1.0 Introduction

Worldwide, the proportion of the old population (people aged above 65 years) will nearly double to 22% in year 2050 WHO (2018). In Denmark 40.800 people live in nursing homes (Health 2016), and it has been estimated that among these, forty-two percent are at risk of undernutrition, due to weight loss (Beck 2012). The problem is highly multifactorial and caused by physical impairments. These include changes in the appetitive system (Rémond 2015), dysphagia (Wirth 2016) and frailty (Morley 2013), but also psychological issues including dementia and depression (Hickson 2006) are factors influencing the nutritional status negatively. Eventually, these health changes cause reduced quality of life in the old individual (Medicine 2000). The multifactorial origin of the problem of undernutrition is illustrated in the M3 model (*Figure 1*) by Heather Keller (2014). Besides the individual changes of the institutionalized old adult, the model shows how the quality of the meal, the meal access or the meal experience all are factors influencing the food intake. It is also seen that the target of intervention could be either at the individual (resident), the environmental (home) or political level (government).

The current PhD project was part of the ELDORADO project (Bredie 2015), and in its various Work Packages (WP) these factors of the M3 model were also in focus. Overall, the ELDORADO project aimed to establish knowledge on how to improve the nutritional status in nursing home residents and dwelling old adults receiving meals-on-wheels.
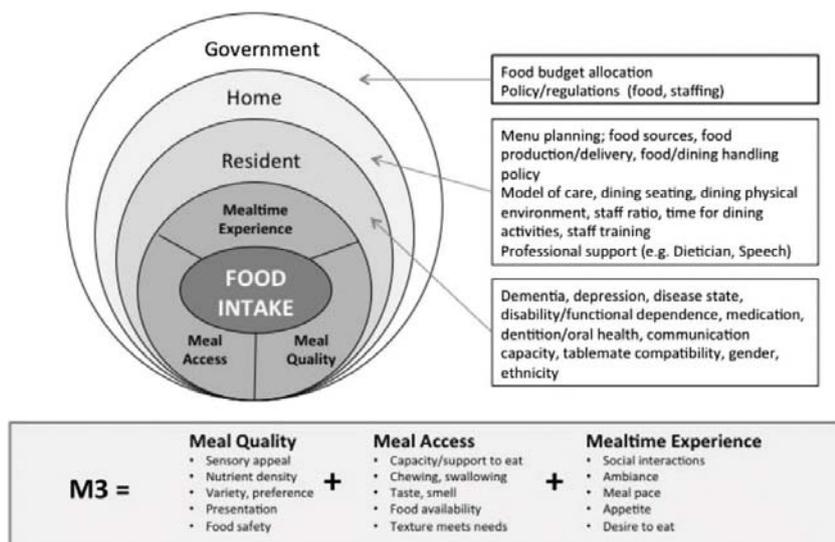

Figure 1. **M3 model describing the relationship between meal quality, meal access and mealtime experience for the food intake (Keller, 2014).** Used with permission from the Journal of Post-Acute and Long-Term Care Medicine (JAMDA).

Obviously, the meals delivered should follow the nutritional recommendations for old adults, regarding a defined high energy and protein content of the meals, due to the lower appetite and intake of meals in nursing home residents and institutionalized old adults (NNR 2012, Pedersen 2015). In addition to the nutritional aspects, sensory preferences are also crucial to make the meal a stimulating and satisfactory experience, and eventually enhance food intake (van der Meij 2015). These sensory preferences include the visual impression, flavor and texture of the meal. Different studies have investigated meal and sensory preferences in old adults and the results show high variability and heterogeneity (Delahunty 2004, Doets 2016, Song 2016). This is difficult to fit into a meals-on-wheels system, which due to practical and logistic reasons, often serve meals for nursing home residents, and therefore general and universal commonalities of a successful meal in nursing home residents were sought.

Universally, an optimal balance in the sensory elements of a meal is crucial (Klosse 2004), and meal familiarity is an important aspect in old adults (Edfors 2012, Nyberg 2014, Beelen 2017). Having secured the familiarity of the meal, however, in order not to create boredom, a meal should also include a culinary complex twist (Berlyne 1970). In this way the meal rises above the ordinary, and by stimulating the appetite this could be one way of combating the problem of undernutrition and reduced health-related quality of life.

The focus of the current PhD project (WP2) was to investigate if the health-related quality of life could be raised in nursing home residents by culinary improvements of a meals-on-wheels menu.