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MASTERARBEIT / MASTER'S THESIS

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„Effect of a combined protein and resistance training intervention on markers of oxidative DNA damage in community-dwelling older adults "

verfasst von / submitted by

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1 Introduction

According to the World Health Organization (WHO) population growth and population aging can be considered as two of the major demographic trends (1). Older adults, defined as people aged 65 and above, are the fastest growing age group globally. This trend can also be seen in Austria. In fact, in the beginning of 2021, the group of older adults and the group of people under 20 were almost equal, representing 19.2% and 19.3% respectively of the Austrian population (2). In the long term, distribution of population will shift towards elderly people. Most estimates predict that by the year of 2030, 25% of the population will be 65 or older and by the year 2100 already 30% (3). Increasing life expectancy can be considered as a main driver for this change. In 2020, life expectancy at birth for men was 78.9 years and for women 83.7 years (4). By 2080, life expectancy will be expected to increase by additional 9.9 life years for males and 8 life years for females (5).

However, with increasing life expectancy the number of years lived with disability or disease are simultaneously increasing, resulting in growing challenges for the public health system (6). One characteristic of aging is a decrease in muscle quantity and quality, known as sarcopenia, which is associated with an increased risk of adverse outcomes, such as falls, fractures, physical disability and even mortality (7). Physical activity and adequate protein intake can be considered as beneficial on muscle physiology, resulting in increased protein synthesis and decreased protein degradation (8). For adults in the german-speaking countries (D-A-CH region) aged 65 or older, a protein intake of 1 g/kg body weight (BW)/day is currently recommended (9). However, emerging evidence suggests that recommendation of protein intake in older people should be elevated to 1.0-1.5 g/kg BW/d in order to prevent or postpone a decline in muscle mass (10-12).

Nevertheless, possible adverse health effects arising from changes in dietary recommendations for older adults should be considered too. It has been described that the aging process and oxidative stress as well as DNA damage as a consequence are closely connected since DNA damage can be considered as one of the molecular drivers of aging (13).

However, there are only a few studies analyzing the effect of a high protein diet on oxidative stress or DNA damage. Results from mice fed with a high protein diet (44 E%) showed elevated oxidative stress levels through an increase in advanced glycation end products (AGE), 4-hydroxynonenal (4-HNE) and malondialdehyde (MDA) after an eight-week dietary intervention (14). In human, Pivovarova-Ramich et al. (2020) observed a decrease in MDA and protein carbonyls after a six-week diet high in animal or plant-based protein (30 E%) in older patients with type 2 diabetes (15). Some studies analyzed combined effects of protein supplementation and exercise on oxidative stress markers. Nabuco et al. (2019) investigated changes regarding antioxidant enzyme activity and oxidative stress markers in older women following a high protein diet. They could not detect any differences after the intervention with 35g of whey protein pre- and post-training for 12 weeks (3x/week, 3 sets of 8-12 repetitions). (16). Similar results were observed after a 12-week intervention of combined protein supplementation (1.5g/kg BW/d) and exercise (2x/week for 60 minutes) in elderly Malays, in which no changes in superoxide dismutase (SOD) level after 12 weeks of intervention were observed in both groups (17). It must be noted that protein supplements and not whole foods were used in these studies.

Therefore, it is important to investigate whether increasing the amount of protein in diet could induce possible unfavorable mechanistical effects regarding DNA damage, thus increasing susceptibility to complex age-related diseases (18). However, data in older adults analyzing potential effects of a high protein intake through regular diet on DNA damage are still missing. Under this aspect the *NutriAging*

Protein study as part of the larger *NutriAging* project evolved. This study investigates whether adjusting protein intake either to current recommendations in the D-A-CH region of 1.0g/kg BW/d or twice as high as recommended (2.0g/kg BW/d) in combination with 8 weeks of progressive resistance training would affect physical performance and general wellbeing. The aim of the present master's thesis as part of the *NutriAging Protein* study was to analyze whether a modified protein intake in combination with resistance training would affect single and double strand breaks, formamidopyrimidine-DNA glycosylase (FPG)-sensitive sites as well as resistance to hydrogen peroxide (H_2O_2) induced DNA damage in whole blood of community-dwelling older adults (aged 65 to 85) measured with the enzyme-modified alkaline single cell gel electrophoresis.

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