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# The Interaction Effect of HMB Supplementation and Eccentric Training on Muscle Hypertrophy Signaling

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**ABSTRACT**

*Resistance exercise is a key component of any training program aiming to increase strength or muscle mass,. Great number of studies emphasizes the importance of eccentric muscle actions as a key component of resistance training programs. ®-Hydroxy ®-methylbutyrate (HMB), a metabolite of the essential amino acidleucine, is one of the latest dietary supplements promoted to enhance gains in strength and lean body mass associated with resistance training. Patients were randomly divided into four groups: 1) control group (n = 6), 2) HMB (n = 6), 3) exercise (n = 6), 4) exercise and HMB (n = 6). After the familiarization stage, supplemental supplementation was performed daily. In HMB and exercise + HMB groups, 480 mg / kg body weight per day was considered. The supplements were dissolved in a milliliter of water and fed to rats. 3 sessions per week, for 6 weeks of exercise exhaust. The rats were anaesthetized and killed after performing the exercise protocol, and the three-body tissue was extracted from the muscle tissue for extraction of the RNA. The results of this study showed that severe eccentric resistance training did not have a significant effect on these levels despite the increase in S6K level (P = 0.01). Also, the results showed that supplemented with eccentric resistance training also had a significant difference on S6K expression level (P = 0.01). However, the results of this study showed that supplementation alone increased the S6K significantly (P = 0.01). The results showed that the combination of resistance and HMB supplemental exercise increased the expression of the S6K factor.*

**Key words:** Premenstrual Syndrome- Health-related Quality of life- Qualitative Study

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## INTRODUCTION

It has been postulated that eccentric actions have the greatest effect on muscle hypertrophy. The potential hypertrophic benefits to eccentric training raise the possibility that muscular growth could be enhanced by supplementing resistance training with eccentric overload training This hypothesis is supported by findings that eccentric actions elicit more rapid elevations in muscle protein synthesis and greater increases in intracellular anabolic signaling and gene expression versus concentric actions [1]

Examining muscle actions and hypertrophy adaptations are somewhat equivocal on the matter. While some studies show that eccentric actions promote greater muscle growth compared to concentric and isometric contractions [2], others have failed to show significant hypertrophic differences between conditions [3].
It has been proposed that an increase in muscle damage may at least partially account for the superior hypertrophic effects of eccentric actions [4]. Although myodamage is seen with the performance of concentric and isometric training eccentric exercise causes the greatest damage to muscle tissue, muscle damage is considered to be one of the three primary mechanisms of exercise-induce muscle hypertrophy [5].although the factors responsible for this phoneme remain to be elucidate ,current theory postulates that structural microtears to contractile elements and the extracellular matrix initiates anabolic processes to reinforce these tissues and thereby safeguard them from future injury Muscle hypertrophy is characterized by a decrease of

degradation and an increase of protein synthesis and is a debilitating phenomenon found in a variety of catabolic conditions such as aging, pyaemia, diabetes, and starvation Accumulating evidence suggests that the phosphatidylinositol-kinase (PI3K)/Akt-dependent mammalian target of3 rapamycin (mTOR) signaling pathway plays an important role in protein synthesis [6]. Akt activation has also been shown to result in the phosphorylation of FoxO transcription factors leading to the exclusion of phosphorylated FoxO proteins from the nucleus and suppression of their transcriptional functions [7] Previous studies have reported that branchedchain amino acids, especially leucine, provoke mTOR phosphorylation which, in turn, enhances eukaryotic initiation factor 4E-binding protein 1 and ribosomal protein S6 kinase, a key molecule in protein synthesis, and ultimately increases protein synthesis [8]. On the basis of these findings and past reports that FoxO family members are implicated in proteasome related intracellular protein ubiquitination by the regulation of target gene expressions in response to stress ,we hypothesize that the administration of β-hydroxy-β- methylbutyrate (HMB), a major metabolite of leucine restores the balance between intracellular protein synthesis and metabolism in the muscle system through activation of the PI3K/Akt-dependent mTOR and FoxO1/FoxO3a signaling transduction. In this study, the effect of eccentric training and HMB supplementation on S6K expression have been investigated.

## MATERIALS AND METHODS

The statistical population of this study was Sprague Dawley male rats, which were kept at the Center for Animal Reproduction and Animal Breeding in Baqiyatallah University of Medical Sciences. Four rats were selected at the age of eight weeks and weighed 20200 grams. The research was based on the terms of the study. The research was experimental in nature and based on the amount of monitoring for the control. To perform the research, after preparing the equipment and preparing the test, a study Pilot study was carried out first, and, after obtaining preliminary results, reviewing them and solving existing deficiencies, the main experiments were followed up The standard parameters were adjusted by standard self-regulating probes. In terms of access to water and food in standard conditions, 12 hours of light and 12 hours of darkness with an average temperature of 223 ° C and a humidity of 60-40% were kept in fiberglass cubicles in binary form. To keep and work with animals, all the ethical considerations of working with animal animals have been respected. Water and food were provided during the course of work. Their storage location was continuously cleaned and the temperature and humidity of the air as well as the circadian cycle (12 hours of darkness, 12 hours of light) were controlled. Rat Feeding Weight Measurement Daily intake of food was measured daily. The measurement of the weight of the test was carried out on the morning of the start of the study and at the end of the study.

Occupational protocol

Patients were randomly divided into four groups: 1) control group (n = 6), 2) HMB (n = 6), 3) exercise (n = 6), 4) exercise and HMB (n = 6). At first, the mice in the training groups and the HMB + exercise group performed three sessions of awareness raising and getting up from the ladder. In order to obtain 1RM of rats, 55% of their body weight was closed to their teeth. If they succeeded, lifting from the ladder was reduced to weights. In the case of successful run-up, in each replica of 35 grams, the weights were increased as they rushed out and they were able to lift from the ladder. The pre-retirement weight was considered as 1RM. The unrestrained rest was 2 minutes. The ladder's device was adjusted to one-meter height. The armchair had a centimeter. Excessive supplementation and extreme extraversion resistance After the familiarization stage, supplemental supplementation was performed daily. In HMB and exercise + HMB groups, 480 mg / kg body weight per day was considered. The supplements were dissolved in a milliliter of water and fed to rats. 3 sessions per week, for 6 weeks of exercise exhaust. Extreme extraversion resistance training was performed from the ladder with a gradient of 80% by closing weights of 120% 1RM to the back of the tail. Each rat was placed on top of the ladder by the examiner, and the rat should have fallen eight times from the ladder in each set. The protocol would run out if they were running three sets. If the three sets were to run out before the three sets were completed and even after three times the protocol was not shocked, it would be the end of the protocol. Each rat rested for 2 minutes between repetitions It did not have the protocol, it was the completion of the protocol. Each rat rested for 2 minutes between repetitions. Texture and laboratory analysis The rats were anaesthetized and killed after performing the

exercise protocol, and the three-body tissue was extracted from the muscle tissue for extraction of the RNA.

**Measuring the amount of gene expression**

The expression of S6K receptor was determined by measuring the amount of mRNA of this gene by a semi-quantitative Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) technique. The total RNA in 50 mg of arterial tissue was removed using a RNA extraction kit according to the manufacturer's instructions. The quantity and quality of the extracted RNA from the specimen were evaluated at 260 and 280 nm wavelength spectrophotometer. 3 µl of RNA from each sample was translated into cDNA using a cDNA synthesis kit. 2 µl of cDNA multiplied by PCR kit according to the manufacturer's instructions. Expression of β-actin gene was used as a benchmark for comparing gene expression. Primers were designed using the Gene Runner software. PCR samples were observed on agarose gel 1.5% using ethidium bromide. Illustrated using Gel Doc,

**Statistical Methods**

Descriptive statistics were used to determine the main indicators of mean, standard deviation, mean standard error and Excell program for drawing graphs. The Kolmogorff-Smirnov test was used to determine the distribution of data. After analyzing the blood samples, all data were analyzed by SPSS20 statistical software. To test the hypotheses, non-parametric statistics (Mann-Whitney and Kruskal-Wallis tests) were used at α-level of ≤0.05.

## RESULTS

findingsThe results of this study showed that severe eccentric resistance training did not have a significant effect on these levels despite the increase in S6K level (P = 0.01). Also, the results showed that supplemented with eccentric resistance training also had a significant difference on S6K expression level (P = 0.01). However, the results of this study showed that supplementation alone increased the S6K significantly (P = 0.01)

## CONCLUSION

Increased muscle cross-sectional area following resistance training occurs when the rate of protein synthesis is greater than protein degradation [9]. Considering the different qualities that eccentric muscle actions present compare to isometric or concentric muscle actions, it is theoretically possible that the benefits eccentric actions present may improve resistance training programs increasing several performance factors. The characteristics of eccentric actions include greater gains of muscle size and strength, decreased muscle soreness, and improvement of neural factors. Furthermore, eccentric exercise requires a lower metabolic cost than concentric or isometric exercise. Thus, the special characteristics of eccentric actions are becoming an important field of research trying to increase the positive outcomes of strength training while, at the same time, reduce the time of work [10] On the other hand, negative aspects such damage and soreness, reduced neural reflexes, altered resting state and acute strength losses should be considered, and minimized, in an eccentric training programs.[11] Collectively, existing results indicate that HMBv supplementation at a dosage of 1.5 to 3 g/day may enhance gains in strength and lean body mass associated with resistance training, at least in young, previously untrained individuals. A mechanism by which this may occur is unknown, but preliminary results indicate that there may be a reduction in skeletal muscle damage, although this has not been assessed directly. The response of resistance trained individuals to HMB supplementation is less clear. While research thus far is encouraging, there is clearly a need for more tightly controlled, longer duration studies to verify if HMB enhances strength hand muscular hypertrophy development associated with resistance training across a range of groups, including resistance trained individuals.

Collectively results from in this study suggest that eccentric muscle actions and high mechanical loads are essential stimuli to optimize exercise-induced muscle hypertrophy. In fact, several studies suggest that eccentric resistance training protocols plus HMB promote greater muscle hypertrophy than eccentric or HMB only

## REFERENCES

1. Barash, IA, Mathew, L, Ryan, AF, Chen, J, and Lieber, RL. Rapid muscle-specific gene expression changes after a single bout of eccentric contractions in the mouse. Am. J. Physiol. Cell. Physiol. 286: C355-64, 2004.
2. Eliasson, J, Elfegoun, T, Nilsson, J, Kohnke, R, Ekblom, B, and Blomstrand, E. Maximal lengthening contractions increase p70 S6

kinase phosphorylation in human skeletal muscle in the absence of nutritional supply. Am. J. Physiol. Endocrinol. Metab. 291: 1197-1205, 2006

3. Friedmann, B, Kinscherf, R, Vorwald, S, Muller, H, Kucera, K, Borisch, S, Richter, G, Bartsch, P, and Billeter, R. Muscular adaptations to computer-guided strength training with eccentric overload. Acta Physiol. Scand. 182: 77-88, 2004.
4. Shepstone, TN, Tang, JE, Dallaire, S, Schuenke, MD, Staron, RS, and Phillips, SM. Short-term highvs. low-velocity isokinetic lengthening training results in greater hypertrophy of the elbow flexors in young men. J. Appl. Physiol. (1985) 98: 1768-1776, 2005.
5. Friedmann, B, Kinscherf, R, Vorwald, S, Muller, H, Kucera, K, Borisch, S, Richter, G, Bartsch, P, and Billeter, R. Muscular adaptations to computer-guided strength training with eccentric overload. Acta Physiol. Scand. 182: 77-88, 2004.
6. Norrbrand, L, Fluckey, JD, Pozzo, M, and Tesch, PA. Resistance training using eccentric overload induces early adaptations in skeletal muscle size. Eur. J. Appl. Physiol. 102: 271-281, 2008.
7. Fernandez-Gonzalo R, Bresciani G, de Souza-Teixeira F, Hernandez-MuruaJA, Jimenez-Jimenez R, et al. (2011) Effects of a 4-week eccentric trainingprogram on the repeated bout effect in young active women. J Sports Sci Med10: 692-699.
8. Spiering BA, Kraemer WJ, Anderson JM, Armstrong LE, Nindl BC, et al. (2008)Resistance exercise biology. Manipulation of resistance exercise programmevariables determines the responses of cellular and molecular signallingpathways. Sports Med 38: 527-540.
9. Schoenfeld BJ (2010) The mechanisms of muscle hypertrophy and theirapplication to resistance training. J Strength Cond Res 24: 2857-2872.
10. Piitulainen H, Holobar A, Avela J (2012) Changes in motor unit characteristicsafter eccentric elbow flexor exercise. Scand J Med Sci Sports 22: 418-429.
11. Krentz JR, Farthing JP (2010) Neural and morphological changes in responseto a 20-day intense eccentric training protocol. Eur J Appl Physiol 110: 333-340
12. Ochi E, Nakazato K, Ishii N (2011) Muscular hypertrophy and changes in cytokine production after eccentric training in the rat skeletal muscle. J Strength Cond Res 25: 2283- 2292.
13. Coffey VG, Hawley JA (2007) The molecular bases of training adaptation.Sports Med 37: 737-763