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Energy and Skeletal Muscle Protein Metabolism Balance and Weight Loss in Patients with Alzheimer's Disease: a Mini-Review

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Introduction

Weight loss is frequent in patients with Alzheimer's disease (AD), even in early disease stage [1]. Therefore, weight loss is a significant predictor of mortality in AD patients. The etiology of AD-associated weight loss is multifactorial, occurring when energy expenditure exceeds energy intake [2]. In addition, the loss of skeletal muscle protein, one of the causes of weight loss, occurs by an imbalance between the rate of protein synthesis and degradation [3]. Therefore, many studies have examined energy expenditure, energy intake, body composition, and other genetic factors in relation to weight loss in AD patients. This mini-review further discusses the factors leading to weight loss in AD patients.

Energy Expenditure

In the 1990s, higher energy expenditure was considered the possible cause of weight loss in AD patients. However, Donaldson et al. [4] reported that resting metabolic rate was not significantly different between AD patients and controls. Poehlman et al. [5] revealed that daily energy expenditure was 14% lower in AD patients compared to controls. In a recent study, Venturell et al. [6] also showed that AD patients and controls have similar levels of daily expenditure. Therefore, it can be inferred that AD patients do not have disease-specific higher energy expenditure.

Energy Intake

Patients with AD have many eating problems, such as swallowing or chewing difficulties, a refusal to eat or drink, suspected dehydration, and persistently reduced oral intake [7]. Impaired swallowing function appears as the disease progresses, resulting in aspiration pneumonia in late-stage disease; texture-modified diets (TMD) are used to prevent this [8]. TMD has been shown to comprise lower energy-, and protein content than normal diets, and can lead to malnutrition [9]. According to Olin et al., higher energy density hospital food can prevent weight loss in patients with dementia [10].

Body Composition

Aging changes body composition in elderly patients [11] due to Sarcopenia. Burns et al. [12] showed that lean body mass was reduced in patients with early AD compared to controls, however, total body fat and percent body fat were not different between two groups. With aging, anabolic hormones such as testosterone, estrogen or growth hormone (ex. IGF-I) are decreased, and catabolic hormones (ex. cortisol) and inflammatory cytokines (ex. TNF-alpha) are increased. Burns et al. [12,13] suggested that the loss of lean body mass shared mechanisms common to both AD and Sarcopenia, which are accelerated in AD, and related to brain atrophy and cognitive performance. Venturelli et al. [7] reported that serum albumin was significantly reduced in AD patients, and Visser et al. [14] showed that low serum albumin concentration might be a risk factor for Sarcopenia. Therefore, Sarcopenia was considered to occur due to multiple factors such as malnutrition, inactivity, cognitive function in AD patients.

Conclusion

Weight loss in AD patients is multifactorial, caused by a disorder of energy and skeletal muscle protein metabolism balance.

To prevent weight loss in AD patients, nutritional care and support, and therapy for activity-related Sarcopenia are necessary.

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