NUTRITION

Leucine: The anabolic stimulus in whey protein

Leucine is a key molecule to trigger synthesis of new muscle proteins in the body. This is especially relevant to consider for elderly and patients where muscle mass is linked to health outcomes.

Ingredients by Fonterra
Dairy for life

Introduction

The elderly population is estimated to rise. The number of people aged 65 and over will double from currently around 700 million to over 1.5 billion in 2050 (UN-DESA, 2020). In older age the incidence of non-communicable diseases like hypertension, Type II Diabetes and heart disease increases. For elderly, co-morbidities are more present than not, with over half of people aged 65 years or older experiencing at least two conditions simultaneously (Barnett 2012).

Sarcopenia is the age-related decline of muscle mass and function, a process that is aggravated by disease, inactivity and malnutrition.

It is associated with worse outcomes in common chronic disease, reduces mobility, independence and therefore quality of life (Cruz-Jentoft, 2019).

PROTEIN INTAKE AND MUSCLE MASS IN ELDERLY

The role of nutrition in sarcopenia has resulted in increased development of research focused on quality of life, independence, and longevity. In a large cohort study an association was found between protein intakes above 1.0g/kg body weight and lower disability outcomes in elderly over 85 years of age (Mendonça 2019). Interventions showed that high protein diets combined with resistance exercise training have a cumulative effect on performance such as gait speed and muscle strength tests in free-living elderly (van Dongen 2019). This is a relevant outcome that helps to establish practices to support long term independence.

A focus on the link between protein and muscle mass and function goes beyond general elderly. In non-communicable diseases like cancer and diabetes (Blauwhoff 2016, Hamasaki 2017) reduced muscle mass is linked to lower survival (Blauwhoff 2016, Hamasaki 2017). Sarcopenia has also been shown to
be an independent risk factor for mortality in nursing home patients (Landi, 2013). This impact of muscle status on health outcomes shows the need for care strategies combining tailor-made exercise programs and nutrition support for elderly both in health and disease.

EFFECTIVENESS OF WHEY DURING RECOVERY

Hospitalization often comes with increased inactivity which, in turn, is related to sarcopenia progression. Even short-term bedrest in elderly results in fast muscle deterioration and can reach as much as 2kg of losses in ten days (Deutz, 2013). Replacing dietary proteins with high-quality whey protein, while keeping total macronutrient intake the same, resulted in better muscle mass maintenance during bedrest. More importantly, the loss of muscle strength over seven days of bedrest was able to be fully recovered within five days in a whey-fed group compared to those on the normal diet (Arentson-Lantz, 2019). In an intervention by Deer et al (2019), supplementing with whey protein, both with or without exercise, was demonstrated to be a potential strategy to support functional recovery.

HIGH-QUALITY WHOLE PROTEIN TRUMPS LEUCINE

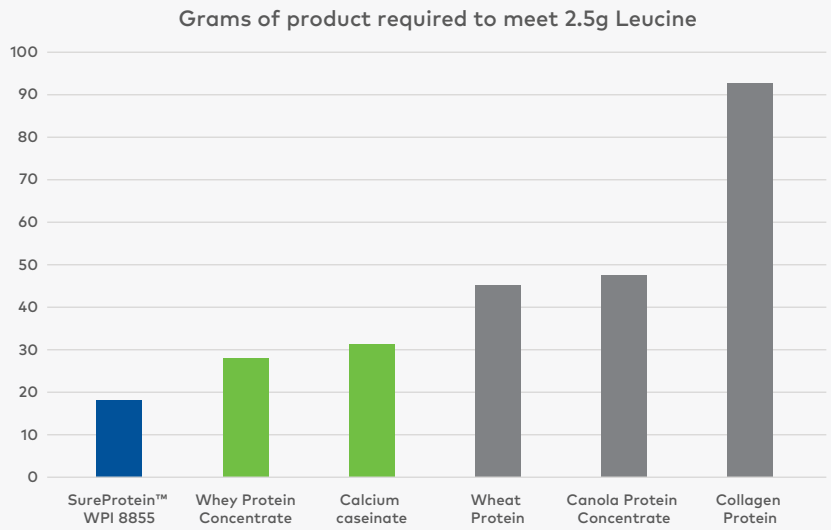
The quality of protein is based on the quantity and digestibility of essential amino acids present in the correct ratios, which is best defined by the DIAAS score (FAO, 2013). Leucine is one of the essential, or indispensable, amino acids, meaning that the body cannot metabolise it by itself. Therefore, people are required to get sufficient intake from their diet. Dairy proteins have the highest DIAAS scores and whey has the highest leucine content of all dairy proteins (see graph). Leucine is the decisive amino acid for muscle protein synthesis (Devries 2018), and it must be consumed in sufficient amounts to trigger this anabolic pathway.

Although it has been shown that a minimum amount of leucine is required to initiate muscle protein synthesis, the full set of essential amino acids is primarily responsible for muscle protein anabolism in healthy elderly (Volpi 2003). Moreover, when testing whey protein against the respective amounts of essential amino acids and non-essential amino acids, it was demonstrated that the complete whey protein had a stronger effect on muscle protein accrual, insinuating a beneficial role of whole proteins compared to amino acids (Katsanos 2006).

EXPERT RECOMMENDATIONS

Since 2013, expert groups have agreed that an intake of 25-30g of protein per serving is recommended for the general elderly population to maintain muscle health, with higher levels required in cases of acute or chronic disease (Bauer et al 2013, Deutz et al 2014). High-quality protein providing the necessary essential amino acids and leucine is preferred. Bauer et al link this recommendation to a per-serving intake of 2.5-2.8g leucine for optimal muscle support. A recent study in healthy elderly men confirms that these levels of leucine are still a useful reference for dietary intake (Szwiega, 2019).

Significantly more efficient in providing sufficient leucine for muscle protein synthesis than other dairy proteins and non-dairy proteins.



Conclusion

Whey is a well-studied protein source with a demonstrated effect on muscle maintenance. It contains the highest levels of essential amino acids and leucine of all commonly used protein sources (Gorissen 2018). On top of that, it is a fast absorbing protein which results in a higher peak of leucine appearance in the blood (Boirie 1997). This makes it the perfect protein to trigger muscle protein synthesis. Although leucine is a pivotal requirement for muscle protein synthesis, studies indicate that there is a benefit of supplementing with whole proteins to provide the full range of essential (and non-essential) amino acids. Whey has a better sensory profile compared to individual amino acids, which have a very bitter taste, making it easier to develop a well-appreciated product using whey. Good tasting products create a more enjoyable consumption experience which increases compliance and makes it easier for elderly to reach the required 2.5g of leucine intake.

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