8:A951, 1994.  
Ref Type: Abstract
303. **Talleyrand V, Zhang Z, Rathmacher J and Nissen S.** Uptake and output of the leucine metabolite Beta-hydroxy-Beta- methylbutyrate (HMB) across the leg of pigs. *FASEB J.* 7:A71. 1993.  
Ref Type: Abstract
304. **Tatara M.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) administration on volumetric bone mineral density, and morphometric and mechanical properties of tibia in male turkeys. *J. Anim. Physiol. a. Anim. Nutr. (Berl.)* 93:669-677, 2009.
305. **Tatara M.** Neonatal programming of skeletal development in sheep is mediated by somatotrophic axis function. *Exp. Physiol.* 93:763-772, 2008.
306. **Tatara MR, E Sliwa E, W Krupski W and Worzakowska M.** 3-Hydroxy-3-methylbutyrate administration diminishes fundectomy-induced osteopenia of the lumbar spine in pigs. *Nutr.* 24:753-760, 2008.
307. **Tatara MR, Krupsik W, Siliwa E, Ostaszewski P, Pierzynowski SG and Studzinski T.** Effects of HMB administration to pregnant sows on femur properties in offspring at slaughter. *Bone* 36:S393, 2005.



Ref Type: Abstract

308. **Tatara MR, Krupsik W, Siliwa E, Ostaszewski P, Pierzynowski SG and Studzinski T.** Effects of 3-hydroxy-3-methylbutyrate (HMB) and alpha-ketoglutarate (AKG) administration to pregnant sows on prenatal programming of bone properties in offspring at slaughter. *Baltic Bone and Cartilage Conference 5*, Naantali, Finland, p. 146, September 2005.  
Ref Type: Abstract
309. **Tatara MR, Krupsik W, Tymczyna B and Studzinski T.** Effects of combined maternal administration with alpha-ketoglutarate (AKG) and beta-hydroxy-beta-methylbutyrate (HMB) on prenatal programming of skeletal properties in the offspring. *Nutr. Metab. (London)* 9:39, 2012.
310. **Tatara MR, Sliwa E and Krupski W.** Prenatal programming of skeletal development in the offspring: effects of maternal treatment with beta-hydroxy-beta-methylbutyrate (HMB) on femur properties in pigs at slaughter age. *Bone* 40:1615-1622, 2007.
311. **Tatti P, Masselli L, Di Mauro P, Strollo F and Pipicelli G.** Systemic effects of specific nutrition for wound healing: Retinal fundus changes. Abstract LB-1006, 32nd ESPEN Congress, Nice, France 2010.  
Ref Type: Abstract
312. **Thompson JS.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) supplementation of resistance trained men. *Asia Pac. J. Clin. Nutr.* 13(Suppl. 1):S59, 2004.  
Ref Type: Abstract
313. **Thomson JS, Watson PE and Rowlands DS.** Effects of nine weeks of  $\beta$ -hydroxy- $\beta$ -methylbutyrate supplementation on strength and body composition in resistance trained men. *J. Strength Cond. Res.* 3:827-835, 2009.
314. **Tisdale MJ.** The ubiquitin-proteasome pathway as a therapeutic target for muscle wasting. *J. Support. Oncol.* 3:209-217, 2005.  
Ref Type: Review
315. **Tisdale MJ.** Clinical anticachexia treatments. *Nutr. Clin. Pract.* 21:168-174, 2006.  
Ref Type: Review
316. **Tisdale MJ.** Catabolic mediators of cancer cachexia. *Curr. Opin. Support. Palliat. Care* 2:256-261, 2008.  
Ref Type: Review
317. **Tomaszewska E, Dobrowolski P, Kostro K, Jakubczak A, Tazskun I, Jaworska-Adamu J, Zmuda A, Rycerz K and Muszynski S.** Effect of HMB and 2-Ox administered during pregnancy on bone properties in primiparous and multiparous minks (*Neivison vison*). *Bull. Vet. Inst. Pulawy* 59:563-568, 2015.
318. **Townsend JR, Fragala MS, Jajtner AR, Gonzalez AM, Wells AJ, Mangine GT, Robinson EH, McCormack WP, Beyer KS, Pruna GJ, Boone CH, Scanlon TM, Bohner JD, Stout JR and Hoffman JR.** beta-Hydroxy-beta-methylbutyrate (HMB)-free acid attenuates circulating TNF-alpha and TNFR1 expression postresistance exercise. *J Appl Physiol (1985)* 115: 1173-1182, 2013.
319. **Townsend JR, Hoffman JR, Gonzalez AM, Jajtner AR, Boone CH, Robinson EH, Mangine GT, Wells AJ, Fragala MS, Fukuda DH and Stout JR.** Effects of beta-Hydroxy-beta-methylbutyrate free acid ingestion and resistance exercise on the acute endocrine response. *Int J Endocrinol* 2015:856708, 2015.
320. **Uni Z, Ferket PR, Tako E and Kedar O.** In ovo feeding improves energy status of late-term chicken embryos. *Poultry Sci.* 84:764-770, 2005.

321. **Vallejo J, Spence M, Cheng AL, Brotto L, Edens NK, Garvey SM and Brotto M.** Cellular and Physiological Effects of Dietary Supplementation with beta-Hydroxy-beta-Methylbutyrate (HMB) and beta-Alanine in Late Middle-Aged Mice. *PLoS One* 11: e0150066, 2016
322. **Van Koevering M and Nissen S.** Oxidation of leucine and alpha-ketoisocaproate to  $\beta$ -hydroxy- $\beta$ -methylbutyrate in vivo. *Am. J. Physiol.* 262:E27-E31, 1992.
323. **Van Koevering MT, Dolezal HG, Gill DR, Owens FN, Strasia CA, Buchanan DS, Lake R and Nissen S.** Effects of beta-hydroxy-beta-methyl butyrate on performance and carcass quality of feedlot steers. *J. Anim. Sci.* 72:1927-1935, 1994.
324. **Van Koevering MT, Gill DR, Smith RA, Owens FN, Nissen S and Ball RL.** Effect of  $\beta$ -hydroxy- $\beta$ -methyl butyrate on the health and performance of shipping-stressed calves. *Oklahoma State Univ. Res. Rep.* pp. 312-316, 1993.
325. **Van Someren KA, Edwards AJ and Howatson G.** Supplementation with  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) and  $\alpha$ -Ketoisocaproic Acid (KIC) reduced signs and symptoms of exercise-induced muscle damage in man. *Int. J. Sport Nutr. & Exer. Met.* 15:413-424, 2005.
326. **Vukovich MD and Adams GD.** Effect of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on VO<sub>2</sub> peak and maximal lactate in endurance trained cyclists. *Med. & Sci. in Sports & Exer.* 29:S252, 1997.  
Ref Type: Abstract
327. **Vukovich MD and Dreifort GD.** Effect of beta-hydroxy beta-methylbutyrate on the onset of blood lactate accumulation and V(O)<sub>2</sub> peak in endurance-trained cyclists. *J. Strength Cond. Res.* 15:491-497, 2001.
328. **Vukovich MD, Slater G, Macchi MB, turner MJ, Fallon K, Boston T and Rathmacher J.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate (HMB) kinetics and the influence of glucose ingestion in humans. *J. Nutr. Biochem.* 12:631-639, 2001.
329. **Vukovich MD, Stubbs NB and Bohlken RM.** Body composition in 70-year old adults responds to dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) similar to that of young adults. *J. Nutr.* 131:2049-2052, 2001.
330. **Vukovich MD, Stubbs NB, Bohlken RM, Desch MF, Fuller JC Jr and Rathmacher JA.** The effect of dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on strength gains and body composition changes in older adults. *FASEB J.* 11:A376, 1997.  
Ref Type: Abstract
331. **Vukovich MD, Stubbs NB, Bohlken RM, Desch MF, Fuller JC Jr and Rathmacher JA.** The effect of dietary  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on body composition changes measured by computerized tomography in older adults participating in an exercise program. *FASEB J.* 12:A652, 1998.  
Ref Type: Abstract
332. **Walker DK, Thaden JJ, Wiezchowska-McNew A, Engelen MPKJ and Deutz NEP.** Determination of  $\beta$ -hydroxy- $\beta$ -methylbutyrate concentration and enrichment in human plasma using chemical ionization gas chromatography tandem mass spectrometry. *J. Chromatog. B* 1040:233-238, 2017.  
Ref Type: Analytical Method
333. **Wiąz M, Bratos M, Kaczmarek S, and Rutkowski.** Application of the beta-hydroxy-beta-methylbutyric (HMB) acid in broiler chicken feeding. *Roczniki Naukowe Polskiego Towarzystwa Zootechnicznego* 6:101-108.

334. **Wan HF, Zhu JT, Shen Y, Xiang X, Yin HJ, Fang ZF, Che LQ, Lin Y, Xu SY, Feng B and Wu D.** Effects of Dietary Supplementation of  $\beta$ -hydroxy- $\beta$ -methylbutyrate on Sow Performance and mRNA Expression of Myogenic Markers in Skeletal Muscle of Neonatal Piglets. *Reprod. Domestic. Anim.* 51:135-142, 2016.
335. **Wan H, Zhu J, Su G, Liu Y, Hua L, Hu L, Wu C, Zhang R, Zhou P, Shen Y, Lin Y, Xu S, Fang Z, Che L, Feng B and Wu D.** Dietary supplementation with beta-hydroxy-beta-methylbutyrate calcium during the early postnatal period accelerates skeletal muscle fibre growth and maturity in intra-uterine growth-retarded and normal-birth-weight piglets. *Br J Nutr* 115: 1360-1369, 2016.
336. **Wan H, Zhu, J, Wu C, Zhou P, Shen Y, Lin Y, Xu S, Che L, Feng B, Li J, Fang Z and Wu D.** Transfer of  $\beta$ -hydroxy- $\beta$ -methylbutyrate from sows to their offspring and its impact on muscle fiber type transformation and performance in pigs. *J. Anim. Sci. and Biotechnol.* 8:2, 2017.
337. **Weitzel LB, Sandoval PA, Mayles WJ, Wischmeyer PE.** Performance-enhancing sports supplements: Role in Critical Care. *Crit. Care Med.* 37:S400-S409, 2009.  
Ref Type: Review
338. **Wheatley, SM, El-Kadi, SW, Suryawan, A, Boutry, C, Orellana, RA, Nguyen, HV, Davis, SR, and Davis, TA.** Protein synthesis in skeletal muscle of neonatal pigs is enhanced by administration of  $\beta$ -hydroxy- $\beta$ -methylbutyrate. *Am. J. Physiol.* 306:E91-E99, 2014.
339. **Whittington R, Shoemaker CA, Lim CE and Klesius PH.** Effects of dietary beta-hydroxy-beta-methylbutyrate on growth and survival of tilapia (*Oreochromis niloticus*) vaccinated against *Streptococcus iniae*. *J. Appl. Aquacul.* 14:25-36, 2003.
340. **Williams JZ, Abumrad N and Barbul A.** Effect of a specialized amino acid mixture on human collagen synthesis. Presented at the 122<sup>nd</sup> Annual Meeting of the American Surgical Association, Hot Springs, VA, April 2002.  
Ref Type: Abstract
341. **Williams JZ, Abumrad N and Barbul A.** Effect of a specialized amino acid mixture on human collagen deposition. *Ann. Surg.* 236:369-374, 2002.
342. **Wilkinson DJ, Hossain T, Hill DS, Phillips BE, Crossland H, Williams J, Loughna P, Churchward-Venne TA, Breen L, Phillips SM, Etheridge T, Rathmacher JA, Smith K, Szewczyk NJ and Atherton PJ.** Effect of leucine and its metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate on human skeletal muscle protein metabolism. *J. Physiol.* 591:2911-2923, 2013.
343. **Wilson GJ, Wilson JM and Manninen AH.** Effects of beta-hydroxy-beta-methylbutyrate (HMB) on exercise performance and body composition across varying levels of age, sex, and training experience: A review. *Nutr. Metab. (London)* 5:1, 2008.  
Ref Type: Review
344. **Wilson JM, Kim J, Lee S, Rathmacher J, Koch H, Kingsley JD, Saadat R L and Panton LB.** Acute timing effects of HMB Supplementation on serum indices of muscle damage. *Med. & Sci. Sports & Exer.* 41(5):509, 2009.  
Ref Type: Abstract
345. **Wilson JM, Kim JS, Lee SR, Rathmacher JA, Dalmau B, Kingsley JD, Koch H, Manninen AH, Saadat R and Panton LB.** Acute and timing effects of beta-hydroxy-beta-methylbutyrate (HMB) on indirect markers of skeletal muscle damage. *Nutr. Metab. (London)* 6:6, 2009.
346. **Wilson JM, Lee SR, Henning P, Ugrinowitsch C, Grant S, Park YM, Masad I, Leonard KP, Zourdos M, Bakhshalian N, Panton L and Kim JS.** HMB decreases body fat in middle aged and old rats. *FASEB J.* 24:736.1, 2010.

Ref Type: Abstract

347. **Wilson JM, Lee SR, Grant SC, Henning PC, Masad I, Park YM, Leonard KP, Rathmacher JA, Zourdos M, Panton LB and Kim JS.** Effects of  $\beta$ -hydroxy- $\beta$ -methylbutyrate (HMB) on myofiber dimensions and myogenic capacity in young and old Fisher 334 rats. *Med. & Sci. in Sports & Exer.* 43:850, 2011.

Ref Type: Abstract

348. **Wilson JM, Grant SC, Lee SR, Masad IS, Park YM, Henning PC, Stout JR, Loenneke JP, Arjmandi BH, Panton LB and Kim JS.** Beta-hydroxy-beta-methyl-butyrate blunts negative age-related changes in body composition, functionality and myofiber dimensions in rats. *JISSN* 9:18, 2012.

349. **Wilson JM, Wilson SMC, Loenneke JP, Wray M, Norton LE, Campbell BI, Lowery RP and Stout, JR.** Effects of amino acids and their metabolites on aerobic and anaerobic sports. *Strength and Cond. J.* 34(4):33-48, 2012.

Ref Type: Review

350. **Wilson JM, Fitschen PJ, Campbell B, Wilson GJ, Zanchi N, Taylor L, Wilborn C, Kalman DS, Stout JR, Hoffman JR, Ziegenfuss TN, Lopez HL, Kreider RB, Smith-Ryan AE and Antonio J.** International Society of Sports Nutrition position stand: beta-hydroxy-beta-methylbutyrate (HMB). *JISSN* 10:6, 2013.

Ref Type: Review

351. **Wilson JM, Lowery RP, Joy JM, Walters JA, Sikorski EM, Baier SM, Fuller, Jr., JC, Stout JR, Duncan NM, Wilson SMC, Norton LE and Rathmacher, J.**  $\beta$ -Hydroxy- $\beta$ -methylbutyrate free acid reduces markers of exercise induced muscle damage and improves recovery in resistance trained men. *Br. J. Nutr.* 110:538-544, 2013.

352. **Wilson JM, Lowery RP, Joy JM, Andersen JC, Stout JR, Fuller, Jr. JC, Baier SM, Wilson SMC, Naimo MA and Rathmacher J.** Effects of 12 weeks of beta-hydroxy-beta-methylbutyrate free acid supplementation on muscle mass, strength, and power in resistance trained individuals. *Eur. J. Appl. Physiol.* 114:1217-1227, 2014.

353. **Wójcik R, Malaczewska J, Siwicki AK, Micinski J and Zwierzchowski G.** The effect of beta-hydroxy-beta-methylbutyrate (HMB) on the proliferative response of blood lymphocytes and the phagocytic activity of blood monocytes and granulocytes in calves. *Pol. J. Vet. Sci.* 16: 567-569, 2013.

354. **Wójcik R, Malaczewska J, Siwicki AK, Micinski J and Zwierzchowski G.** The effect of beta-hydroxy-beta-methylbutyrate (HMB) on selected parameters of humoral immunity in calves. *Pol. J. Vet. Sci.* 17: 357-359, 2014.

355. **Wong A, Chew A, Wang CM, Ong L, Zhang SH and Young S.** The use of a specialised amino acid mixture for pressure ulcers: a placebo-controlled trial. *J Wound Care* 23: 259-4, 266, 2014.

356. **Wu, H, Xia, Y, Jiang, J, Du, H, Guo, X, Liu, X, Li, C, Huang, G and Niu, K.** Effect of beta-hydroxy-beta-methylbutyrate supplementation on muscle loss in older adults: a systemic review and meta-analysis. *Arch. Gerontol. Geriatr.* 61:168-175, 2015.

Ref Type: Meta-Analysis

357. **Xing J.** *Efficacy of beta-hydroxy-beta-methylbutyrate (HMB) in free acid gel on indirect markers of skeletal muscle damage.* M.S. Thesis, Iowa State University, 2012.

Ref Type: Thesis

358. **Yani H.** Nutrition for sarcopenia. *J. Clin. Med. Res.* 7:926-931, 2015.

359. **Yavas C, Yavas G, Acar H, Toy H, Yuce D, Akyurek S and Ata O.** Amelioration of radiation –induced acute inflammation and mucosal atrophy by beta-hydroxy-beta-methylbutyrate L-glutamine, L-arginine:results of an experimental study. *Support. Care Cancer* DOI 10.1007/s0020-012-1601-x, 2012.
360. **Yonamine CY, Teixeira SS, Campello RS, Gerlinger-Romero F, Rodrigues CF, Jr., Guimaraes-Ferreira L, Machado UF and Nunes MT.** Beta hydroxy beta methylbutyrate supplementation impairs peripheral insulin sensitivity in healthy sedentary Wistar rats. *Acta Physiol (Oxf)* 212: 62-74, 2014.
361. **Zachwieja JJ, Smith SR, Bray GA, Lovejoy JC, Witt TL, DeLany JP and Rathmacher JA.** Effect of the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate on muscle protein synthesis during prolonged bedrest. *FASEB J.* 13:A1025, 1999.  
Ref Type: Abstract
362. **Zachwieja JJ, Smith SR, Nissen SL and Rathmacher JA.** Beta-hydroxy-beta-methylbutyrate (HMB) is produced in vivo in humans from leucine. *FASEB J.* 14:A747, 2000.  
Ref Type: Abstract
363. **Zanchi NE, Gerlinger-Romero F, Guimarães-Ferreira L, de Siqueira Filho MA, Felitti V, Lira FS, Seelaender M and Lancha AH Jr.** HMB supplementation: clinical and athletic performance-related effects and mechanisms of action. *Amino Acids* 40:1015-1025, 2011.  
Ref Type: Review
364. **Zhang Z.** *Distribution of  $\beta$ -hydroxy- $\beta$ -methyl butyrate in plant and animal tissues.* M.S. Thesis, Iowa State University, 1994.  
Ref Type: Thesis
365. **Zhang Z, Coates C, Rathmacher J and Nissen S.** Distribution of the leucine metabolite  $\beta$ -hydroxy- $\beta$ -methylbutyrate in foods and feeds, *FASEB J.* 8:A464, 1994.  
Ref Type: Abstract
366. **Zhang Z, Talleyrand V, Rathmacher J and Nissen S.** Change in plasma beta-hydroxy-beta-methylbutyrate (HMB) by feeding leucine, alpha-ketoglutarate (KIC) and isovaleric acid (IVA) to pigs. *FASEB J.* 7:A392. 1993.  
Ref Type: Abstract
367. **Zhong Y, Cohen JT, Goates S, Luo M, Nelson J and Neumann PJ.** The cost-effectiveness of oral nutrition supplementation for malnourished older hospital patients. *Appl. Health Econ. Health Pol.* 15:75-83, 2017.

## II. HMB Biochemistry References

368. **Adamson LF and Greenberg DM.** The significance of certain carboxylic acids as intermediates in the biosynthesis of cholesterol. *Biochim. Biophys. Acta* 23: 472-479, 1957
369. **Bachhawat BK, Robinson WG and Coon MJ.** The enzymatic cleavage of beta-hydroxy-beta-methylglutaryl coenzyme A to aceto-acetate and acetyl coenzyme A. *J. Biol. Chem.* 216: 727-736, 1955.
370. **Bachhawat BK, Robinson WG and Coon MJ.** Enzymatic carboxylation of beta-hydroxyisovaleryl coenzyme A. *J. Biol. Chem.* 219:539-550, 1956.
371. **Bloch K, Clark LC and Haray I.** Utilization of branched chain acids in cholesterol synthesis. *J. Biol. Chem.* 211: 687-699, 1954.
372. **Coon MJ.** Enzymatic synthesis of branched chain acids from amino acids. *Fed. Proc.* 14: 762-764, 1955.
373. **Coon MJ, Robinson WG and Bachhawat BK.** Enzymatic studies on the biological degradation of the branched chain amino acids. In *Amino Acid Metabolism*. Edited by Edited by McElroy WD, Glass HB. Baltimore: The Johns Hopkins Press. 1955, pp. 431-441.
374. **Dhar A, Dhar K and Rosazza JPN.** Purification and characterization of a *Galactomyces reessii* hydratase that converts 3-methylcrotonic acid to 3-hydroxy-3-methylbutyric acid. *J. Int. Microbiol. & Biotech.* 28:81-87, 2002.
375. **Frexes-Steed M, Warner ML, Bulus N, Flakoll P and Abumrad NN.** (1990) Role of insulin and branched-chain amino acids in regulating protein metabolism during fasting. *Am. J. Physiol. (Endocrinol. Metab.)* 258: E907-E917, 1990.
376. **Gey KF, Pletsher A, Isler O, Ruegg R and Wursch, J.** The influence of isoprenic C5 and C6 compounds upon the acetate incorporation into cholesterol. *Helvetica Chim. Acta* 40: 2354-2368, 1957.
377. **Gogerty DS and Bobik TA.** Formation of isobutene from 3-hydroxy-3-methylbutyrate by diphosphomevalonate decarboxylase. *Appl. Environ. Microbiol.* 76:8004-8010, 2010.
378. **Hasegawa J, Hamaguchi S, Ogura M and Watanabe K.** Production of  $\beta$ -hydroxycarboxylic acids from aliphatic carboxylic acids by microorganisms. *J Ferment Technol* 59:257-262 1981.
379. **Jaskiewicz J, Popov KM and Harris RA.**  $\alpha$ -Ketoisocaproate dioxygenase, a dual-specificity enzyme corresponds to alloantigen F. *FASEB J.* 9:A1318, 1996.  
Ref Type: Abstract
380. **Landaas S.** Accumulation of 3-hydroxyisobutyric acid, 2-methyl-3-hydroxybutyric acid and 3-hydroxyisovaleric acid in ketoacidosis. *Clin Chim Acta* 64:143-154, 1975.
381. **Lee IY, Nissen SL and Rossa JP.** Conversion of beta-methylbutyric acid to beta-hydroxy-beta-methylbutyrate by *Galactomyces reessii*. *Appl. Environ. Microbiol.* 63:4191-4195, 1997.
382. **Rabinowitz JL, Dituri F, Cobey F and Gurin S.** Branched chain acids in the biosynthesis of squalene and cholesterol. *Fed. Proc.* 14: 760-761, 1955.
383. **Robinson WG, Bachhawat BK and Coon MJ.** Enzymatic carbon dioxide fixation by seneciocyl coenzyme A. *Fed. Proc.* 13: 281, 1954.  
Ref Type: Abstract
384. **Rudney H and Farkas TG.** Biosynthesis of branched chain acids. *Fed. Proc.* 14: 757-759, 1955.

385. **Rudney H.** The synthesis of  $\beta$ -hydroxy- $\beta$ -methylglutaric acid in rat liver homogenates. *J. Am. Chem. Soc.* 76:2595-2596, 1954.
386. **Sabourin PJ and Bieber LL.** Branched-chain  $\alpha$ -keto acid decarboxylases in rat liver. *Fed. Proc.* 38:283, 1979.  
Ref Type: Abstract
387. **Sabourin PJ and Bieber LL.** Formation of  $\beta$ -hydroxyisovalerate by an  $\alpha$ -ketoisocaproate oxygenase in human liver. *Metab* 1983, 32:160-164, 1983.
388. **Sabourin PJ and Bieber LL.** Formation of  $\beta$ -hydroxyisovalerate from  $\alpha$ -ketoisocaproate by a soluble preparation from rat liver. In *Metabolism and clinical implications of branched chain amino and ketoacids*. Edited by Edited by Walser M, Williamson JR. New York, Amsterdam, Oxford: Elsevier North Holland Inc. 1981, pp. 149-154.
389. **Sabourin PJ and Bieber LL.** Purification and characterization of an alpha-ketoisocaproate oxygenase of rat liver. *J. Biol. Chem.* 257:7460-7467, 1982.
390. **Sabourin PJ and Bieber LL.** Subcellular distribution and partial characterization of an  $\alpha$ -ketoisocaproate oxidase of rat liver: formation of  $\beta$ -hydroxyisovaleric acid. *Arch. Biochem. Biophys.* 206:132-144, 1981.
391. **Sabourin PJ and Bieber LL.** The mechanism of  $\alpha$ -ketoisocaproate oxygenase. Formation of  $\beta$ -hydroxyisovalerate from  $\alpha$ -ketoisocaproate. *J. Biol. Chem.* 257:7468-7471, 1982.
392. **Sabourin PJ and Bieber LL.** Purification and assay of alpha-ketoisocaproate dioxygenase from rat liver. *Methods Enzymol.* 166:288-297, 1988.
393. **Spydevold O and Hokland B.** Release of leucine and isoleucine metabolites by perfused skeletal muscle and liver of rat. *Int. J. Biochem.* 15:985-990, 1983.
394. **Zabin I and Bloch K.** The utilization of butyric acid for the synthesis of cholesterol and fatty acids. *J. Biol. Chem.* 192: 261-266, 1951.