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Infographic: a systematic review and meta-analysis of the effect of β -alanine supplementation on exercise capacity and performance.

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β-alanine Supplementation to Improve Exercise Capacity and Performance: A Systematic Review and Meta-analysis

Study Details

- ◆ Meta-analysis including 40 studies
- ◆ 1,461 total participants
- ◆ Chronic (>1 day) β-alanine supplementation protocols only

Effects of β-alanine by Exercise Duration

Short (≤ 0.5 mins)

0.05 [-0.14, 0.23]

Moderate (0.5-10 mins)

0.22 [0.09, 0.36]

Long (> 10 mins)

0.19 [-0.07, 0.45]

Overall

0.18 [0.08, 0.28]

Effect Size [95% CI]

Diamond length represents 95% CI



How It Works

1

Intense exercise causes hydrogen (H⁺) ions to accumulate in muscle, creating an acidic environment.

2

H⁺ buildup (muscle acidity) negatively impacts muscle function, and causes muscle fatigue and decreased performance.

3

Carnosine buffers the H⁺ ions, helping the muscles maintain a stable environment. This delays muscle fatigue and can increase performance.

General Recommendations

Exercise Types

Intermittent or continuous exercise lasting 30s-10min in duration, such as 100-200m swimming, 4km cycling, 2000m rowing & 800m running

How Much

3.2-6.4 grams/day; 0.6-1.6 grams every 3-4hrs during the day to avoid acute side effects of paraesthesia

How Long

2-4 weeks of supplementation at the recommended dose

Key Takeaways

1

β-alanine increases muscle carnosine, leading to improvements in exercise capacity & performance during continuous & intermittent activities

2

Effects are greatest for exercise lasting 30s-10min, with smaller effects seen in trained versus untrained individuals

3

Acute co-supplementation of sodium bicarbonate may further improve exercise gains

Infographic: A systematic review and meta-analysis of the effect of β -alanine supplementation on exercise capacity and performance

Review Article

Running head: β -alanine for exercise: meta-analysis

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Carnosine (β -alanyl-L-histidine) is an abundant compound in skeletal muscle suggesting it plays an important role during exercise, with a key physiological role considered to be intracellular pH regulation (Dolan et al., 2019). Chronic β -alanine supplementation can increase muscle carnosine content when taken for several weeks (Harris et al., 2006) and studies have shown that supplementation for between 4 and 24 weeks can improve high-intensity exercise capacity, with the gains in exercise associated with the increase in muscle carnosine content (Hill et al., 2007, Saunders et al., 2017b). Although several studies have demonstrated the efficacy of β -alanine supplementation as an ergogenic aid, there are a number of confounding factors which may modify its effect including exercise type, duration and mode, training status and co-supplementation that may influence the effects of β -alanine supplementation. The aim of our systematic review and meta-analysis was to determine the effects of β -alanine supplementation accounting for these potential modifying factors (Saunders et al., 2017a).

There was a significant overall ergogenic effect of β -alanine supplementation on exercise measures. Exercise duration was the greatest factor influencing the effect size of β -alanine; exercise 0.5 to 10 min in duration results in the greatest effect while very short duration exercise (<0.5 min) clearly resulted in no benefits. Longer duration exercise (>10 min) was not significantly improved with β -alanine, although there was still a moderate sized effect. Exercise capacity and performance protocols were both improved by supplementation, although effect sizes were larger for capacity tests, particularly during exercise lasting from 0.5 to 10 min in duration. The effect of β -alanine on trained individuals showed smaller effect sizes than on non-trained individuals, although these gains may translate into worthwhile improvements in applied settings (*i.e.*, competition). Isolated limb and whole-body exercise benefitted equally from β -alanine supplementation whereas co-supplementation of β -alanine with sodium

bicarbonate, thereby increasing both intracellular and extracellular buffering capacity, was shown to result in greater improvements above β -alanine alone.

These meta-analytical data allow coaches and athletes to make informed decisions as to the likelihood of an ergogenic effect with β -alanine supplementation based upon their specific exercise demands, those performing high-intensity tasks between 30 s and 10 min most likely to benefit. Individuals can safely supplement daily with β -alanine for up to 24 weeks at a dose of 3.2 – 6.4 g·day⁻¹ ingested at several timepoints throughout the day (0.8 – 1.6 g every 3 – 4 h) to avoid acute side-effects (*i.e.*, paraesthesia).

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