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***Title*: Physical Activity and Nutrition in Ageing and independent living**

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Healthy ageing is the process of developing and maintaining the functional ability that enables well-being in older adults over 65 years (Fig. 1). The most frequent nutrition-related disorders are malnutrition and sarcopenic obesity (Fig. 2) with own aetiology requiring a specific nutrition and physical activity treatment.

-The physiologic anorexia of ageing (a linear decline in food intake) puts older adults at high risk for developing protein-energy malnutrition (undernutrition). Clinical evidence indicates that a combination of physical inactivity and hypocaloric nutrition may rapidly lead to protein-energy malnutrition, and affect the regulation of lean body mass (LBM).

-Sarcopenia is a syndrome characterised by age-related loss of skeletal muscle mass and strength, and fat-replaced muscle (sarcopenic obesity). The main determinant of sarcopenia appears to be the decline in resistance-type physical activities. Primary sarcopenia directly results from ageing itself, whereas secondary sarcopenia may result from physical inactivity, disease, and/or nutrient deficiencies.

Physical activity is reduced during physiologic ageing. Older adults often combine muscle inactivity with a reduced energy intake (malnutrition, undernutrition, anorexia) that is below their energy expenditure, and thus they lose skeletal muscle and fat mass. Accelerating the loss through changes in whole-body protein kinetics leads to an increased incidence of complications with a poor clinical outcome.

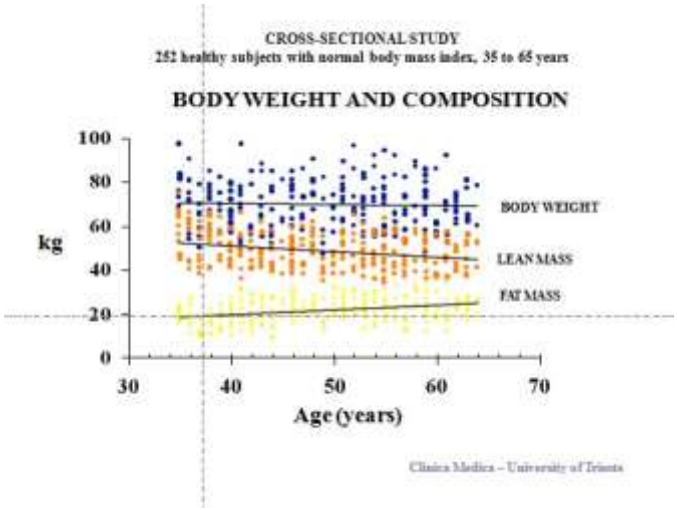

Fig-1: Body weight and composition in ageing.

Because protein metabolism is less efficient with increasing age, it has been suggested that older adults may need to increase their protein intake to prevent LBM and to prevent musculoskeletal conditions. In addition, the specific effects of inactivity on physiologic functions include decreased turnover of skeletal muscle proteins and impaired dietary amino acid utilization, which lead to muscle dysfunction and atrophy.

The most effective preventive measures against a functional decline in older adults are focusing on energy balance, adequate protein intake, and vitamin D supplementation, intensive efforts with resistance exercise and specifically designed supplements containing essential amino acids (EEAs) /Leucine.

Protein requirements per kg per day do not change with age during adult life, but the low energy requirement of sedentary older adults means that the protein: energy ratio of their requirement is higher than for younger age groups. The most appropriate response to this is to encourage increased physical activity, energy expenditure and consequent increased food intake and protein-enriched diet.

The protein needs of older adults have lower rates of protein synthesis than younger adults. Older adults are less able to recover LBM loss resulting from physical inactivity. Recommended dietary allowance (RDA) of 0.8 g/kg per day protein seems to be insufficient for older adults to maintain nitrogen balance. The average requirement for protein intake is 0.94 g/kg per day. Muscle strength may be increased on a protein intake over 0.8 g/kg per day, an average of 1.0-1.2 g/kg per day (40% less loss of muscle mass), but not higher than 1.5 g/kg per day. Also, dietary intake of protein should not be lower than 0.8 g/kg per day for older adults. Consumption of more than about 45% of the dietary energy as protein led to nausea and diarrhoea within 3 days and to death in a few weeks, a condition known as "rabbit starvation". Also, older adults need higher consumption of 10-15g/day EAAs to have the same degree of stimulation of muscle protein synthesis as their younger people. This close relation suggests that the intracellular availability of amino acids may be a factor that dictates the rate of muscle protein synthesis and therefore provides both a rationale and a mechanism of action for a potential beneficial effect of protein supplements.

Food intake can stimulate muscle protein synthesis secondary to an *increased insulin release*, because insulin can directly stimulate muscle protein synthesis and, to at least some extent, decrease protein breakdown.

Scientific data indicate that muscle is more efficient at utilizing a given amount of amino acid *after resistance exercise*. The infusion of a balanced amino acid mixture after exercise causes a large increase in net protein synthesis. Protein intake over the day to maximize protein synthesis is after dinner. Also, it's known that vitamin D deficiency affected functional limitations.

In conclusion: A protein-enriched diet combined with progressive resistant training enhances LBM and muscle strength. For any diet in which protein intake is likely to be limiting, sedentary older adults are the population group most at risk from protein deficiency.

For that reason, essential amino acid and carbohydrate supplementation in interaction with the resistant exercise make improvement to muscle protein loss in ageing.

From a public health perspective, the development of population-targeted food products is highly important. The particular initiative aims to develop dietary products that maintain and support normal cognitive function in healthy ageing and to help reduce cerebrovascular risks.

The stimulatory effect of amino acids after exercise has a direct stimulatory effect on the rate of muscle protein synthesis and it's greater than the effect when given at rest.

Keywords: older adults, muscle inactivity, protein metabolism, hypocaloric diet, lean body mass (LBM).

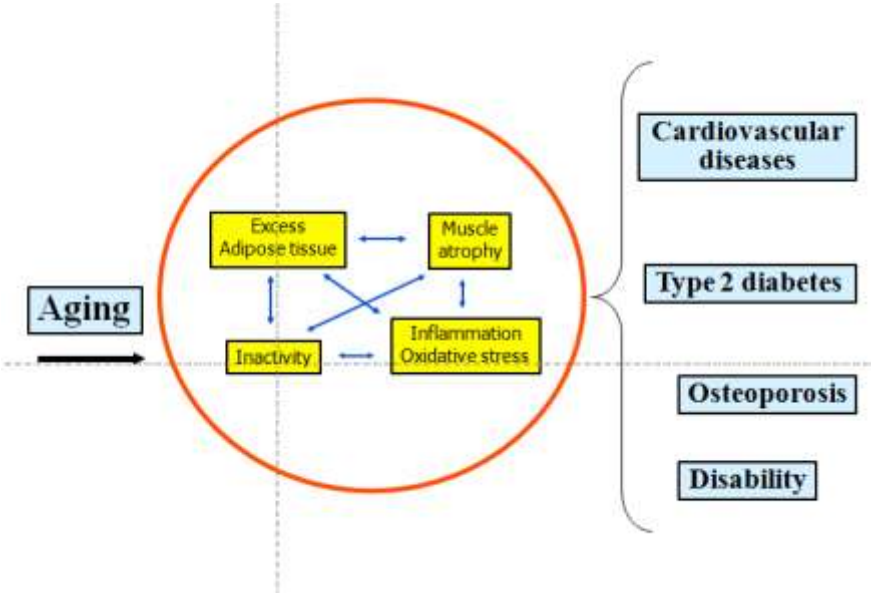

Fig-2. Ageing - Process and Consequences Related to Sarcopenia

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