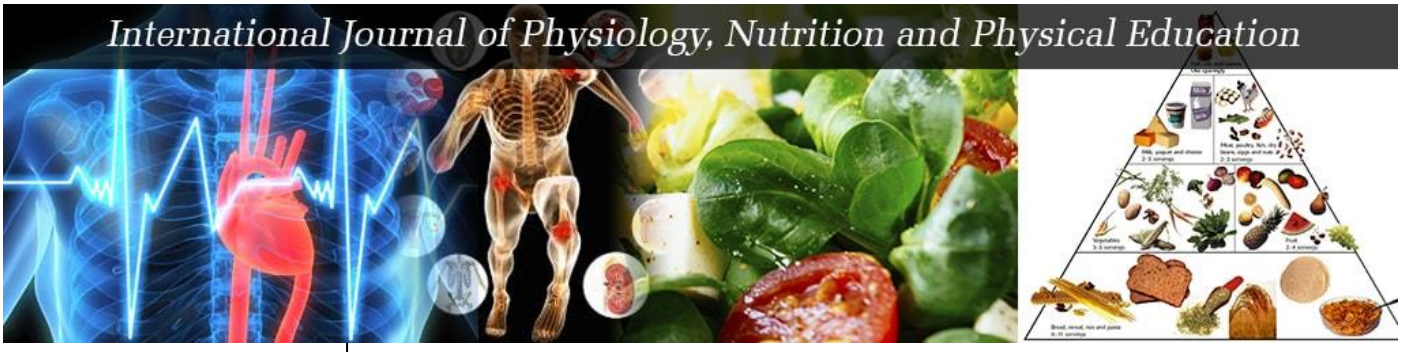

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Effect of leucine supplementation in muscle growth in gym goers

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Abstract
The present study was conducted with an aim to investigate the effect of leucine supplementation in muscle growth of gym goers. 15 healthy male gym-goers ingested with 3 g/d of leucine and 15 healthy male gym goers were considered as test and placebo group, respectively. Their daily dietary intake was assessed and was told to stay on same diet and exercise routine till the completion of study period. Anthropometric measurements, body measurements and body composition were assessed on the initial day and at the end of the study period. A significant difference ($p \leq 0.01$) was observed between pre and post value of supplemented group for WHR. Medium effect size (0.7) for WHR between two groups was observed significantly which indicates that the change was moderate between the groups after supplementation. Independent t- test showed small value of effect size for visceral fat (0.3) and medium for bone mass (0.4) between two groups. These results states that 3 g/d of leucine supplementation for 45 days can enhance muscle growth and increases the strength performance of the gym persons.

Keywords: Ergogenic aids, leucine, WHR, oxidation, protein synthesis

1. Introduction
Branched chain amino-acid is an amino- acid that has an aliphatic side chain with a group. These 3 BCAA's belongs to the 9 critical amino-acids for human beings, computing for 35% of the essential amino-acid in muscle protein and 40 % of the favoured amino-acid which are needed by mammals [1]. Leucine is one of the essential amino-acid that cannot be synthesised by our body and must get it from dietary sources. It plays a selected and pertinent role within the regulation of protein turnover. It has been established certainly that leucine may act as nutrient signal to stimulate protein synthesis in animal research because of having the ability to enhance anabolism and it also act as an ergogenic agent [2]. Intravenous infusion of Leucine is responsible for protein degradation at rest but oral ingestion of leucine may increases muscle protein synthesis at rest in both young and elderly individuals [3]. Greater responses are produced in the rate of muscle protein synthesis by the addition of leucine to carbohydrate/protein supplement post-exercise in healthy male as compared to carbohydrate/protein supplement following a resistance training bout [4].
Leucine supplementation during exercise is responsible for muscle growth, strength and performance [5]. After exercise, both blood and muscle level of BCAAs decreases then leucine burned as fuel by muscles. During exercise, it can be trans-aminated and oxidised to produce acetyl-CoA in muscles [6]. Leucine in diet helps to maximize muscle anabolism after resistance exercise. It has also been cautioned that the recommended dietary intake of leucine of 14 mg/kg body weight/d is insufficient in individuals who are physically active [7].
Leucine is not much beneficial when taken in diet as compared to leucine supplement because of non-availability of branched chain amino acid transferase enzyme in liver that allows the dietary leucine to reach the plasma levels [8]. The time taken to reach the maximum plasma leucine concentration reflects delay for leucine when taken in meal compared to leucine supplement. It is due to the fact that food is retained in the stomach before gastric emptying in case of meal. Food rheology and nutrients ingested at the time are the factors by which rate of gastric emptying is affected [9]. So, in normal meals always include both protein and other nutrients thus gastric emptying get delay which leads to more time to appear in the plasma after digestion and absorption and causes delay in plasma leucine concentration increases [10].

The principle intention of the present investigation was to assess the potential of 3 g/d oral ingestion of leucine for at least 45 days in muscle growth and body composition of young male gym-goers.

2. Materials and methods

Thirty healthy males were selected in this study that was in average weight range of 75±6.5 kgs. The volunteers were divided in to two groups as placebo group (P) and a test group (L). Selected respondents were not taking any dietary supplements earlier. Consent was taken from the respondents regarding the medicals issues related and further health effects after supplementation. The respondents selected for the study that performs exercise on regular basis and were told to retain the similar life-style and exercise levels during the study period. Anthropometric measurement, body measurements and body composition was assessed on the first day of study period and final day of the supplementation. Body composition was assessed by Body Composition Analyzer name, MI body composition scale.

Dietary recall of 3 days of all participants was taken. Supplementation was continued till the last day of the study. The supplement would be taken immediately after workout. The quantity was 3 g/d for leucine (Healthvit Fitness Leucine Powder). The participants were instructed to mix leucine and water for 15-20 seconds with the help of spoon.

Statistical analysis was done by using mean, SD and t test. The difference in anthropometric measurements, body measurements and body composition between the two groups after supplementation was analysed by independent t test and the changes within group before and after supplementation were analysed by using paired t test.

3. Results and Discussion

3.1 Effect of Leucine supplementation on anthropometric measurements of Placebo and Test group

The anthropometric measurements of placebo and test group before and after supplementation are presented in Table 3.1. Statistically, there was no difference in anthropometric measurements of within groups before and after supplementation. It is clear from the Table that the gain score in Test group across the 45 days study period remained constant as that of Placebo group. Since nothing was provided to placebo group, there was no change in their weight, BMI and WHR after 45 days. In case of test group, observed mean was 72.64 and 72.04 kgs for weight, for BMI mean was 23.9 and 23.7 kg/m^2 and for WHR it was 0.85 and 0.86 respectively, before and after supplementation. There was no significant difference ($p \leq 0.01$; 0.05) within the placebo group ((G.S = -0.73, E.S = 0.05 for weight), (G.S = -0.46, E.S = 0.1 for BMI) and (G.S = 0, E.S = 0 WHR)) and test group ((G.S = -0.6, E.S = -0.07 for weight), (G.S = -0.2, E.S =-0.2 for BMI)). A significant difference ($p \leq 0.01$) was observed between pre and post- test of supplemented group for WHR (G.S = 0.01, E.S = 0.16).

Independent t test between groups revealed that there was no difference in weight and BMI of two groups but medium effect size (0.7) for WHR between two groups was observed significantly which is also shown in Table 3.1.1. It indicates that the change was moderate.

Yet, the present study give support for the conception that leucine supplementation might take action as an ergogenic aid in gym-goers. However the no change in weight and BMI may be contributed to genetic control and growth factors. Lean body mass and muscle power are also related to genetic control and growth factors such as hormone and hormone like compound that enhances the cells to produce gains in muscle fibre size. This may have caused variations in progress [12].

3.2 Effect of Leucine supplementation on body measurement of placebo and test group

The body measurements of placebo and test group before and after supplementation are presented in Table 3.2. There was a significant difference ($p \leq 0.01$) in body measurements within the groups before and after supplementation. In case of test group, the mean gain significances from 44.9 cms to 45.2 cms for shoulder girth, 37.2 cms to 37.7 cms for biceps, 93.7 cms to 94.1 cms for chest girth, 84.7 cms for 85.9 cms for waist girth, 98.2 cms to 98.3 cms for hips and 36.7 cms to 37.3 cms for calf girth, respectively. Table 3.2 also depicts that in case of placebo group, except waist, the gain score in all body measurement is 0 which revealed that there was no muscle growth in placebo group without intake of leucine which reveals the role of leucine in muscle growth. A significant difference ($p \leq 0.01$) was observed between two groups for shoulder, biceps and calf for test group.

Daily supplementation of leucine for forty five days resulted in significant profits in body measurements in comparison with placebo (with normal diet). Differences within two situations are because of the ingestion of leucine supplementation. Both groups had performed the same type and quantity of workout. Along with it, respondents did not change any workout or its level and also they maintained their nutritional consumption, as they did at the end of study period.

According to independent t test analysis, a small effect size in shoulder (0.3), biceps (0.1), chest (0.3), waist (0.01) and calf (0.2) was observed between two groups. The medium effect size of hips (0.5) showed difference between two groups. Hips and waist girth also concludes that study with a smaller duration and exercise may have resulted in significant differences within groups in body measurement. In people, co-ingestion of leucine and protein shows a greater anabolic response than CHO alone or CHO/protein, however absence of leucine within the presence of all different amino-acids can decrease protein synthesis by means of 40% [13]. Thus, this supports that leucine supplementation to a more extent enhances the rates of muscle protein synthesis in test group when in comparison with diet alone and this favours the small impact size in body measurements and body composition. Some encouraged that addition of leucine to a whey protein supplement before exercise gives more anabolic response than whey protein alone [14]. The profits in test group can be the end result of amelioration of vital fatigue as leucine consumption elevates plasma leucine and BCAA concentration without affecting plasma unfastened tryptophan and the ratio of free-tryptophan to BCAA ratio [15].

3.3 Effect of Leucine supplementation on body composition of Placebo and Test group

Table 3.3 reports the body composition measures of placebo and test group at baseline and day 45 of supplementation. The mean changes for pre and post in placebo group ranged from 54.9 kg to 55.3 kg for muscle, 22.8 per cent to 23.4 per cent for body fat, 56.04 per cent to 56.34 per cent for water, 1657.3 kcal to 1663.8 kcal for basal metabolism, 7.3 to 7.6 for visceral fat and 2.9 kg to 3.0 kg for bone mass. In case of test group, mean for muscle shifted from 53.5 kg to 54.3kg after supplementation. Body fat changed to 22.6 per cent from 22.3

per cent, water per cent changed to 57.1 per cent from 56 per cent. The values of basal metabolism, visceral fat and bone mass changed to 1670.6 kcal, 8.2 and 7.0 kgs respectively from 1653.54 kcal, 7.8 and 3.2 kgs respectively, after supplementation. Though the change was non-significant.

Independent t- test showed that there was a non-significant difference ($p \leq 0.01$) within body composition after supplementation. The reason of this may be attributed to less study period i.e. a minimum of 6 weeks of supplementation and exercise was required to observe measurable changes in muscle mass and body composition [16]. Table 3.3 showed small value of effect size for visceral fat (0.3) and medium for bone mass (0.4) between two groups.

4. Conclusion

This study concludes that 3 gm/ d of leucine supplementation for 45 days increases muscle growth to a smaller extent. Though, the amount used in this research (3 g/d) appears to be proper and sufficient quantity to get positive changes during 45 days of study period but distinctive amount of leucine should be further investigated.

Table 1: Anthropometric measurements of Placebo and Test group before and after supplementation

Placebo Group (N=15)				
	Measures	**Weight (kg)**	**BMI (kg/m^2)**	**WHR**
0 day	Mean	72.07	24.06	0.9
	Standard Deviation	13.5	3.5	0.04
45 day	Mean	71.34	23.6	0.9
	Standard Deviation	12.8	3.6	0.04
Gain Score		-0.73	-0.46	0
Test Group (N=15)				
0 day	Mean	72.64	23.9	0.85
	Standard Deviation	8.7	2.4	0.061
45 day	Mean	72.04	23.7	0.86
	Standard Deviation	6.9	1.9	0.062
Gain Score		-0.6	-0.2	0.01**
Effect Size		0.06	0.03	0.7

** At 1% level of significance

Table 2: Body measurement of Placebo and Test group before and after supplementation

Placebo Group (N=15)							
	Measures	**Shoulder (cm)**	**Biceps (cm)**	**Chest (cm)**	**Waist (cm)**	**Hips (cm)**	**Calf (cm)**
0 day	Mean	44.0	36.8	90.3	85.5	93.0	36.2
	Standard Deviation	4.1	6.0	5.7	4.52	5.6	5.4
45 day	Mean	44.0	36.8	90.3	85.8	95.0	36.2
	Standard Deviation	4.1	6.1	5.7	4.51	5.6	5.4
Gain Score		0	0	0	0.3	0	0
Test Group (N=15)							
0 day	Mean	44.9	37.2	93.7	84.7	98.2	36.7
	Standard Deviation	3.08	3.6	13.5	6.7	5.5	4.0
45 day	Mean	45.2	37.7	94.1	85.9	98.3	37.3
	Standard Deviation	3.03	3.7	13.7	6.8	5.8	4.2
Gain Score		0.3**	0.5	0.4**	1.2**	0.1**	0.6**
Effect Size		0.3	0.1	0.3	0.01	0.5	0.2

** At 1% level of significance

Table 3: Body composition of Placebo and Supplemented group before and after supplementation

Placebo Group (N=15)							
	Measures	**Muscle (kg)**	**Body Fat (%)**	**Water (%)**	**Basal Metabolism (kcal)**	**Visceral Fat**	**Bone Mass (kg)**
0 day	Mean	54.9	22.8	56.04	1657.3	7.3	2.9
	Standard Deviation	6.0	6.6	6.0	.224.2	2.2	0.5
45 day	Mean	55.3	23.4	56.34	1663.8	7.6	2.91
	Standard Deviation	6.0	6.6	6.01	229.1	2.3	0.51
Gain Score		0.4	0.6	7.6	6.5	0.3	0.01
Test Group (N=15)							
0 day	Mean	53.5	22.3	56.0	1653.54	7.8	3.2
	Standard Deviation	0.01	6.01	5.6	225.19	1.9	0.23
45 day	Mean	54.3	22.6	57.1	1670.6	8.2	7.0
	Standard Deviation	6.2	6.07	5.8	209.8	1.3	10.73
Gain Score		0.8	0.3	1.1	17.2	0.4	3.8
Effect Size		0.16	0.12	0.12	0.03	0.3	0.5

** At 1% level of significance and * at 5 % level of significance

5. References

1. Shimomura Y, Murakami T, Nakai N, Nagasaki M, Harris R.A. Exercise promotes BCAA catabolism: Effects of BCAA Supplementation on skeletal muscle during exercise, J of Nutr. 2004; 136(6):1583-1587.
2. Anthony JC, Yoshizawa F, Anthony TG, Vary TC, Jefferson LS, Kimball SR. Leucine stimulates translation initiation in skeletal muscle of postabsorptive rats via a rapamycin-sensitive pathway, J Nutr. 2000; 130(10):2413-2419.
3. Nair KS, Schwartz RG, Welle S. Leucine as a regulator of whole body and skeletal muscle protein metabolism in humans, Am J Physiol. 1992; 263(5 Pt 1):E928-E934.
4. Koopman R, Wagenmakers AJ, Manders RJ, *et al.* Combined ingestion of protein and free leucine with carbohydrate increases postexercise muscle protein synthesis *in vivo* in male subjects, Am J Physiol Endocrinol Metab. 2005; 288(4):E645-E653.
5. Bruce Stuart, Phillips S, Woledge R. Interpreting the relation between force and cross-sectional area in human muscle.Med Sci Sports Exerc. 1997; 29(5):677-83.
6. Ananieva EA, Powell JD, Hutson SM. Leucine Metabolism in T Cell Activation: mTOR signalling and beyond, Adv Nutr. 2016; 7(4):798-805.
7. Hood DA, Terjung RL. Amino acid metabolism during exercise and following endurance training, Sports Med. 1990; 9(1):23–35.
8. Harper AE, Miller RH, Block KP. Branched chain amino acid metabolism. Annu Rev Nutr. 1984; 4:409-54.
9. Tougas G, Eaker EY, Albell TL, Abrahamsson H, Boivin M, Chen J, Hocking MP, *et al.* Assessment of gastric emptying using a low fat meal: Establishment of international control values, Am J Gastroenterol. 2000; 95(6):1456-62.
10. Yoshi Naomi, Sato Koji, Ogasawara Riki, Nishimura Yusuke, Shinohara Yasushi, Fujita Satoshi. Effect of mixed meal and leucine intake on plasma amino acid concentrations in young men, Nutr. 2018; 10(10):E1543.
11. Cafri Guy, Thompson JK. Measuring male body image: A review of the current methodology, Psychology of men and masculinity. 2004; 5(1):18-29.
12. Ispoglou Theocharis, King Roderick FGJ, Polman Remco CJ, Zanker Cathy. Dietary l-leucine supplementation in novice trainees during a 12-week weight training program, Int J Sports Physiol Perform. 2011; 6(1):38-50.
13. Vary TC, Jefferson LS, Kimball SR. Amino acid-induced stimulation of translation initiation in rat skeletal muscle, Am J Physiol. 1999; 277(6):E1077-E1086.
14. Zhang XJ, Chinkes DL, Wolfe RR. Leucine supplementation has an anabolic effect on proteins in rabbit skin wound and muscle, J Nutr. 2004; 134(12):3313–3318.
15. Crowe MJ, Weatherson JN, Bowden BF. Effects of dietary leucine supplementation on exercise performance, Eur J Appl Physiol. 2006; 97(6):664–672.
16. Trabal Joan, Forga Maria, Leyes Pere, Torres Ferran, Rubio Jordi, Prieto *et al.* Effects of free leucine supplementation and resistance training on muscle strength and functional status in older adults: a randomized controlled trial, Dovepress. 2015; 2015(10): 713-723.