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PhD Thesis

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Finger foods

A cross-disciplinary study about the development of finger foods for older adults with motoric eating difficulties

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Preface

In August 2011, I left my job as a professional chef at Hotel Marienlyst in Helsingör, Denmark to pursue a Bachelor's Degree in Food and Meal Science at Kristianstad University. Today, almost 11 years later, I have a one-year Master's Degree in Food and Meal Science and a two-year Master's Degree in Health Science, and my journey as a doctoral student has come to an end. My journey has been both exciting and challenging, and it would not have been possible without the amazing people in my life. I would like to thank my supervisors Wender Bredie and Karin Wendin for their valuable guidance and support throughout my PhD work. A huge thanks also to project members Mikael Nilsson, Marie Lindau, Ewa Hansson, Kenneth Nilsson and Jenny Lindberg from Findus, Annika Krona from Rise, Annika Giunti Hansson and Therese Denker from NÄVER (NEN), Anna Blücher from Linnaeus University, Maud and Christer Eker from Parkinson Skåne (Scanian Parkinson coalition). Sincere thanks also to all those who participated in the studies and made this thesis possible.

I would also like to thank my colleagues at the Department of Food and Meal Science at Kristianstad University and the research environment MEAL-Food and Meals in Everyday Life. Special thanks to Maria Nyberg, Elisabet Rothenberg and Viktoria Olsson – I am so grateful for your guidance and valuable feedback. I also want to thank Albert Westergren as well as my fellow PhD colleagues and senior researchers at the Research Platform Collaboration for Health. Thank you for taking me in and letting me join the PhD activities, I have learned so much from our discussions and, during the pandemic, your friendship and support have been essential for my wellbeing.

A special thanks to Bitte Müller-Hansen for believing in me. You paved the way!

Finally, I want to thank my wonderful friends, family, my husband Mattias and beautiful sons, Liam, Isak and Leon, my mom Marianne and my sister Hannah for not giving up on me when I have been absent-minded, frustrated, stressed out and not always patient - I know it has been tough for you. Thank you for your endless love and support! I love you!

Sarah Forsberg

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Table of contents

Abstract

Motoric eating difficulties are often a consequence of disease and affect the ability to eat independently with cutlery. Not being able to eat properly with a knife and fork may lead to reduced food intake, social withdrawal and poor quality of life. Finger foods that are easy to transport from the plate to the mouth may be a strategy to maintain autonomy, food intake and social interaction. The overall aim of this thesis was to develop attractive, functional, and nutritionally adapted finger foods based on the preferences, demands and requirements of older adults over 65 years of age with motoric eating difficulties. This thesis is based on five cross-disciplinary studies and papers using mixed method methodology. It is organised into seven chapters where the results are presented in three of the chapters: *Preferences, demands and requirements of older adults with motoric eating difficulties*, *Designing, developing and evaluating prototypes* and *Implementing finger food meals*.

Preferences, demands and requirements of older adults with motoric eating difficulties describes the target population and their preferences, demands and requirements. Finger foods were found to be more favourable for those with major motoric eating difficulties because they were already eating with their fingers and had developed self-acceptance of their difficulties over time. In addition, sensory impairment, such as chemosensory decline, chewing and swallowing difficulties and visual impairments, are common and therefore enhanced flavour intensity, softer textures and serving the components separately on the plate are important. In order to increase the acceptability of eating with the fingers it is important to consider culinary rules, such as the type of foods in relation to viscosity, size and temperature.

Designing, developing and evaluating prototypes describes the gap where finger foods are needed and the development process. For finger foods to be a long-lasting strategy, the development should be focused on complete meals for lunch and dinner. A traditional Swedish meal comprising flatbreads, beef rolls, brown sauce and vegetables was developed and evaluated. An optimal beef roll is tender enough for the target population to chew and swallow and has a caramelised surface that increases the odour sensations and flavour. The optimal flatbread is flexible so that it can be used to wrap other foods and should be neutral in flavour so that they can be eaten with different types of dishes. A prebiotic mayonnaise was used to develop a brown sauce that had a high overall flavour intensity and higher viscosity which was optimal

for dipping. In addition, oven baked vegetables and deep-fried vegetables were found to be optimal for finger foods.

Implementing finger food meals describes the functional and social aspects of eating difficulties and the use of finger foods with regard to autonomy, food intake and social interaction. From a functional perspective, a finger food meal facilitated autonomous eating. By eating finger foods, the participants did not have to rely on others to cut their food and they were able to grab the components and bring them to the mouth by themselves without spilling, in their preferred order and at their own speed. However, not all participants were able to eat a finger food meal, indicating that this new way of managing the meal and navigating the plate has to be mastered before autonomy and food intake can be assessed. There is an opportunity for social interaction when less focus is being placed on the meal itself. Moreover, the attitudes of the professional caregivers and relatives were important in the creation of a permissive environment and for enabling residents to feel comfortable eating with their fingers. Arranging the seats and tables so that residents with similar difficulties are able to eat together may help them to acquire a sense of normality and belonging. In addition, professional caregivers and relatives can help those with poor performance eat independently by mirroring the movements of eating.

Abstrakt

Motoriske spisevanskeligheder er ofte en konsekvens af sygdom og påvirker evnen til at spise selvstændigt med bestik, og ikke at kunne spise ordentligt med gaffel og kniv. Det kan føre til nedsat fødevare indtagelse, social tilbagetrækning og dårlig livskvalitet. Fingermad, der er lette at transportere fra tallerkenen til munden, kan være en strategi for at opretholde autonomi, fødevare indtagelse og social interaktion. Formålet med denne afhandling var at udvikle attraktive, funktionelle og ernæringsmæssigt tilpassede fingermad baseret på præferencer og krav fra ældre voksne over 65 år med motoriske spisevanskeligheder. Afhandlingen er baseret på fem tværfaglige undersøgelser ved hjælp af et blande metode vælg, som er er organiseret i syv kapitler, hvor resultaterne præsenteres i tre af kapitlerne: *Præferencer og krav til ældre voksne med motoriske spisevanskeligheder*, *design, udvikling og evaluering af prototyper* og *implementering af fingermadsmåltider*.

Præferencer og krav hos ældre voksne med motoriske spisevanskeligheder beskriver målgruppen og deres præferencer og krav. Fingermad viste sig at være mere gunstigt for dem med store motoriske spisevanskeligheder, fordi de allerede spiste med fingrene og havde udviklet selvaccept af deres vanskeligheder over tid. Derudover er sensorisk svækkelse, såsom kemosensorisk tilbagegang, tygge- og synkebesvær og synshandicap, almindelige, og derfor er øget smagsintensitet, blødere teksturer og servering af komponenterne separat på tallerkenen vigtige. For at øge accepten af at spise med fingrene er det vigtigt at overveje kulinariske regler, såsom typen af fødevarer i forhold til viskositet, størrelse og temperatur.

Design, udvikling og evaluering af prototyper beskriver kløften, hvor der er behov for fingermad, og udviklingsprocessen. For at fingermad skal være en langvarig strategi, bør udviklingen fokusere på komplette måltider til frokost og middag. Et traditionelt svensk måltid bestående af fladbrød, okseruller, brun sovs og grøntsager blev udviklet og evalueret. En optimal oksevalserulle er mør nok til, at målgruppen kan tygge og sluge, og den har en karamelliseret overflade, der øger lugtfornemmelsen og smagen. Det optimale fladbrød er fleksibelt, så det kan bruges til at pakke andre fødevarer ind og skal være neutralt i smagen, så de kan spises sammen med forskellige typer retter. En præbiotisk mayonnaise blev brugt til at udvikle en brun sauce, der havde en høj samlet smagsintensitet og højere viskositet optimal til dypning. Derudover var ovnbagte grøntsager og friturestegte grøntsager optimale til fingermad.

Implementering af fingermadsmåltider beskriver de funktionelle og sociale aspekter af spisevanskeligheder og fingerfødevarer med hensyn til autonomi, fødeindtagelse og social interaktion. Fra et funktionelt perspektiv lettede et fingermadsmåltid autonom spisning. Ved at spise fingermad behøvede deltagerne ikke at stole på, at andre skar deres mad, og de var i stand til at gribe komponenterne og bringe dem til munden af sig selv uden at spilde, i deres foretrukne rækkefølge og i deres eget tempo. Imidlertid var ikke alle deltagere i stand til at spise et fingermadsmåltid, hvilket indikerer, at denne nye måde at styre måltidet og navigere på tallerkenen skal mestres, før autonomi og fødeindtagelse kan vurderes. Der er mulighed for social interaktion, når der bliver lagt mindre fokus på selve måltidet. De professionelle omsorgspersoners og pårørendes holdninger var vigtige for at skabe et eftergivende miljø og for beboerne at føle sig trygge ved at spise med fingrene. At arrangere sæder og borde, så beboere med lignende vanskeligheder er i stand til at spise sammen, kan hjælpe dem med at få en følelse af normalitet og tilhørsforhold. Derudover kan professionelle omsorgspersoner og pårørende hjælpe dem med dårlig præstation med at spise uafhængigt ved at spejle bevægelserne ved at spise.

Abbreviations and definitions

Intrinsic capacity	Underlying physiological and psychological changes, health-related behaviours, and presence or absence of disease (WHO, 2015).
Healthy ageing	The process of developing and maintaining the functional ability that enables well-being in older age (WHO, 2015).
Eating	Coordinated tasks and actions of eating food that has been served, bringing it to the mouth and consuming it in culturally acceptable ways, cutting or breaking food into pieces, opening bottles and cans, using eating implements, having meals, feasting, or dining" (WHO, 2001).
Eating difficulties	Activities, emotional requirements and relations that, alone or in combination, negatively interfere with the process of preparing food, transferring food into the mouth, chewing and swallowing (Klinke, Wilson, Hafsteinsdottir & Jonsdottir, 2013, p 1498).
Tremor	Shaking in the hands, arms, legs, jaw or head
Rigidity	Stiffness or inflexibility of the muscles in the limbs and trunk
Hypokinesia	Partial or complete loss of muscle movement due to a disruption in the basal ganglia
Bradykinesia	Slowness of movement
Gait disorder	Imbalance, shuffling, frequent falls, staggering, and freezing of gait
Gustation	The sense of taste
Olfaction	The sense of odour
Olfactory epithelium	The olfactory epithelium is located within the nasal cavity and contains olfactory receptor cells
Olfactory bulb	The olfactory bulb is a layered structure that serves as the first relay system in the olfactory pathway
Detection thresholds	The concentration at which a taste can be detected
Identification thresholds	The concentration at which a taste can be recognised
Suprathreshold intensity	Perceived intensity

List of papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

I. Forsberg S, Westergren A, Wendin K, Rothenberg E, Bredie WLP & Nyberg M. (2022). Perceptions and Attitudes about Eating with the Fingers - An Explorative Study among Older Adults with Motoric Eating Difficulties, Relatives and Professional Caregivers. *Journal of Nutrition in Gerontology and Geriatrics,* 41(1), 65-91. https://doi.org/10.1080/21551197.2022.2025970

II. Forsberg S, Bredie WLP & Wendin K. (2022). Development of finger foods - Sensory preferences and requirements among Swedish older adults with motoric eating difficulties. *Food and Nutrition Research.* [Submitted]

III. Forsberg S, Olsson V, Verstraelen E, Krona A, Bredie WLP & Wendin K. (2022). Proposal of development of finger foods for older adults with motoric eating difficulties - A study based on creative design. *International Journal of Gastronomy and Food Science,* 28, 100516. https://doi.org/10.1016/j.ijgfs.2022.100516

IV. Forsberg S, Olsson V, Bredie WLP & Wendin K. (2022). Vegetable finger foods - Preferences among older adults with motoric eating difficulties. *International Journal of Gastronomy and Food Science,* 28, 100528. https://doi.org/10.1016/j.ijgfs.2022.100528

V. Forsberg S, Rothenberg E, Wendin K, Olsson V, Nyberg , Bredie WLP, Westergren A. (2022). Finger food meals -A vehicle to improve autonomy, food intake and social interaction among older adults with motoric eating difficulties. [Manuscript]

1. Introduction

This thesis is written in the scientific field of Food and Meal Science and has been submitted in fulfilment of the requirements for a PhD degree at the Department of Food Science, Faculty of Science, University of Copenhagen, Denmark. The thesis was conducted as part of the project "*Finger foods - a vehicle to prevent malnutrition, maintain physical and social health as well as quality of life among older adults*" which has been funded by The Kamprad Family Foundation for Entrepreneurship, Research and Charity, Sweden.

Eating is defined by The International Classification of Functioning, Disability and Health (ICF) as "*coordinated tasks and actions of eating food that has been served, bringing it to the mouth and consuming it in culturally acceptable ways, cutting or breaking food into pieces, opening bottles and cans, using eating implements, having meals, feasting, or dining*" (WHO, 2001). The definition comprises both functional and social aspects of eating and emphasises the cultural meaning of eating. Acceptable ways of eating will differ from context to context; in Western societies, using a knife and fork during a meal is considered the proper way of eating (Elias, 2000). However, when the ability to dine and consume foods in culturally acceptable ways is reduced, eating becomes a biological necessity for survival rather than a pleasurable event (Walker, 2005; Nyberg, Olsson, Örtman, Pajalic, Andersson, Blücher, Lindborg, Wendin & Westergren, 2018). In the book Food: The Key Concepts, Belasco states that *"Dining is much more than feeding. While all creatures feed, only humans dine"* (Belasco, 2008 p.15). This indicates that the way humans eat, often partaking in a shared meal with others, is what differentiates humans from other creatures. Not being able to partake in a shared meal according to established norms can therefore make a person feel less of a human, resulting in feelings of exclusion and alienation.

Motoric eating difficulties are often a consequence of disease and affect the ability to eat independently with cutlery (Jacobsson, Axelsson, Österlind & Norberg, 2000; Westergren, Unosson, Ohlsson, Lorefält & Hallberg, 2002; Medin, Windahl, von Arbin, Tham & Wredling, 2011). Not being able to eat properly with a fork and knife may lead to reduced food intake, social withdrawal and poor quality of life (Nyberg et al., 2018; Nyberg, Olsson, Pajalic, Örtman, Andersson, Blücher, Wendin & Westergren, 2015). Finger foods that are easy to transport from the plate to the mouth may be a strategy to maintain autonomy, food intake and social interaction.

The overall aim of the work in this thesis was, therefore, to develop attractive, functional and nutritionally adapted finger foods based on the preferences, demands and requirements of older adults with motoric eating difficulties over 65 years of age. To accomplish this, a cross-disciplinary approach was needed, including such aspects as the sociology of food, nutrition and physiology, food science, product development, and sensory and consumer science. In addition, knowledge about gerontology, geriatrics and geriatric nutrition has been essential to understand the demands of the target group as well as the context in which the finger foods will be served.

After the introduction here in Chapter 1, a literature review is presented in Chapter 2 to provide a general description and understanding of the research problem and the conceptual framework used in the thesis. In Chapter 3, the aims and objectives of the thesis are presented, and Chapter 4 presents an overview of the study design and methods. The results are presented as a synthesis which is structured in three separate chapters, Chapters 5, 6 and 7 (Figure 1). Chapter 5 describes the target population and their preferences, demands and requirements, Chapter 6 describes the development of the finger food components and Chapter 7 describes functional and social aspects concerning finger food meals. Chapter 8 comprises the general discussion, methodological discussion and future perspectives. The conclusions are then presented in Chapter 9.

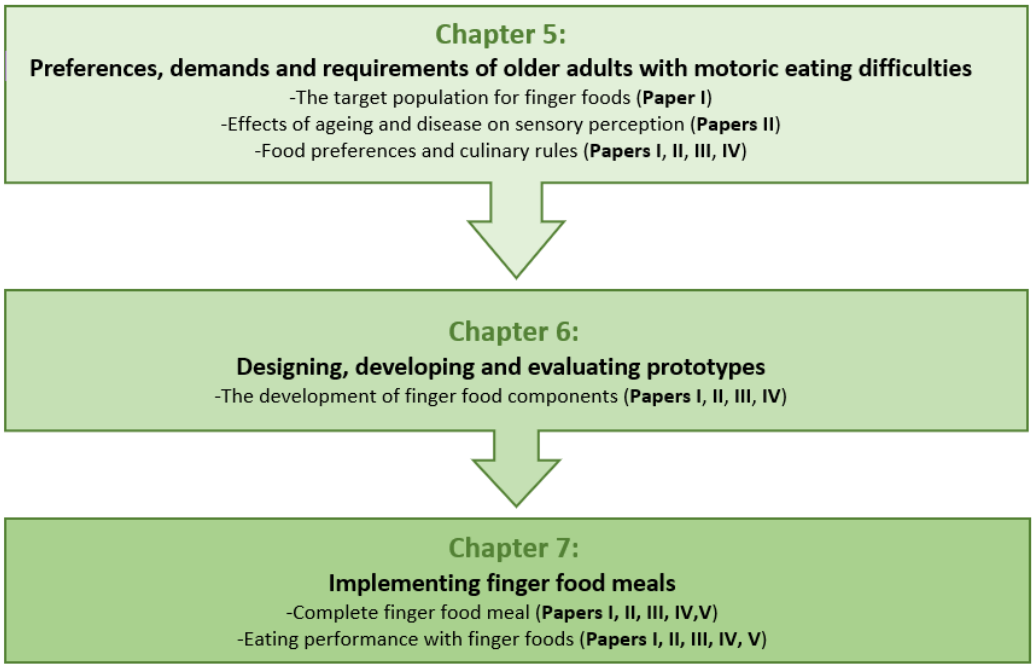

Figure 1. An overview of the results of the thesis, presented as synthesis of the five studies and papers

2. Literature review

2.1 Ageing and functional ability

In Europe, the older adult population >65 years of age is projected to increase by 11% by the year 2100, and the proportion of older adults >80 years of age is expected to increase from 6% to 15% (Eurostat, 2019). Ageing is a multifactorial process characterised by a progressive deterioration of cellular processes in all tissues (Harries, 2014) which results in increased susceptibility to age-related diseases (Mathers, 2015), impaired function and increased vulnerability to death (López-Otíin, Blasco, Partridge, Serrano & Kroemer, 2013). Since the prevalence of diseases generally increases with age the number of older adults living with disabilities will increase (World Health Organisation & World Bank, 2011) as will the period of time spent in disabled states (Keeler, Guralnik, Tian, Wallace & Reuben, 2010). According to WHO (2015), global policymakers and healthcare providers may not be sufficiently prepared to be able to cope with the increased prevalence of chronic disorders and relating disabilities due to the extended life expectancy.

The World Health Organization (2015) defines healthy ageing as "*the process of developing and maintaining the functional ability that enables well-being in older age*". According to WHO (2015), functional ability refers to the individual's intrinsic capacity and environmental factors, as well as the interaction between the individual and the environment. Intrinsic capacity in turn refers to underlying physiological and psychological changes, health-related behaviours and presence or absence of disease (WHO, 2015). Functional limitations and disabilities threaten older adults' ability for selfcare and independence in daily activities (WHO, 2015). Declining physical and cognitive abilities have a negative impact on older adults' food intake, including their ability to procure, prepare and ingest food and meals (Wylie, Copeman & Kirk, 1999; Nicklett & Kadell, 2013; Jacobsson, Axelsson, Wenngren & Norberg, 1996; Westergren, Karlsson, Andersson, Ohlsson, & Hallberg, 2001; Andersson & Sidenvall, 2001; Gustafsson, Andersson, Andersson, Fjellström & Sidenvall, 2003; Westergren, Hagell, Wendin & Sjödahl Hammarlund, 2016).

2.2 Eating difficulties

Eating difficulties have been defined as "*activities, emotional requirements and relations that, alone or in combination, negatively interfere with the process of preparing food, transferring food into the mouth, chewing and swallowing*" (Klinke, Wilson, Hafsteinsdottir, Jonsdottir, 2013,

p 1498). Eating difficulties are common among older adults in hospitals and nursing homes (Westergren, 2019) and can be related to three phases of eating; 1) *ingestion* - the ability to manipulate food on the plate and transport it to the mouth, 2) *deglutition* - the ability to chew and swallow food and 3) *energy/appetite* - having sufficient energy to manage and consume a full meal (Westergren et al., 2002).

In the study by Medin, Larson, von Arbin, Wredling and Tham (2010), those with eating difficulties struggled to eat both properly and safely. Eating properly was related to the ability to eat according to expected meal behaviour, while eating safely was related to the ability to chew and swallow properly without choking (Medin et al., 2010). Since previous research has been mostly focused on chewing and swallowing difficulties, there is a need for more research om motoric eating difficulties. However, since motoric eating difficulties are complex and often occur together with other eating difficulties, it is not possible to separate them completely.

2.3 Diseases causing motoric eating difficulties

Motoric eating difficulties are caused by motor symptoms associated with a reduced ability to handle cutlery during a meal, making it difficult to manipulate food on the plate and transport food to the mouth (Jacobsson et al., 2000; Westergren et al., 2002; Medin et al., 2011). Studies have shown that there is a large group of older adults who experience motoric eating difficulties as a result of diseases such as stroke, Parkinson's disease, rheumatoid arthritis (Jacobsson et al., 2000) and dementia (Jung, Lee, De Gagne, Lee, Lee, Yoo, Won & Choi, 2021). In addition, old age and frailty may also influence eating ability (Nyberg et al., 2015).

However, the characteristics of motoric eating difficulties vary depending on the type of disease and the type of symptoms. Generally, persons diagnosed with Parkinson's disease experience motor symptoms such as tremor, rigidity, hypokinesia, bradykinesia, postural instability, gait disorder and involuntary movements (Widner & Marktorp, 2015; National Institute for Health & Clinical Excellence, 2006), whereas persons who have had a stroke may experience numbness, weakness or paresis in the arm (Medin, 2010). For persons diagnosed with dementia, changes in movement influence the ability to handle cutlery (Kai, Hashimoto, Amano, Tanaka, Fukuhara & Ikeda, 2015), whereas those diagnosed with rheumatoid arthritis suffer from functional deficits, such as swelling, stiffness and tenderness in the joints, that impair the range of motion in the hands and fingers (Gibofsky, 2012; Yeager, 2019).

Studies including mainly stroke patients >65 years of age in hospital rehabilitation have found that motoric eating difficulties are the most common eating difficulties among persons after a stroke; the prevalence of one or more eating difficulties is approximately 80% (Westergren et al., 2001; Westergren et al., 2002; Medin et al., 2011). In addition, motoric eating difficulties are among the most severe eating difficulties and the likelihood of the person also having other eating difficulties is high (Westergren & Melgaard, 2020). For example, chewing and swallowing difficulties are common in the acute phase of a stroke and often persist for three months after stroke (Medin et al., 2011). According to Westergren, Ohlsson & Hallberg (2001), a certain level of energy and alertness is important for an individual to be able to regain the ability to eat and swallow after a stroke.

Westergren et al., (2016) described how motor problems interfered with daily activities, and in particular eating, among older adults diagnosed with Parkinson's disease. Meals were described as time-consuming since tremor and involuntary movements made it difficult for them to eat properly with cutlery and caused them to knock over glasses and spill food and drink (Westergren et al., 2016). Parkinson's disease is a chronic progressive neurodegenerative disease caused by the loss of dopaminergic neurons (Widner & Marktorp, 2015) resulting in motor symptoms that progress throughout the course of the disease (Widner & Marktorp, 2015).

However, the manifestation of the disease is heterogenous (Vieira, Jesus-Ribeiro & Januário, 2020), with some persons experiencing rigidity and bradykinesia whereas for others tremor is the predominant symptom. Chewing and swallowing difficulties are common in the advanced stages of Parkinson's disease (Kwon & Lee, 2019). In addition, disease progression and functional decline are often more rapid for atypical parkinsonian syndromes such as dementia with Lewy bodies (DLB), multiple system atrophy (MSA), progressive supranuclear palsy (PSP), and corticobasal degeneration (CBD) (McFarland, 2016) and the ability to chew and swallow food can therefore be severely impaired during early stages of such diseases (McFarland, 2016; Forster, Samaras, Gold & Samaras, 2011).

2.4 Consequences of motoric eating difficulties

Eating difficulties are associated with assisted eating needs (Westergren et al., 2002), withdrawal from social activities (Nyberg et al., 2018), and nutritional risks that may decrease quality of life (Nyberg et al., 2015). Several studies have reported that older adults with motoric eating difficulties experience lack of control when it comes to food and meals. They were often dependent on others to prepare their meals and to cut their food into smaller pieces (Westergren

et al., 2016; Nyberg et al., 2018). Those in need of assisted eating did not feel that they were able to control the speed, rhythm and portion size of the foods being fed to them (Medin et al., 2010; Nyberg et al., 2015).

Striving for control was an ongoing process in eating situations after stroke in the studies by Medin et al., (2010) and Nyberg et al., (2018). In order to avoid revealing their difficulties, they would carefully plan where and with whom they ate, decline dinner invitations, and avoid activities with people they did not know (Medin et al., 2010; Westergren et al., 2016). In addition, studies have shown that persons with eating difficulties avoid eating with others (Medin et al., 2010; Nyberg et al., 2018; Westergren et al., 2016). This may be a result of feelings of exclusion (Wallin, 2015), shame and guilt due to not being able to eat properly (Nyberg et al., 2018) or concern about other people's opinions (Medin et al., 2010).

Meal practices were also constantly adjusted and readjusted to sustain normality to be able to remain in control for as long as possible and common strategies were, for example, eating only with a fork or spoon, using bowls instead of plates, and drinking through straws (Nyberg et al., 2018). Some reported that they ate fewer cooked meals and instead choose simple cold foods and snacks that were easier to prepare (Andersson & Sidenvall, 2001; Westergren et al., 2016). This may affect food choice and result in a monotonous and unbalanced diet (Sidenvall, Fjellström & Ek, 1994).

Eating difficulties have been found to be an important risk factor for malnutrition (Westergren et al., 2001). Forty-six percent of those with eating difficulties were at risk of being malnourished or had suspected or manifest malnutrition in the study by Westergren et al., (2002). A Danish study showed that older adults with eating difficulties had a significantly higher risk (155%) of having poor nutritional status (Nielsen, Maribo, Westergren & Melgaard, 2018). Although motoric eating difficulties have been associated with eating assistance, this did not contribute significantly to malnutrition (Westergren et al., 2002). Low energy and alertness, eating time, and food consumption had the strongest associations with malnutrition (Westergren et al., 2002). However, since motoric eating difficulties can be time and energy consuming there is a risk that those with motoric eating difficulties do not have sufficient energy to finish a meal. This may in turn have a negative influence on their nutritional status and quality of life.

2.5 Nutritional demand and interventions

Proper nutrition is fundamental to the promotion of healthy ageing since it may retard the ageing process by reducing inflammation, oxidative and metabolic stress, and by enhancing cellular capacities for damage management and repair (Malcomson & Mathers, 2019). Nutritional interventions can also delay care dependency and improve older adults' intrinsic capacity (Dorner, Lackinger, Haider, Luger, Kapan, Luger & Schindler, 2013). Generally older adults have an increased demand for protein and energy due to physiological changes, such as declining anabolic response and decreased appetite (Deutz, Bauer, Barazzoni, Biolo, Boirie, Bosy-Westphal, Cederholm, Cruz-Jentoft, Krznariç, Nair, Singer, Teta, Tipton, Calder, 2014). The importance of protein-enriched foods has been stressed due to their role in contributing to quality of life and independent living in older adult populations (van der Zanden, van Kleef, de Wijk & van Trijp, 2014). An increased protein intake can contribute to the improvement of muscle strength and function (Lutz, Petzold & Albala, 2019).

The Nordic Nutrition Recommendations [NNR] suggest a protein intake of 1.1-1.2 g protein/kg body weight/ day for older adults ≥65 years of age and for protein to correspond to approximately 15-20% of total energy intake (Nordic Council of Ministers (2014). The Swedish National Board of Health and Welfare (2020) recommends a protein intake of 1.2-1.5 g protein/kg body weight/ day for older adults ≥65 years of age at risk of being malnourished, with manifest malnutrition, or with an acute or chronic disease. According to the NNR, fat should provide approximately 25-40% of the energy intake in healthy older adults (Nordic Council of Ministers (2014). However, the energy demand is often increased in this group and fat intakes of 40% of energy intake and higher are therefore recommended by The Swedish National Board of Health and Welfare (2020). According to the NNR, carbohydrates should provide approximately 45-60% of the energy intake for healthy older adults (Nordic Council of Ministers (2014). However, an increase in protein and fat will result in a decrease in the percentage of energy from carbohydrates to below 45% (The Swedish National Board of Health and Welfare, 2020).

In addition, dietary fibre also plays an important role in the management of constipation, which is common in older adults diagnosed with Parkinson's disease (Barichella, Cereda & Pezzoli, 2009). Beta glucans and oligosaccharides such as galactose, fructose, lactulose and inulin are fermentable compounds that act as substrate for the intrinsic probiotic microflora and encourage their growth in the intestine (prebiotics) (Hamilton-Miller, 2004) affecting intestinal peristalsis favourably.

2.6 Finger foods

To promote health and independence among persons with motoric eating difficulties, Nyberg et al., (2015) suggest a need for refined and socially accepted eating aids in combination with nutritious and tasty products. The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends the use of finger foods to increase the energy and nutrient intakes of older adults with malnutrition or at risk of malnutrition, and in particular those unable to eat with cutlery (Volkert, Beck, Cederholm, Cruz-Jentoft, Goisser, Hooper, Kiesswetter, Maggio, Raynaud-Simon, Sieber, Sobotka, van Asselt, Wirth & Bischoff, 2019).

Finger foods are defined as foods that you can eat without needing knives, forks or spoons (Cambridge dictionary, 2022) and pieces of food that you can eat easily with your fingers (Oxford dictionary, 2022). Many cultures in the world provide foods that are easily eaten with the fingers, for example, antipasto from Italy, yum cha from China and Meze from the Mediterranean, Balkans and parts of the Middle East (Burbidge, 2013). In the literature, finger foods have been described as comprising sandwiches, fruits, vegetables, semi-manufactured components, such as tater tots, fish, and chicken sticks (Soltesz & Dayton, 1995), quiches, brownies and cakes (Visscher, Battjes-Fries, van de Rest, Patijn, van der Lee, Wijma-Idsinga, Pot & Voshol, 2020), as well as pureed and reconstituted solid meals (Pouyet, Giboreau, Benattar & Cuvelier, 2014).

The concept of finger foods has mainly been focused on increasing autonomy and food intake in persons with dementia (Jean, 1997; Pouyet et al., 2014; Murphy, Soltesz & Dayton, 1995). In the study by Holmes & Brooks (2017), frequent mini meals served as finger foods were recommended as these are easily served in different settings to encourage food intake among older adults with dementia. Soltesz and Dayton (1995) altered the typical menu in a nursing home to include more finger foods. They concluded that finger foods were an effective strategy to increase food intakes and maintain weight among older adults with Alzheimer's disease and that finger foods were especially beneficial for those struggling to eat with cutlery or whose movements were slow (Soltesz & Dayton, 1995). Although these studies do not provide robust evidence for the effectiveness of finger foods, they suggest that finger foods may have a positive influence on the food intake of persons with cognitive impairment (Heelan, Prieto, Roberts, Gallant, Barnes, & Green, 2020).

2.7 The Five Aspect Meal Model

The Five Aspect Meal Model (FAMM), comprising product, room, meeting, atmosphere, and management control system, can be a valuable tool for creating meal experiences (Figure 2) (Gustafsson, Öström, Johansson and Mossberg, 2006). FAMM was used in this thesis to ensure that all aspects of the meal were included and properly spanned.

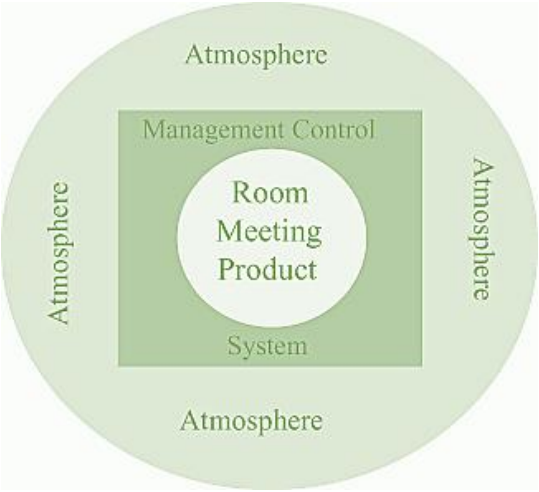

Figure 2. Displays The Five Aspect Meal Model developed by Gustafsson, Öström, Johansson and Mossberg (2006).

The product involves the planning and preparation of appetising dishes as well as the combination of food and beverages based on consumer needs. This includes the food composition, cooking methods, nutrition, sensory factors (taste, flavour, colour, form) and temperature (Gustafsson et al., 2006). This aspect has been central in the design and development of attractive, functional and nutritional finger food meals.

The room represents the setting where the meal service is provided (Gustafsson et al., 2006) and *the meeting* encompasses the social aspects, for example the rules and etiquette in the dining room. This is an important aspect to consider since those with motoric eating difficulties lack the ability to eat with cutlery in accordance with what are commonly considered to be proper table manners, but also because they may not be comfortable eating with their fingers in front of other care recipients, relatives and care professionals. The interaction with other guests, relatives and care professionals is, therefore, essential to consider.

The atmosphere is the overall meal experience and is made up of the aspects, that is the product, room, meeting, and the management control system (Gustafsson et al., 2006). All these aspects are important to take into account in the development and implementation of a finger food meal concept. *The management control system* governs all the other aspects, and includes the

economic and legal factors, as well as the planning of the kitchen and dining room (Gustafsson et al., 2006). This aspect will also include nutritional guidelines.

2.8 The Disablement process

In this thesis, eating difficulties are seen from the theoretical viewpoint of the disablement process, which builds on a model that was first described by Nagi (1965). The disablement process is a conceptual scheme for disability, used in physical therapy, and describes how chronic and acute disorders affect functioning, fundamental physical and mental actions, and activities in daily life (Verbrugge & Jette, 1994). The disablement process is a socio-medical model, which means that it includes both social and medical aspects (Verbrugge & Jette, 1994).

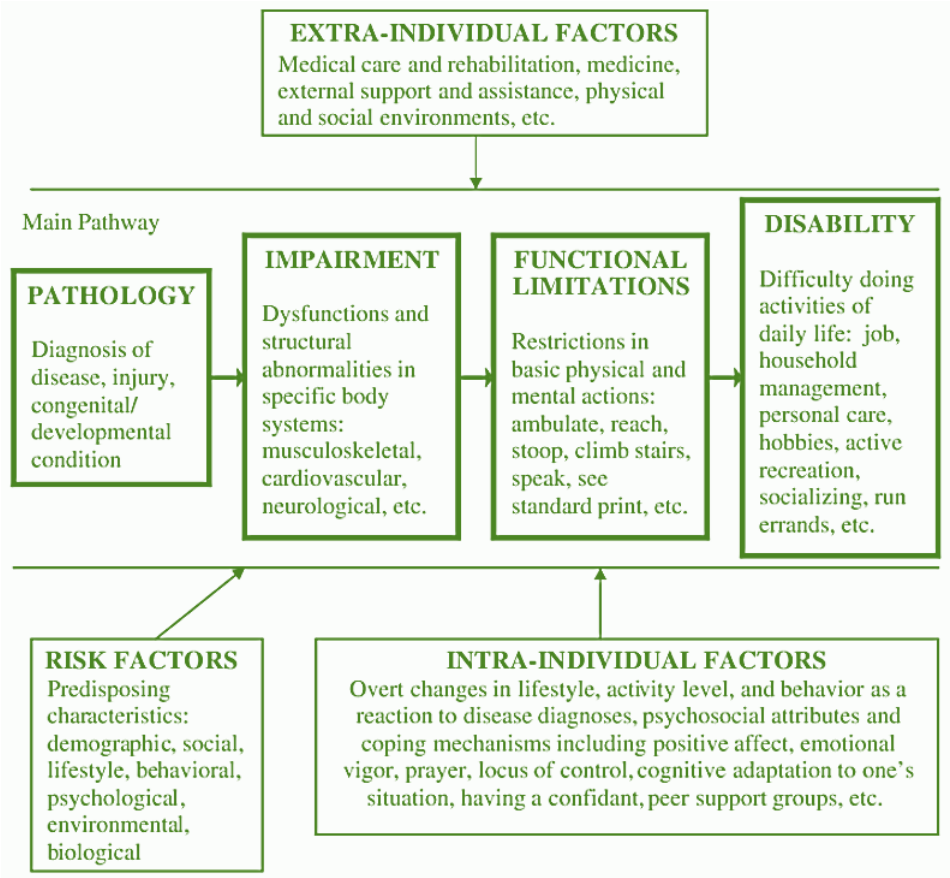

Figure 3. Displays The Disability Process described by Verbrugge and Jette (1994).

The model displays the main pathway from pathology to disability together with risk factors, interventions and exacerbators (Figure 3). *Risk factors* exist before the disablement process, and they affect the presence and severity of impairments, functional limitations, and disabilities (Verbrugge & Jette, 1994). *Interventions* includes medical care, rehabilitation, medications, external support and modifications of the physical and social environment that are inserted

during the disablement process to avoid, retard, or reverse the outcomes (Verbrugge & Jette, 1994). *Exacerbators* are the barriers that prompt dysfunction (Verbrugge & Jette, 1994). In this thesis, the barriers are the social norms surrounding the meal and the intervention using acceptable finger foods may encourage and facilitate autonomous eating and, in turn, avoid eating difficulties becoming a disability. Intra-individual factors operate within a person such as behavioural changes and coping skills, while extra-individual factors operate outside the physical and social context (Verbrugge & Jette, 1994). International Classification of Function, Disability and Health (ICF) is another international framework that describes functioning and disability in relation to a health condition. However, the disablement process provides a simple framework for the development of motoric eating difficulties in the present thesis.

3. Rationale, aim and objectives

Finger foods that are easy to transport to the mouth with the fingers may be beneficial for older adults with motoric eating difficulties and a reduced ability to handle cutlery. In addition, finger foods may be a strategy to increase autonomy, food intake, and social inclusion. However, little is known about the acceptability of such foods among older adults. More research on the acceptability and use of finger foods is needed in order to design and develop attractive finger foods that older adults are willing to eat with their fingers.

The overall aim was therefore to develop and evaluate attractive, functional, and nutritionally adapted finger foods based on the preferences, demands and requirements of older adults >65 years with motoric eating difficulties. The specific objectives were:

I. To explore perceptions and attitudes about eating with the fingers among older adults >65 years with motoric eating difficulties, and among relatives and professional caregivers.

II. To assess sensory preferences and requirements for everyday meals among Swedish older adults with motoric eating difficulties and use the findings in the development of finger foods.

III. To develop and evaluate finger food components as part of a complete meal for older adults with motoric eating difficulties. The specific objectives were to evaluate the sensory quality and the end-user acceptability of finger food components flatbreads, beef rolls and brown sauces.

IV. To investigate vegetable preferences among older adults >65 years with motoric eating difficulties.

V. To describe the eating situation when using finger food meals compared to regular meals with regard to autonomy, food intake and social inclusion among older adults >65 years with major motoric eating difficulties

4. Study design and methods

This chapter provides an overview of the methods used in this thesis and a description of the design of each study in order to clearly present the study operation and progression of the studies and relating papers. Specific details can be found in the associated papers.

4.1 Overview of methods for data collection and analysis

The use of mixed methodology has been essential to obtain a more comprehensive view of the research problem in response to the research questions. Mixed methodology involves the collection and analysis of both qualitative and quantitative data, and subsequently merging and connecting these data (Creswell, 2015). The following methods have been used in the thesis.

4.1.1 Focus groups

Focus groups are typically conducted to collect data by exploring the perceptions, feelings and thinking of participants concerning issues, ideas, products and services (Krueger & Casey, 2009). The goal is to obtain data about a topic from participants with a range of opinions and then compare and contrast data across groups (Krueger & Casey, 2009). Approximately 5-8 participants who are similar to each other are typically recruited but this can range from 4-12 participants (Krueger & Casey, 2009). According to Krueger and Casey (2009) the groups have to be small enough to allow the possibility for every participant to share their insights but also large enough to obtain diversity in perception.

4.1.2 Individual interviews

Individual interviews are used to gain insights into people's perceptions, understanding and experience of a given phenomenon (Ryan, Coughlan & Cronin, 2009). Ryan, Coughlan & Cronin (2009) describe three types of interviews: standardized, semi-standardized and unstandardized. Standardized (structured) interviews are based on structured explicit questions, semi-standardized (semi-structured) interviews are more flexible and uses less structured questions and allows for spontaneous explorations, and unstandardized (unstructured) interviews no not engage with any framework and instead engage in conversation about a specific topic. In addition, in-depth interviews can be used when the participants are not comfortable talking openly about a topic in a group or when there is a need for more detailed information about the participants' behaviours or thoughts, but also to explore novel issues in depth (Boyce & Neale, 2006).

4.1.3 Photo elicitation

Photo elicitation is an interview in which photographs are as used to stimulate and guide the interview (Harper, 2002), creating a comfortable space for discussion (Epstein, Stevens, McKeever & Baruchel, 2006). Using photographs evokes information, feelings and memories that can trigger the conversation (Harper, 2002).

4.1.4 Observations

Observations are used to capture the activities of participants in a given setting and can be performed either quantitatively or qualitatively depending on the research question (Salmon, 2015). One strength with observations is that this method provides direct access to the phenomena under investigation (Salmon, 2015) and an opportunity to observe at first-hand behaviours, events, actions and interactions (Twycross & Shorten, 2016).

4.1.5 Content analysis

Content analysis is a common qualitative research technique used to interpret meaning from the content of text data (Hsieh & Shannon, 2005). There are three distinct approaches to content analysis: conventional, directed, and summative and the main differences are related to coding scheme, origins of codes and threats to trustworthiness (Hsieh & Shannon, 2005). According to Hsieh and Shannon (2005), the conventional approach is inductive where coding categories are derived directly from the data, while the directed approach is deductive where the coding is guided by a theory or research findings. Inductive content analysis can be used to explore a phenomenon that has previously not been studied or when there is a need for more research, while deductive content analysis can be used to test a theory or model (Elo & Kyngäs, 2008). The summative approach involves counting and comparison of keywords followed by interpretation of the underlying context (Hsieh & Shannon, 2005).

4.1.6 Classical transcript analysis

A classical transcript analysis is a method based on groupings of similar ideas (Lawless & Heymann, 2010). It is a straightforward method abridged from a method described by Kreuger and Casey (2009). Information-rich quotes are extracted from the transcripts and categorised based on their content, forming a basic information matrix from which the construct themes are identified using frequency and extent (Lawless & Heymann, 2010). Transcript summaries are then written built on the identified themes or questions, and quotes are used to illustrate each

summary point (Lawless & Heymann, 2010). The transcript summary is then used as a centrepiece of the written report (Lawless & Heymann, 2010).

4.1.7 Check-all-that-apply

Check-all-that-apply (CATA) is a consumer friendly, rapid methodology used to obtain sensory product characterisation (Reinbach, Giacalone, Machado Ribeiro, Bredie, Bom Frøst, 2014; Ares & Jaeger, 2015). The CATA questionnaire consists of a list of terms, e.g., sensory attributes, hedonic responses, emotional responses, purchase intentions etcetera, and the consumers select all the terms that apply to the product or sample under evaluation (Varela & Ares, 2012; Ares & Jaeger, 2015). The CATA questionnaire has been found to be valid and repeatable (Ares, Tárrega, Izquierdo & Jaeger, 2014; Ares & Jaeger, 2015; Jaeger, Giacalone, Roigaard, Pineau, Vidal, Giménez, Bom Frøst & Ares, 2013) and a sample of approximately 60-80 consumers is regarded as sufficient (Ares et al., 2014).

4.1.8 Creative design

Creative design is a technique that combines experimental design with creativity and food knowledge (Naes & Nyvold, 2004). Creative design comprises three stages of development: 1) *Experimental cooking*, prioritise, select, and set up an experimental design of the selected product attributes; 2) *Sensory evaluation*, develop prototypes to create the best possible product according to the set-up in the design instead of identifying and estimating the effects; and 3) *Consumer testing*, an important tool used to ensure that the consumers like the product (Naes & Nyvold, 2004).

4.1.9 Consensus profiling

Sensory profiles, which are descriptions of the sensory attributes of products including intensity values, can be established by sensory evaluation (ISO, 2016). In consensus profiling, a panel of assessors evaluate the sensory attributes and intensities in consensus (ISO, 2016). Initially, the assessors develop and define a common terminology that is later used during the evaluation, and the assessors individually evaluate the samples and record the intensities of attributes (ISO, 2016). The panel leader guides the procedure and discussion and provides reference samples to enrich the discussion and enable the assessors to reach a consensus (ISO, 2016).

4.2 Overview of the studies and experimental work

The present thesis is based on five studies which have resulted in five papers. To be able to develop finger foods that meet the preferences and requirements of older adults with motoric 26 eating difficulties. Study I explores perceptions and attitudes about eating with the fingers among older adults with motoric eating difficulties (n=14), relatives (n=15) and professional caregivers (n=15). Study II investigates sensory preferences and requirements among older adults with motoric eating difficulties (n=15). The insights gained from Studies I and II were then used to develop finger food components (flatbreads, beef rolls and brown sauces), and evaluate in Study III. Insights into vegetable preferences were assessed in a general older adult population in Study IV and the findings used to develop vegetable finger foods. The components developed in Studies III and IV were also evaluated by persons diagnosed with and spouses of older adults diagnosed with Parkinson's disease (n=6). Thereafter, a complete finger food meal was evaluated in regard to autonomy, food intake and social interaction with older adults with some type of motoric eating difficulty in Study V. Table 1 provides an overview of each study and Figure 4 shows the progression of the PhD project and studies.

Table 1. Overview of the studies included in the thesis.

	Study I	Study II	Study III	Study IV	Study V
Research design	-Qualitative exploratory	-Mixed method convergent	-Creative design	-Mixed method sequential design	-Qualitative exploratory design
Data Collection	-Individual interviews -Focus groups -Photo elicitation	-Survey CATA	-Consensus profiling -Texture analysis -Focus groups	-Survey -Focus groups	-Meal observations -Minimal Eating Observation Form -II
Sample	-Older adults >65 years with motoric eating difficulties (n=14) -Relatives (n=15) -Professional caregivers (n=15)	-Older adults >65 years with motoric eating difficulties (n=15)	-Analytic sensory panel (n=5-6) -Persons diagnosed with/spouses of older adults diagnosed with PD (n=6)	-Older adults >65 years (n=97) -Persons diagnosed with/spouses of older adults diagnosed with PD (n=6)	-Older adults with motoric eating difficulties (n=6)
Data analysis	-Content analysis: both deductive and inductive approaches	-Summative content analysis -Descriptive statistics, Cochran's Q-Test, Correspondence analysis	-Descriptive statistics -One-way ANOVA -Classical transcript analysis	-Descriptive statistics -Chi-square -Classical transcript analysis	-Content analysis: deductive approach

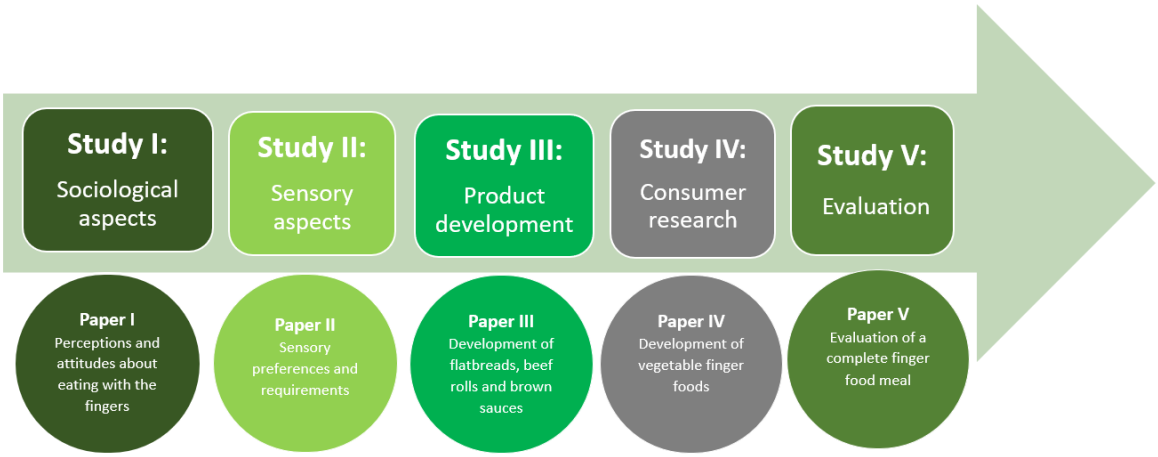

Figure 4. Displays the progression of the five studies and relating papers.

4.1.1 Study I: Perceptions and attitudes about eating with the fingers

In order to explore the perceptions and attitudes about eating with the fingers, individual interviews were conducted with older adults with motoric eating difficulties and focus groups were conducted with relatives and professional caregivers. An interview guide with pictures of different dishes and meal contexts were created and used to facilitate the data collection. Content analysis with both deductive and inductive approaches was used to analyse the data (Elo & Kyngäs, 2008). Initially, data were coded and organized deductively into categories based on key concepts found in the literature: why, what, with whom and where. An inductive analysis was then performed, and subcategories were created for each category.

Data from **Study I** was then analysed further. Data were read through several times and vegetable and meat preferences and requirements mentioned in the data were coded, sorted, and compiled into two separate categories, *meat* and *vegetables*. These were then used in the innovation process to select relevant meal components for the development of finger foods. These findings are not included in the paper but are used in the thesis and will be referred to as **Additional data**, **Study I**.

4.1.2 Study II: Sensory preferences and requirements

In order to assess sensory preferences and requirements among Swedish older adults with motoric eating difficulties, data were collected through a digital survey based on Check-all-that-apply (CATA). The questionnaire consisted of an open-ended question about food preferences for everyday meals followed by a list of CATA terms consisting of 29 sensory attributes. The sensory attributes had been collected through a literature review and the assessment of sensory attributes that are of importance to older adults in a Scandinavian context. Food preferences were analysed with inspiration from summative content analysis (Hsieh & Shannon, 2005) and were

used to explain the survey results. Descriptive statistics were analysed to describe the important sensory attributes. Cochran's Q Test was used to assess the difference in proportion between related samples of breakfast, lunch, dinner, snack and fika (coffee with cake) and a correspondence analysis to check for relationships in the data.

4.1.3 Study III: Development of finger food components

Creative design was used to develop and evaluate finger food components as part of a complete meal for older adults with motoric eating difficulties. Twenty flatbreads, sixteen beef rolls and eleven brown sauces were developed. Initially colour and texture measurements were performed on all components. Thereafter, sensory profiles of the finger food components were established using consensus profiling (ISO, 2016). Finally, focus groups were conducted to evaluate the finger food components from the end-user's perspective and the participants were spouses of older adults with Parkinson's disease and persons diagnosed with Parkinson's disease. Sensory data were compiled in spider plots. Data from the texture analysis were analysed by calculating mean values and standard deviations, and one-way analysis of variance (ANOVA) was conducted to compare variability between the samples; a post hoc test, Tukey's HSD test, was used. A classical transcript analysis was used to analyse the focus group data (Lawless & Heymann 2010; Kreuger and Casey, 2009).

4.1.4 Study IV: Vegetable finger foods

Vegetable preferences among older adults with motoric eating difficulties were assessed with data being collected in two steps. First a survey was digitally distributed using social media to Swedish older adults (persons aged 65 years and older) in a general older adult population. The questionnaire included five closed-ended questions regarding type, colour, preparation, texture, and finger food presentations. Thereafter, the survey results were explored further in digital focus groups where the participants were persons diagnosed with Parkinson's disease and spouses of older adults with Parkinson's disease. Descriptive statistics were analysed using frequency and percent to describe vegetable preferences among older adults >65 years of age. Group comparisons were conducted using Chi-square for independence, by calculating the Yates Correction for Continuity, and with the Phi-coefficient value (2 by 2 tables) to explore differences in preferences between men and women. The focus group data were analysed using a classical transcript analysis (Lawless & Heymann, 2010; Kreuger & Casey, 2009).

4.1.5 Study V: Evaluation of finger food meals compared to regular meals

Finger foods meals were compared to regular meals and evaluated in regard to autonomy, food intake and social interaction among older adults with motoric eating difficulties. An observation guide was then created based on MEOF-II (Westergren, Lindholm, Mattsson, Ulander, 2009) and pilot tested during a finger food meal. The observation guide and selected meal were pilot tested before the observation study was initiated and the results were later added to the data. The observations were conducted in two nursing homes with five participants who had some type of motoric eating difficulty. The observations were performed on two occasions; the first occasion was during a regular meal and the second during a finger food meal. Data were analysed using content analysis with a deductive approach (Elo & Kyngäs, 2008).

Additional data were collected through individual interviews with spouses of older adults with Parkinson's disease and persons diagnosed with Parkinson's disease. The purpose was to select and combine finger food meals based on the person's own or the spouses' preferences and demands. These findings are not included in the papers but are used in the thesis and will be referred to as **Additional data**, **Study III** or **IV.**

4.2 Methodological challenges and adaptation of methods

This thesis offered several methodological challenges since the target population is hard to reach and comprises persons who suffer from diseases that cause both functional and cognitive impairments. Although NEN and the Parkinson coalition functioned as valuable mediators to gain access to the target population, the sample size is still small. However, complementing or replacing the sample population would lead to unrepresentable results. An important part of this thesis has therefore been the adaptation of the methods to include the voices of the target population.

Studies I and **II** were conducted in parallel; this way the participants were able to participate in both studies on one occasion. Initially interviews were conducted (**Study I**) and afterwards a survey was performed in person (**Study II**). This offered depth to **Study II** that would not have been possible to obtain with a regular digital or paper survey. The questionnaire was also simplified using CATA terms without scales and, to obtain context for the CATA terms, open-ended questions enabled the collection of information regarding food preferences. All the CATA terms were defined beforehand to make sure they were communicated in the same manner to all participants. The interviewer asked the questions and reported the responses on the

questionnaire. Since it was difficult to recruit a large sample for the survey in **Study II**, it was decided to investigate vegetable food preferences in two phases in **Study IV**. In the first phase, vegetable preferences were investigated in a general older population (survey) and in the second phase, the survey results were investigated in relation to the preferences, demands and requirements of older adults with motoric eating difficulties (focus groups).

Several of the studies included the assistance of spouses, either to support the participants during the individual interviews (**Study I**) and survey (**Study II**) or to evaluate, select and combine finger foods in **Studies III** and **IV**. Due to the Covid-19 pandemic, the consumer testing phase used in the creative design in **Study III** had to be replaced with digital focus groups with spouses to evaluate end-user acceptability. Other alterations that were made included adding texture measurements to the sensory evaluation phase as a complement to the sensory data, and only reporting the overall main findings from the transcript analysis in **Studies III** and **IV** since the focus was on the experimental work.

4.3 Ethical considerations

The studies in this thesis were performed in accordance with the Declaration of Helsinki, the statement of ethical principles developed for physicians conducting medical research involving human subjects (World Medical Association [WMA], 2013). The WMA (2013) encourages researchers in medical research involving human subjects to adopt these principles. Although this thesis does not specifically involve medical research, it involves vulnerable older adults with diseases that cause both functional and cognitive impairments. The Helsinki Declaration of Ethical Principles was therefore considered important in this thesis to protect the health and rights of the participants.

According to the Declaration of Helsinki, groups that are underrepresented should be provided with an opportunity to participate in research. The researcher is responsible for conducting the research in a manner that does not cause harm and protects the health, well-being, and rights of the participants (WMA, 2013). Research participants must be adequately informed of the aims, methods, sources of funding, and any possible conflicts of interest (WMA, 2013). In addition, informed consent should be obtained since participation in research must be voluntary. In this thesis, the participants were informed about the project and purpose of the specific study, and written consent was obtained. They were also informed that their participation was voluntary and that they could withdraw at any time without explanation.

However, vulnerable older adults may not be capable of giving informed consent and if so, it may be appropriate to consult family members (WMA, 2013). In cases where the participants were unable to give informed written consent, family members were contacted. For example, five of the older adults in **Study V** were diagnosed with dementia (Alzheimer's disease, vascular dementia and unspecified dementia) and two participants in **Studies I** and **II** had Lewy body dementia. The inclusion of these participants was important for this thesis since the study population cannot be replaced with another population. In addition, the finger foods do not entail any risks or harm for the participants and could instead potentially be a strategy to increase their wellbeing. Moreover, ethical approval was received by an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019-01691). Since every precaution must be taken to protect the privacy of the participants and the confidentiality of their personal information (WMA, 2013), data were handled according to the guidelines of the General Data Protection Regulation (GDPR) (The Swedish Data Protection Authority, 2021). The participants were anonymous, and no data were presented in the results that could be correlated to any individual person. Data were handled according to the guidelines of the GDPR, the European Union's General Data Protection Regulation (The Swedish Data Protection Authority, n.d.).

4.4 Recruitment

Since this thesis is aimed at a specific sample population, purposive sampling and convenience sampling were used to recruit participants. Recruitment was conducted with support from the Scanian Parkinson coalition and the Network for Eating and Nutrition (NEN), a platform for cooperation over organisational borders in healthcare sectors in the northeast of the Swedish province of Scania (Pajalic & Westergren, 2014). In **Studies I** and **II,** older adults and professional caregivers were recruited by NEN. NEN consists of dietitians and nurses with a focus on nutritional perspectives in healthcare, and they had contacts within several municipalities in the province of Scania. Members of NEN forwarded the information letter within their own networks and in turn reached out to older adults (care recipients) who met the inclusion criteria. The inclusion criteria were that the participants were >65 years of age, had some type of motoric eating difficulty, and were able to communicate in Swedish. Care professionals who were interested in participating could voluntarily sign up for participation. In **Studies I**, **III** and **IV,** spouses of older adults with Parkinson's disease were recruited by the Parkinson's coalition.

5. Preferences, demands and requirements of older adults with motoric eating difficulties

Strong market orientation that builds on the voices of the target consumer at every stage of the development process is important for new product success (Cooper, 2010). Thorough market assessment and research is important in order to gain knowledge and understanding of consumers' wants and needs and deliver products with superior benefits and value (Cooper, 1988). The first step is to identify and describe the target population, which is a group of individuals with similar needs, wants and expectations (Zanden & van Trijp, 2017). For finger foods to be successful, it is therefore important to identify the population group that will benefit most from finger foods and determine the factors that are important to consider in the development of attractive finger foods.

5.1 The target population for finger foods

Paper I showed that those with minor to moderate motoric eating difficulties as a result of early stages of Parkinson's disease, stroke or rheumatoid arthritis were still able to eat with cutlery, a spoon or a fork, or with adapted cutlery. Since they did not have a need to eat with their fingers they were not open to the idea of finger foods. Not wanting to think about the future, self-deception, and making the best of every moment may be coping strategies for being able to live as normal a life as possible (Sjödahl Hammarlund, Westergren, Åström, Edberg & Hagell, 2018). However, those with major motoric eating difficulties as a result of advanced stages of Parkinson's disease and atypical Parkinsonism were already using their fingers in combination with a spoon or fork and could, therefore, see the benefits of finger foods.

Type of disease and severity of motoric eating difficulties influenced the participants' self-acceptance and in turn acceptance of finger foods. This was especially observed in older adults diagnosed with Parkinson's disease, since motoric eating difficulties and self-acceptance seemed to develop simultaneously during the progression of the disease (Figure 5). The study by Sjödahl Hammarlund et al., (2018) found that persons with Parkinson's disease applied various strategies to compensate for loss of function. For example, by reminding themselves that Parkinson's disease could progress in many ways and that other people were worse off than themselves they were able to obtain a sense of acceptance (Sjödahl Hammarlund et al., 2018). In addition, the recent study by Lin, Ou, Wei, Cao, Li, Hou, Zhang, Liu, Shang (2022) showed that the prevalence of self-stigma among persons with Parkinson's disease decreased from 58% at

baseline to 49% after 3 years, indicating that the prevalence of self-stigma tends to decrease as the disease progresses. Finger foods may, therefore, be more beneficial for those with major motoric eating difficulties since these persons have developed self-acceptance over time in relation to their condition.

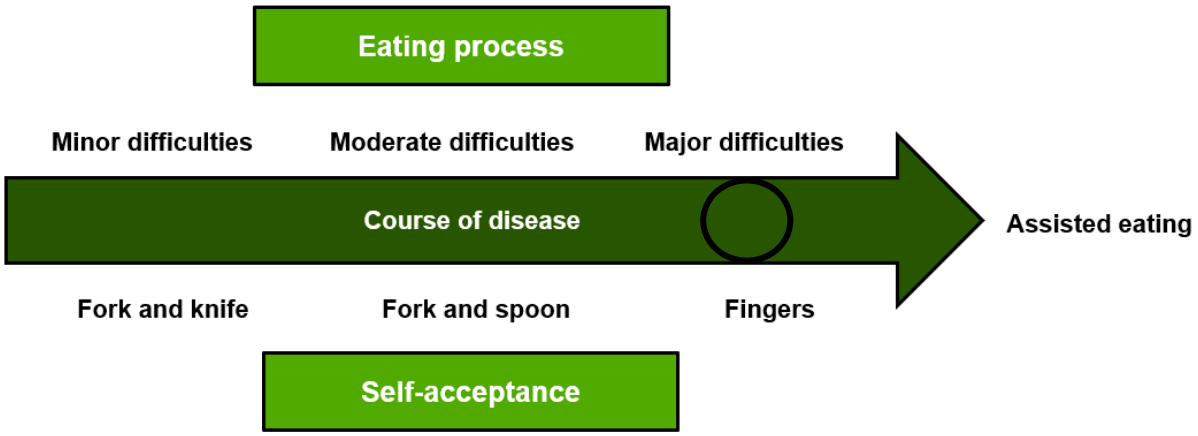

Figure 5. The model shows the gap where finger foods can be a solution (major motoric eating difficulties).

5.2 Effects of ageing and disease on sensory perception

Foods and beverages have sensory properties that are important drivers of food acceptance (Sørensen, Møller, Martens & Raben, 2003) and food acceptance results from the interaction between the sensory properties of foods and the human senses (Schifferstein, 2006). Many older adults experience decreases in sensory perception, texture perception, and chewing efficiency that can impact overall perception and food enjoyment (Boesveldt, Bobowski, McCrickerd, Maître, Sulmont-Rossé & Forde, 2018). However, according to Kremer (2006), a gradual decline in olfactory and gustatory function is a natural part of the ageing process (Doty & Kamath, 2014) and should therefore not affect food enjoyment.

5.2.1 Chemosensory losses and food flavour

The majority of the participants in **Paper II** reported that they experienced a loss of taste and smell. In addition, most of them were diagnosed with Parkinson's disease. Although taste impairments have been demonstrated in Parkinson's disease, there is no clear evidence to suggest any definitive conclusions (Oppo, Melis, Melis, Tomassini Barbarossa, Cossu, 2020). However, smell dysfunction is a common (75-95%) non-motor symptom and part of the clinical diagnosis of Parkinson's disease (Melis, Haehner, Mastinu, Hummel & Tomassini Barbarossa, 2008; Nolano, Provitera, Estraneo, Selim, Caporaso, Stancanelli, Saltalamacchia, Lanzillo &

Santoro, 2008). The perception of flavour is a combination of retronasal sensations and gustatory sensations (smell and taste) and occurs when volatile food odours are released from the food during mastication and forced up into the nasal cavity (Wolfe, Kluender, Levi, Bartoshuk, Herz, Klatzky, Lederman & Merfeld, 2012a; Wolfe, Kluender, Levi, Bartoshuk, Herz, Klatzky, Lederman & Merfeld, 2012b). A decline in the perception of odour will, therefore, also affect the perception of flavour and may have a negative influence on food enjoyment among persons with Parkinson's disease (Westergren et al., 2016). Sensory interventions, such as taste and odour intensification, can be used to compensate for age-related perceptual losses according to Schiffman (2000).

In **Paper II,** flavourful meals and flavour intensity were found to be important sensory attributes for lunch and dinner. Flavourful refers to meals consisting of diverse flavours and meal components, and flavour intensity to the concentration and balance of the flavours. Although there is no consensus when it comes to the effect of flavour enhancement, studies have suggested that flavour enhancement can increase food intake among older adults (Mathey, Siebelink, de Graaf, & Van Staveren, 2001; Pouyet, Cuvelier, Benattar & Giboreau, 2015). In the study by Thomas, Boobyer, Borgonha, van den Heuvel and Appleton (2021), it was found that food flavour can be enhanced either by increasing the intensity of an existing flavour or by increasing the number of flavours; food flavour was increased by adding naturally flavoursome foods, such as herbs, garlic, onions, or by adding sauce to a meal. Flavour can also be enhanced by the use flavour enhancers such as mono-sodium glutamate (MSG) (Appleton, 2016).

5.2.2 Textural demand

The majority of the participants in **Paper II** reported that they appreciated variation in texture. Older adults may depend more on the oral texture of food products when the perception of odour and flavour is impaired (Westergren et al., 2016; Doets & Kremer, 2016; Song, 2018). In the study by Westergren et al., (2016), food pleasure was reduced due to the loss of tactile sense among persons diagnosed with Parkinson's disease. The oral processing of foods into smaller particles and salivary enzymatic interactions are important for the perception of food flavour, since tastants have to be released from the food and dissolved in saliva in order to reach the receptors (Pedersen, Sørensen, Proctor & Carpenter, 2018; Field & Duizer, 2016).

The majority of the participants reported that coarse and crispy were important attributes for texture and only a few participants found that soft, smooth, and fine textures were important.

This indicates a variability in the demand for texture among older adults with motoric eating difficulties. **Paper I** showed that the gap for finger foods was among those with major motoric eating difficulties. Since **Papers I** and **II** were conducted with the same participants, with a few exceptions, the demand for fine, smooth, and soft textures may be correlated with the severity of eating difficulties. In **Papers I, III** and **IV,** it was shown that the motoric eating difficulties became more severe during the progression of Parkinson's disease and that impaired chewing and swallowing are common in advanced stages of the disease. This corresponds to the clinical picture of Parkinson's disease (Kwon & Lee, 2019). When focusing on those with major eating difficulties the texture of finger foods should be soft and easy to chew and swallow.

5.2.3 Visual cues and presentation

Colourful and separated on the plate were important attributes for the appearance of lunch and dinner in **Paper II**. Colour plays a key role in food choice by influencing acceptability and food preference, flavour intensity, sweetness perception, and pleasantness (Clydesdale, 1993). Several studies have reported that colour is important for acceptability and appetite in older adults (Mahadevan, Hartwell, Feldman, Ruzsilla & Raines, 2014; Zhou, Hartvig, Pérez-Cueto, Bredie, 2021; Meiselman, Macfie, 2012). In the study by Wendin, Biörklund-Helgesson, Andersson-Stefanovic, Lareke, Böök and Skjöldebrand (2021), it was found that the presence of a touch of colour and the way the food is arranged on the plate have a great impact on liking. In **Papers III** and **IV**, it was shown that colour may also help distinguish the meal components on the plate. Parkinson's disease is associated with visual symptoms such as poor acuity, especially at low contrast and blurred vision for colour stimuli (Armstrong, 2011). Colourful vegetables and garnishes may be a strategy to help contrast the meal components on the plate.

Separating the meal components on the plate may be another strategy to help distinguish the meal components. This has been reported by Höglund, Ekman, Stuhr-Olsson, Lundgren, Albinsson, Signäs, Karlsson, Rothenberg and Wendin (2018) and Hall and Wendin (2008). This may be even more important for finger foods since the meal components should be both functional and acceptable to eat with the fingers (**Paper I**). Arranging the sauce separately to avoid a messy appearance and the consumer's sticky fingers may, therefore, be crucial.

5.3 Food preferences and culinary rules

Knowledge about food preferences is important to be able to develop attractive finger foods with high acceptability. In **Paper II,** the participants reported that they appreciated both Swedish and ethnic flavours but only described meals that are typical for the Swedish cuisine (Mäkelä, Kjærnes & Pipping Ekström, 2001). Previous studies have found that Swedish older adults prefer home cooked, old-fashioned, traditional dishes using familiar spices that they grew up with (Edfors & Westergren, 2012; Nordlander, Isaksson & Hörnsten, 2019; Wikby & Fägerskiöld, 2004). In the study by Edfors and Westergren (2012), modern foods, such as pizza, were not appreciated by the older adults. However, in **Paper I,** ethnic foods such as pizza, hamburgers, tacos, kebabs and hotdogs were regularly eaten and enjoyed. This may be because these types of foods are not associated with the Swedish cuisine and its related norms.

According to Rozin (2000), every cuisine has its own specific culinary system and structure. Dishes within the culinary system and structure symbolize the taste and shape of the cuisine, such as for example what ingredients are used, how the food is prepared, and how it is served and eaten. Swedes have a tradition of eating cooked meals for lunch (Mäkelä et al., 2001; Holm, Skov Lauridsen, Gronow, Kahma, Kjærnes, Bøker Lund, Mäkelä & Niva, 2012) where a proper meal consists of a main dish (meat, fish, and vegetables), staples (potatoes, rice, pasta, bread), vegetables, and trimmings (gravy, condiments) (Mäkelä et al., 2001). Locally and seasonally produced ingredients, such as wholemeal bread, potatoes, pork and fresh fish, veal, lamb, vegetables, fat and cream, cooked with familiar spices such as salt, pepper, dill, and bay leaves, were appreciated in the study by Edfors and Westergren (2012). The use of traditional condiments in the Swedish cuisine, such as lingonberries, horseradish, pickled cucumber, and beetroots, was something that was considered important (**Paper II**).

Overlooking traditional culinary rules, such as condiments, can have a negative impact on the wellbeing and food intake of older adults (Mattsson Sydner, Fjellström, 2006). Familiarity is an important aspect of food intake in relation to food liking and intensity perception (Pouyet, Cuvelier, Benattar, & Giboreau, 2015) since the appearance of foods influences the expectations of how they should taste (Wendin et al., 2021). Familiar dishes can, therefore, have a positive influence on sensory perception, since their appearance communicates what they will taste like (Andersson & Sidenvall, 2001).

According to Fox (2016), proper eating includes the type of food used, the way it is prepared, the manner in which it is served and the way it is eaten. In order to be able to develop finger foods that older adults are willing to eat with their fingers, it is, therefore, important to be aware of and understand the culinary rules related to table manners, meal composition, and functionality when designing and developing finger food meals (**Papers I, III, IV**). Some foods were considered more appropriate to eat with the fingers than others, for example meat on the bone, such as chicken legs, wings, ribs and porkchops, are categorised as foods that are allowed to be eaten with the fingers, since the bones function as practical handles and provide distance between the fingers and the meat (**Paper I**). A skewer can be inserted into meats with no bone to increase appropriateness; however, this was not recommended for those with major eating difficulties due to reduced fine motoric skills, tremor, and coordination problems (**Paper IV**).

To reduce the risk of getting greasy fingers bread could be used to scoop up soup, stew, and gravy, or to wrap around meat with since it provides a non-stick surface for components that are inappropriate to eat with the fingers. In the study by Pouyet et al., (2014) professional caregivers described that finger foods had to be easy to grasp and pick up with the fingers and that each piece of finger food had to be large enough to be eaten in a minimum of two bites. In the study by Visscher et al., (2020), finger foods of a larger size were offered, pieces of circa 5x5 cm. However, **Paper I** showed that to avoid messy eating, bite-sized foods comprising one to three bites were optimal for finger foods. In addition, toppings, and layers should be avoided.

6. Designing, developing and evaluating prototypes

Once the target population has been identified, a concept can be defined, and product ideas generated and designed based on the needs of the target population (Costa & Jongen, 2010). The development of prototypes can then begin. Chapter 6 focuses on the design, development, and evaluation of a series of prototypes, and the selection and arrangement of a complete finger food meal.

6.1 The development of finger food components

A Swedish meal comprising traditional meal components, such as a main dish (meat, fish or vegetarian substitute), staples such as potatoes, rice, pasta or bread, sauce, vegetables, and condiments, was chosen for this study (**Paper II**; Mäkelä et al., 2001). According to Song (2018), familiar and traditional meal components were more favourable as carriers for protein enrichment among older adults. Although protein enrichment was not planned for all meal components in this study, a familiar and traditional meal may be a more promising carrier for protein enrichment in the target population. Based on cultural preferences, the development was therefore focused on beef rolls, vegetables, and brown sauces. In addition, since **Paper I** showed that adding bread may increase the acceptability of eating with the fingers a bread was also developed. These components were also considered easy to adapt nutritionally to meet the increased demand for protein, energy and dietary fibre in the target population.

Figure 6. An example of the traditional Swedish dish that the finger food meal is based on. Photo courtesy of Pixabay.com

Flatbreads, beef rolls and brown sauces were developed in **Paper III** with inspiration from creative design (Naes & Nyvold, 2004) and vegetable preferences were investigated in **Paper IV** to gain insights into the development of attractive vegetable finger foods**.**

6.2.1 Flatbreads

Enriching familiar foods and beverages has been found to be an effective strategy to increase older adults' protein and energy intakes (Beelen, Roose & de Groot, 2017). Bread is easy to adapt nutritionally and enriching the bread with protein and fat increases the nutritional value of the meals for the current target population. Both whey and soy proteins contain high amounts of essential amino acids that complement those present in cereals and have, therefore, nutritional benefits (Madenci & Bilgiçli, 2014, Russell, Drake & Gerard, 2006). Bread has been used as a successful carrier of protein in several studies (Song, Perez-Cueto & Bredie, 2018). However, protein has a profound effect on taste and texture that may affect consumer acceptability (Russel et al., 2006; Wendin, Höglund, Andersson & Rothenberg, 2017; Song et al., 2018; Höglund, Albinsson, Stuhr-Olsson, Signäs, Karlsson, Rothenberg & Wendin, 2017). Twenty flatbreads, comprising high (15%) and low (10%) protein contents in various combinations of soy protein isolate (SPI) and whey protein concentrate (WPC), and high (33.75 g) and low (11.25) fat content, were therefore developed, and sensory and textural parameters evaluated (**Paper III**).

Figure 7. Flatbreads enriched with 10% protein comprising 50% SPI and 50% WPC was selected to be included in the finger food meal.

Paper III showed that an optimal flatbread should be neutral in flavour so that it can be eaten with several types of dishes. The texture should be springy because this makes it easy to wrap and scoop up food with. Flatbreads with a higher percentage of WPC had a springier texture than flatbreads with a higher percentage of SPI (Figure 8). This affect was also observed in previous studies, for example Wendin et al. (2017) and Höglund et al. (2017). On the other hand, a higher percentage of

SPI made the texture of the flatbreads compact and gritty. This effect was also seen in the doughs; doughs with high SPI percentage were hard and gritty and difficult to roll out, while doughs with a higher percentage of WPC were loose and hard to handle. Moreover, a higher fat content did not result in a favourable texture as it was perceived as sticky and unbaked. A protein content of 10% comprising SPI 50% and WPC 50% and 11.25 g of fat was therefore considered the most optimal combination of SPI and WPC (**Paper III**). A blend comprising equal amounts of soy and whey protein also gave promising results in ryebread in the study by Song et al., (2018).

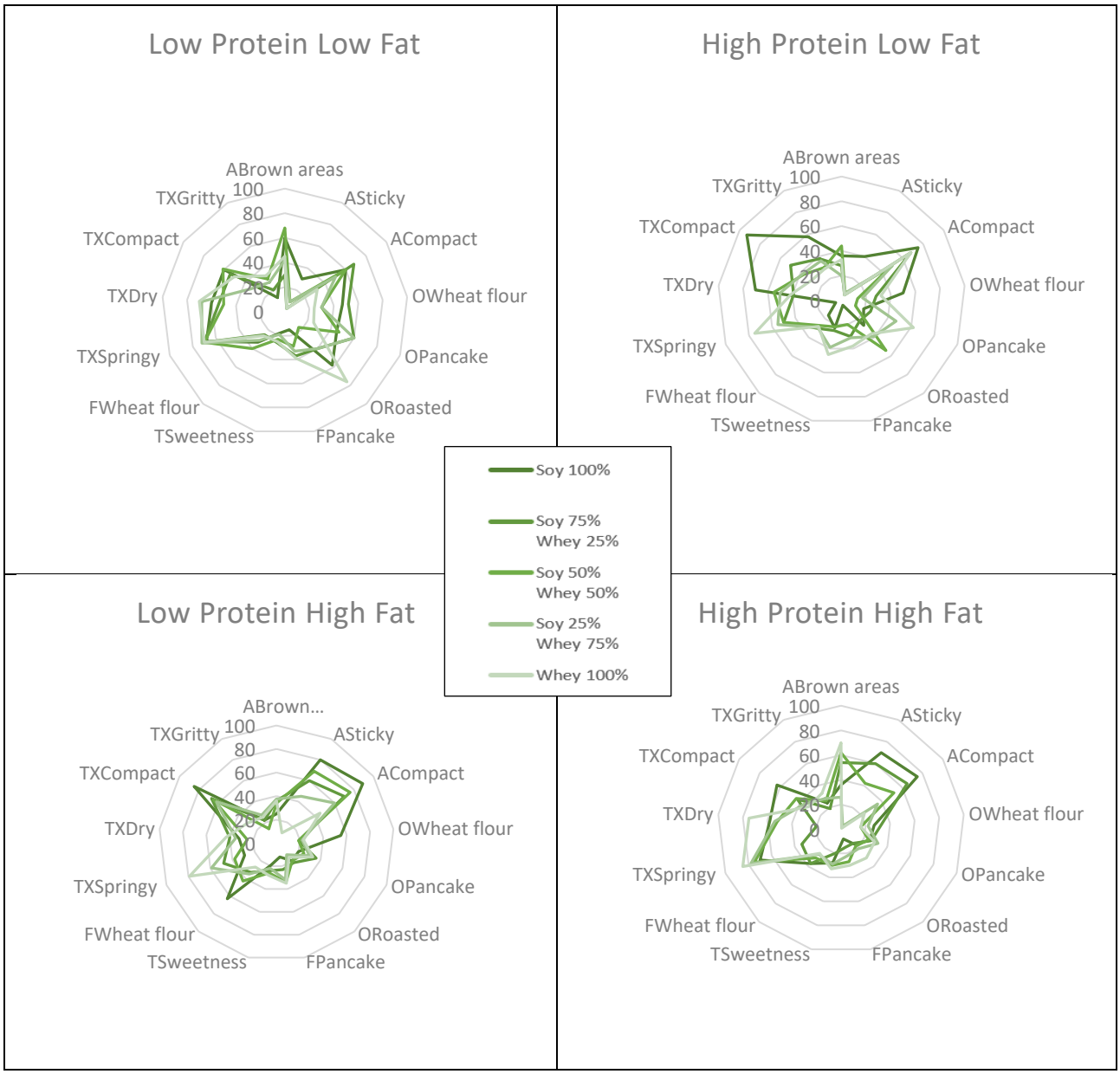

Figure 8. Sensory profile for flatbreads baked with high (15%) and low (10%) protein content, and high (33.75g) and low (11.25g) fat content. **A=** appearance, **O=** odour, **T**= taste, **F=** flavour, **TX=** texture.

In **Paper III**, bread was not considered a natural part of a complete Swedish meal, but bread was perceived to be an acceptable and helpful tool for those with major motoric eating difficulties. For the bread to be functional it has to be available in several forms, for example as flatbreads, pita bread, sausage bun, tartlets and dinner rolls. This way it can easily be added to different types of dishes and meet the various demands of the target population (**Additional data, Study III**).

6.2.2 Beef rolls

Red meat is a valuable source of high biological value protein, vitamins and minerals, (Gorissen & Witard, 2018; Wyness, 2015) and meat is also potent in terms of stimulating muscle protein synthesis among older adults (Gorissen and Witard, 2018). However, studies have shown that whole meat, and in particular beef, is avoided by older adults due to the texture (**Additional data, Study III;** Botinestean, Gomez, Nian, Auty, Kerry & Hamill, 2017; Anderson and Sidenvall, 2001; Appleton, 2016). The tough texture challenges chewing and swallowing ability as well as the ability to cut the meat independently. Minced beef, or other less tough meats, are a good alternative for those with chewing difficulties (Anderson & Sidenvall, 2001); it is also digested and absorbed more rapidly than beef steak, increasing the availability of amino acids (Pennings, Groen, van Dijk, de Lange, Kiskini, Kuklinski, Senden & van Loon, 2013). However, semi-finished minced meat products, such as meatballs, are already available in the stores. Regardless of the texture, whole beef was widely desired (**Additional data, Study I**) and Nordlander et al., (2019) also found that older adults had a desire for thicker slices of meat.

The development was, therefore, focused on a whole beef finger food component that was tender enough to bite through, chew and swallow. Beef rolls were chosen since they comply with cultural preferences and can be filled with energy rich and flavourful ingredients, such as prunes, cheese, cream cheese, mustard, and bacon. This may be an easy strategy to enhance the food flavour (**Paper II**) and the nutritional value with regard to protein and energy contents. Two different beef roll designs were developed and evaluated in **Paper III.** In the first design, the beef rolls were made by braising the meat in whole pieces and rolling after braising (BWP), while in the second design, the beef rolls were sliced and rolled raw before they were braised (BIR). The designs were tested with both inner and outer thigh beef cuts because these meat cuts are commonly used for making braised beef rolls.

Figure 9. The beef rolls design: 1) braised in a whole piece (BWP) and sliced and rolled after braising (left) and 2) sliced and rolled raw and braised in rolls (BIR) (right). BIR 2mm was selected to be included in the finger food meal.

The focus groups in **Paper III** showed that the most important attribute for beef rolls was tenderness. Although there were no pronounced differences in texture between the meat cuts, the texture analyser was not able to cut through thicker slices (5 mm) of outer thigh. In addition, the sensory evaluation showed that the most tender beef rolls were made from inner thigh and cooked for either 3 hours or to an inner core temperature of 90°C (Figure 10).

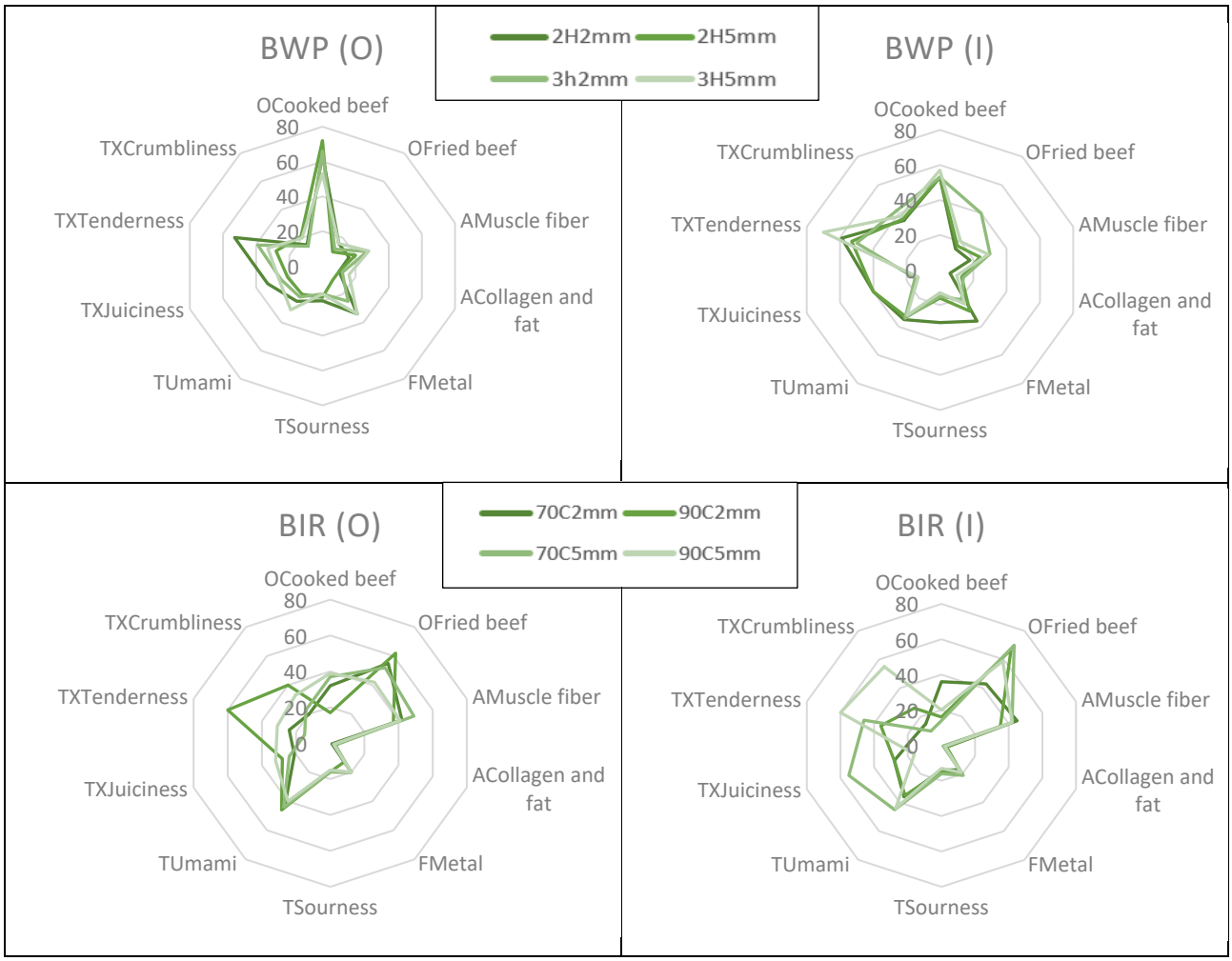

Figure 10. Sensory profiles of beef rolls made from m. biceps femoris (O) and m. semimembranosus (I). **A=** appearance, **O=** odour, **T**= taste, **F=** flavour, **TX=** texture.

This indicates that inner thigh may be the most optimal meat cut for tender beef rolls, and thinner slices (2 mm) should also result in more tender beef rolls. The results from the focus groups also showed that beef rolls BIR were perceived to have a more intense odour and flavour due to the caramelised surface. In addition, the sensory evaluation showed that BWP were characterised by a boiled odour and BIR by a fired odour (Figure 10). This corresponds to the study by Klosse, Riga, Cramwinckel & Saris (2004) who found that, in comparison to pan-fried beef, poached beef lacked flavour and the odour sensations arising from the caramelised surface formed after pan-frying. This may be especially important among older adults since the intensity perception of odours from foods such as fried meat decline with age (Honnens de Lichtenberg Broge, Wendin, Rasmussen & Bredie, 2021). BIR may, therefore, be the most optimal beef roll design since the browning of the beef rolls may act as a visual stimulus for odour and flavour. Moreover, the beef roll designs BWP and BIR were perceived as two totally different components and were also associated with different trimmings. The beef rolls in the first design, BWP, were preferably served cold like roast beef and filled with, for example, remoulade, mimosa salad or potato salad, whereas the beef rolls BIR were preferably served warm with potatoes, sauce and vegetables. The designs could, therefore, be used to compose several types of dishes (**Additional data, Study III**).

6.2.3 Brown sauce

In **Paper III,** sauce and gravy were described as the most important components on the plate as these were perceived to add additional flavour to a meal. Appleton (2018) found that sauces and gravies increase the pleasantness, tastiness, and familiarity of a meal. Sauce was also a key driver for the attractiveness of finger foods in the study by Pouyet et al., (2014). In addition, sauce and gravy were also important as they made the food moist, which facilitates swallowing (**Paper III**; Andersson and Sidenvall, 2001; Pouyet et al., 2014).

Appleton (2018) found that the nutritional content of a meal is easily increased by adding sauce or gravy. Based on this, the development focused on traditional brown sauces and the goal was to produce sauces that were rich in energy, fat and protein, enriched with prebiotics, and which enhanced the flavour of the meal. Initially, a mayonnaise rich in energy and fat was developed and beta glucans and inulin were added for a prebiotic effect. Thereafter, to assess the effect of

the basic tastes on brown sauces (Figure 11), 10 flavoured samples were made by adding ingredients to obtain the basic tastes sweet, umami, salty, sour and bitter, in high and low concentration.

Figure 11. The prebiotic mayonnaise based brown sauce with high flavour intensity of umami was selected to be included in the finger food meal.

The sensory evaluation showed that the addition of umami enhanced the flavour profile of the brown sauce resulting in a more flavourful sauce (Figure 12). It is well established that umami is present in palatable foods (Klosse et al., 2004). The addition of salty also had a positive effect on the flavour profile of the brown sauce. However, the addition of acidity, sweetness and bitterness decreased the flavour profile resulting in a less flavourful sauce. It was shown in **Paper II** that flavour balance was important for acceptability in the target population. According to Klosse et al., (2004), in palatable foods the flavour components are well balanced. Nordlander et al., (2019) found that older adults did not like food to be too sour, tasteless, unbalanced, or too hot. This can be achieved by balancing the basic tastes into a harmonious blend, making sure that flavour compounds enrich each other rather than overpower each other (Klosse et al., 2004). A flavourful but well-balanced sauce may therefore be important for the palatability of a finger food meal.

In **Paper I,** viscosity was considered a barrier for acceptance of finger foods and eating with the fingers because the participants did not want to get greasy fingers. In **Paper II,** it was also found important to serve the meal components separately on the plate, with the sauce preferably also served separately to avoid getting sauce on the meal components. For the sauce to play its role in the meal, that is contribute nutrients, add flavour, and lubricate the food, it is important that the sauce remains on the foods when being dipped in the sauce. The viscosity of the sauces must, therefore, be as high as possible without affecting the lubrication of the food.

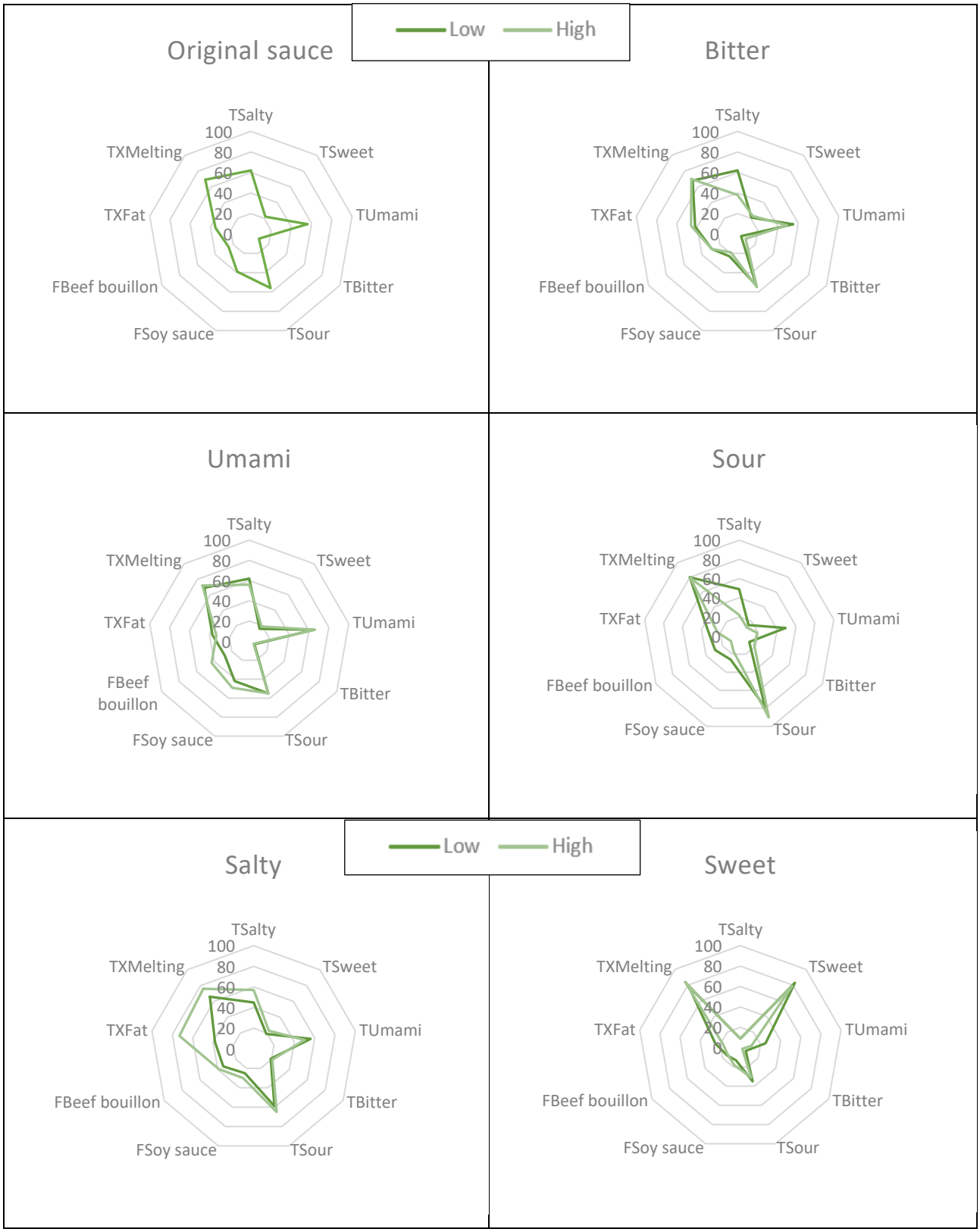

Figure 12. Sensory profile for prebiotic beef sauces, control sauces, and sauces flavoured with the basic tastes, both low and high concentrates. **T**= taste, **F**= flavour, and **TX**= texture.

The prebiotic mayonnaise base can be used to develop several types of sauces. As well as brown sauce, the spouses suggested that garlic and herb sauce and bearnaise sauce would be complementary sauces for beef rolls BIR (**Additional data, Study III**).

6.2.4 Vegetables

In **Paper IV,** insights into preferences for vegetables were explored to enable the development of attractive and functional vegetable finger foods. Overall, the preferences for vegetables of a general Swedish older adult population did not differ from those of persons with motoric eating difficulties. The most liked vegetables were broccoli, carrot, tomato, asparagus, cauliflower, avocado, mushrooms, beetroot, red bell pepper, haricot verts and peas. These preferences correlate with the vegetable preferences of Finnish older adults found in the European study by Mingioni, Mehinagic, Laguna, Sarkar, Pirttijärvi, van Wymelbeke, Artigas, Chen, Kautola, Järvenpää, Mäenpää, Tahvonen, Grabska-Kobylecka, & Maitre, 2016). Moreover, similar food patterns have been previously found in a survey among Swedish and Finnish individuals (Mäkelä et al., 2001).

Although our results did not show any differences in vegetable preferences among a general older adult population and older adults with motoric eating difficulties, the choice of vegetables was limited due to the participants' reduced ability to grip, chew and swallow. Small, stringy and hard vegetables were, therefore, avoided. Peas, for example, were difficult to grip with the fingers, haricot verts and asparagus have a stringy texture that can easily get stuck in the throat, and careful preparation was necessary to obtain an optimal texture for hard textured vegetables such as carrots, broccoli and cauliflower.

The most popular preparation methods of vegetables were oven baked, boiled and raw (**Paper IV**). Oven baked potatoes and vegetables were also considered appropriate for eating with the fingers (**Additional data, Study I).** Vegetable finger foods served as vegetable snacks, traditionally on the plate or deep fried, were the most appreciated presentation suggestions. Since it had already been established in **Paper I** that fresh vegetables served as vegetable snacks were appropriate to eat with the fingers, it was decided to add two different vegetable finger foods: 1) oven baked potatoes, carrots, broccoli and cauliflower served traditionally on the plate and cut into wedges comprising 2-3 bites and 2) deep-fried broccoli and cauliflower comprising 1-2 bites (Figure 13).

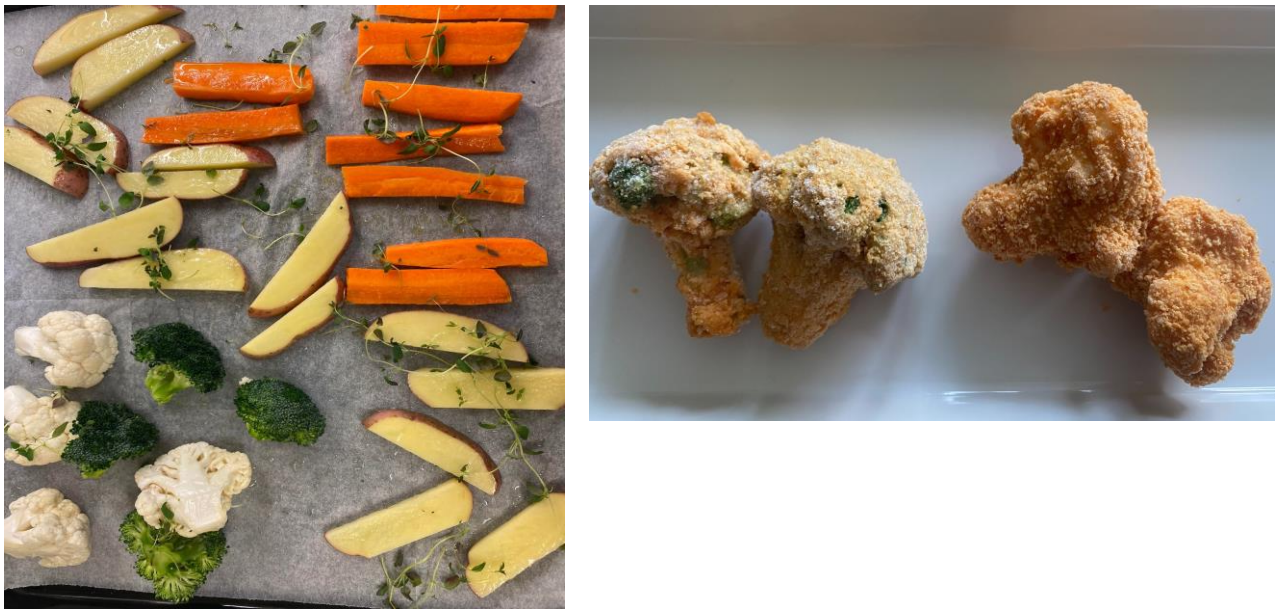

Figure 13. The two vegetable finger foods selected to be included in the finger food meal, **left:** oven baked vegetables, **right:** deep-fried vegetables.

7. Implementing finger food meals

This chapter will describe the implementation of finger foods, starting with the complete finger food meal, and then describing important aspects of eating performance with finger food meals.

7.1 Complete finger food meal

Based on the results from the evaluation, finger food components were selected and tailored into a complete meal (**Additional data, Study III** and **IV**). The meal comprised beef rolls filled with prunes; oven baked potatoes, carrots, broccoli and cauliflower; deep-fried broccoli and cauliflower; brown sauce and flatbread (Figure 14). The components were served separately on the plate so that they could be easily distinguished by the participants (**Study II**). The brown sauce was served in a bowl to avoid the sauce spreading over the components, making them inappropriate to eat with the fingers (**Study I**).

Figure 14. The complete finger food meal.

The distribution of the total energy content of the meal derived from each of the macronutrients in percent is protein 14%, fat 57% and carbohydrate 29%. The fat is mostly represented by monosaturated fat from rapeseed oil.

Based on the recommendations of 1.5 g protein/kg body weight/ day, the recommended protein intake for a person with a body weight of 60 kg, is 90 g/day and for a person weighing 70 kg, 105 g/day. If the protein requirement is divided over 5-6 meals (breakfast, lunch, dinner and 2-3 snacks)

this results in an amount of 15-18g protein per meal for a body weight of 60 kg and 17.5-21g per meal for a body weight of 70 kg. The total protein content of the finger food meal presented in Table 2 is 16.8 g, which is approximately 14% of the total energy content. This is lower than the NNR, however, this can easily be increased by an adding an extra beef roll (4.25 g protein) or a flatbread (4.1 g protein). The meal could also be served with a glass of milk, an appetizer and a dessert, which would also increase both the protein and energy intakes.

The energy content of the meal was 502 calories whereof the sauce (30 g) contributed 181 calories (Table 2). In addition, 1 dl brown sauce contains approximately 3 g of inulin and 0.6 g of beta-glucans. However, 1 dl of brown sauce based on mayonnaise may not be a realistic amount for the target population. It was estimated that 30 g of sauce was a reasonable portion size for the observations, which contributes approximately 0.9 g inulin and 0.18 g beta glucans. Although the amount of fibre in 30 g sauce is not enough, it provides a good complement to other types of dietary fibre.

Table 2. Presents the nutritional content (protein and calories) of the complete finger food meal presented in Figure 13.

Finger food components	**Amount in g**	**Calories**	**Protein g**
Beef rolls	50 (2x25)	102	8.5
Oven baked potatoes and vegetables	114	54	1.6
Deep-fried broccoli	24	42	1
Deep-fried cauliflower	24	38	0.6
Brown sauce	30	181	1
Flatbread	32	85	4.1
Total	**274**	**502**	**16.81**

7.2 Eating performance with finger foods

7.2.1 Autonomy and functionality

The eating difficulties observed during regular meals in **Paper V** were mainly a result of physical difficulties, such as slow movements, balance, stiffness and tremor. However, cognitive difficulties that inhibited eating were also observed. All participants received help with plating and cutting the food into smaller pieces. Most participants ate from a deep plate and used a spoon to bring the food to the mouth. Two of the participants required assisted eating because they were unable eat independently. According to Westergren et al., (2002) it is important discover persons with low energy and without assisted eating and provide interventions to hinder

further decline in nutritional status. Finger foods may be an effective intervention for those with assisted eating.

From a functional perspective a finger food meal facilitated autonomous eating (**Paper V**). Most participates were able to eat a finger food meal independently; they did not have to rely on others to cut their food and they were able to grab the components and bring them to the mouth by themselves without spilling, in their preferred order and at their own speed. In a previous study eating assistance was associated with lack of control of speed and rhythm (Medin, 2010). However, by serving finger foods, those with assisted eating may regain control of their eating situation. The duration of eating did not differ between finger food meals and regular meals, but the participants did not have to struggle as much with a finger food meal. This should result in less energy being spent during the meal and may open up the opportunity for social interaction when less focus is being placed on the meal itself.

However, a few participants were not able to eat the finger foods. They would just stare at the plate, not knowing what was expected of them. The two participants who received assisted eating during regular meals, responded differently to a finger food meal. One of them was able to eat two portions of finger foods independently, while the other participant was not able to eat by herself and instead played with the food. The inability to recognise food and eating utensils, difficulties in maintaining attention and an eating routine have been found to be common among persons with dementia (Kai et al., 2015). Previous studies about finger foods have been conducted with older adults with dementia (Soltesz & Dayton, 1995; Jean, 1997; Pouyet et al., 2014) and suggest a positive effect on food intake. However, according to the professional caregivers in the study by Murphy et al., (2017), the stage of the dementia is important to consider since those in advanced stages of dementia may need support to be able to consume a meal.

7.2.3 Acceptance and handling of finger food components

In **Paper I,** viscosity was considered one of the main barriers for the acceptability of eating finger foods. To increase acceptance and avoid greasy fingers bread was perceived as a vehicle for other foods since it provides a non-stick surface and makes food appropriate to eat with the fingers. In addition, Pouyet et al., suggested the use of bread to wipe up sauce with. A flatbread was therefore developed to be used to wrap the beef rolls and prevent the fingers from becoming greasy (**Paper III)**. However, during the observations in **Paper V,** the flatbread was not used as

anticipated since none of the participants used the flatbread to wrap the foods. Instead, they would break off a piece of the flatbread and dip it in the sauce before bringing it up to the mouth. In addition, the beef rolls were eaten with the fingers without hesitation. This may indicate that older adults with major eating difficulties may not be as sensitive to table manners and culinary rules as those with minor to moderate eating difficulties.

To increase acceptance sauce was also served separately in a bowl to prevent the sauce from spreading to the other components (**Paper I**). The viscosity of the sauce was also made high so that the sauce would stick to the foods when they were dipped in it and to prevent spilling (**Paper III**). This was successful since none of the participants spilled any sauce during the observations. However, in one of the nursing homes the professional caregivers emptied the sauce on to the plate to make it easier for the participants to notice and recognise the sauce (**Paper V**). This resulted in sauce spreading to the other components and eventually to the participants' fingers and the table. Serving the sauce separately in a bowl is, therefore, recommended to prevent messy eating; it may therefore be better to communicate what components the meal comprises and how these are intended to be consumed.

Serving all components separately on the plate was found to be important in **Paper II**, since this made it easier to distinguish the different foods on the plate. In addition, the spouses in **Paper IV** described visual difficulties being common among those with Parkinson's disease and that this made it complicated for them to eat independently. Colour can also be used to contrast the food on the plate which may facilitate eating the meal for those with visual and cognitive impairment (The National Food Agency, 2019). During the observations, one participant was served finger foods on fine chinaware with engraved flowers; he tried several times to grasp the flowers thinking they were the deep-fried vegetables (**Paper V**). This shows that plates with a pattern may not be suitable for those with visual impairments and in particular for older adults with Parkinson's disease since blurred vision and reduced colour and contrast vision (Armstrong, 2011) may compromise eating. Moreover, it was more difficult to navigate the plate with reduced vision which may be compensated by the use of a bigger white plate where the components are not crowded and can be easily distinguished, and the sauce may benefit from being served in a colourful bowl.

The finger food components seemed overall to be liked and there were no signs or expressions of dislike among the participants. Since chewing and swallowing difficulties are common in the

target population (Kwon & Lee, 2019; Medin et al., 2011), it was important that the beef rolls were tender enough for the participants to be able to chew and swallow. Some of the participants had difficulties chewing and swallowing meat during the regular meal, although, this was not seen during the finger food meal. The beef rolls were braised tender, and the sauce also helped to lubricate the meat and facilitate swallowing. Preparation methods for slow cooking such as braising and less coarse textured meat cuts such as inner thigh resulted in a favourable texture of beef rolls. Slow cooking is an effective method to soften the texture of meat and aid consumption according to Appleton (2016).

7.2.4 Food intake

According to Soltesz and Dayton (1995), the use of finger foods increases the physical involvement and interaction with the meal and may, therefore, in turn increase food intake. However, when comparing the participants' food intake between when they ate regular meals and when they ate finger food meals in **Paper V**, some participants ate more food when finger food meals were served and some participants less. Those who ate more were able to feed themselves without struggling and those who ate less either needed assistance to eat the regular meals or did not understand how to eat the finger food meal.

The observations in **Paper V** also showed that presenting the participants with more food during the meal may be more effective in increasing food intake than asking them if they wanted another serving. Participants who were asked if they wanted a second portion of food declined, while those who were just presented with more vegetables or bread accepted and ate the additional foods that were served. This increased the overall protein intake significantly.

7.2.5 Eating norms and social interaction

Paper I showed that proper table manners, including eating properly with both a knife and a fork, were deeply rooted among the older adults. Most participants in **Paper I** avoided eating out in public with people they did not know because they were worried about others looking at them and judging them for not being able to eat properly. This has been seen in several studies, for example in the study by Medin (2010), where eating with unfamiliar people resulted in feelings of embarrassment and shame among older adults' post stroke; they therefore avoided eating in situations with others present. Overall, table manners and eating norms were not so evident during the observations on the ward (**Paper V)**. Although most residents did not hesitate to eat with their fingers when the finger food meal was served, a few still had some notion of table manners and

would communicate glimpses of discomfort when touching the foods with their fingers. However, severe cognitive decline may have made them less sensitive to norms surrounding the meals and less aware of other guests in the dining room.

In **Paper V,** the social interaction with caregivers at mealtimes on both the ward (nursing home) and at home (private home) were solely focused on the meal. The professional caregivers and spouses plated and served the food, encouraged the residents to eat throughout the meal and assisted them if needed. This was seen both during regular meals and finger food meals, however, for different reasons. During regular meals, the encouragement was mainly directed at the struggle with manipulation of the food on the plate and transportation to the mouth, while for finger foods it was directed at explaining that the meal is supposed to be eaten with the fingers and showing them how to do this. Some residents did not need to be encouraged as they would just dig their hands into the meal.

In **Paper I**, one of the spouses perceived that finger foods could enable her and her husband to share a meal together for a change. Normally she would serve him first and then eat when he had finished his meal, otherwise her food would get cold. During the observations in **Paper V**, the interaction between a spouse and her husband during a regular meal focused on coaching and encouraging him to eat. However, with finger foods he did not need as much coaching as before and this opened up the opportunity for small talk about other things.

The professional caregivers in **Paper I** described how, from time to time, residents commented on each other's table manners. This was also seen during the observations in **Paper V**, where reactions from the other residents at the table were minimal. One of the residents at the table would observe others struggling to eat and using their fingers to help and commented when food was spilled. Another resident was sceptically watching others eat the finger foods, asking continuously why they were eating with their fingers. When informed of the purpose of the observations, she was positive towards the finger foods, which shows that communication may be important to obtain empathy and understanding among residents. In **Paper I** the professional caregivers and relatives' attitudes were important in the creation of a permissive environment and for residents to feel comfortable eating with their fingers.

8. Discussion

8.1.General discussion

Previous studies about the use of finger foods have reported positive outcomes in terms of benefits, wellbeing and quality of life (Heelan et al., 2020). However, few studies have investigated the views and acceptability of finger foods among caregivers and older adults with motoric eating difficulties themselves (Heelan et al., 2020). The five studies included in this thesis have added new depth to existing literature concerning motoric eating difficulties and how persons with motoric eating difficulties perceive meals in relation to their disease and eating norms. Previous research on motoric eating difficulties have been focused on describing the problems and experiences from the perspective of those diagnosed with stroke (Jacobsson, 2000; Westergren, 2002; Carlsson et al., 2004; Medin, 2010; Klinke et al., 2013). This thesis adds knowledge about eating difficulties among those with Parkinson's disease. Although, the motor symptoms among persons with Parkinson's disease differ from those experienced by persons post stroke, the feelings of shame and guilt at not being able to eat properly are the same. However, the coping strategies among persons with Parkinson's disease may differ from those of persons post stroke. Parkinson's disease is a progressive disease and persons with the disease may, therefore, simultaneously develop self-acceptance over time. A stroke on the other hand occurs unexpectedly changing eating ability from one day to another and, although it can cause long-term problems, for some there is the possibility of recovering their former independence. These different conditions influence coping strategies and self-acceptance among individuals and in turn the acceptance of eating with the fingers and finger foods.

This thesis also adds knowledge about the acceptability of finger foods among older adults and sensory requirements that may be important to consider when developing meals overall to older adults with motoric eating difficulties. In addition, all studies in this thesis have been conducted in collaboration with either caregivers, spouses or older adults themselves, which has been sparsely reported earlier. This thesis is a contribution to a relatively unexplored research topic and although the results may not be generalisable due to the small sample size, it does highlight several important aspects that may be valuable for further research and development of finger foods. The following findings are important to consider in future development and implementation of finger foods:

8.1.1 The product

Finger foods are easily prepared for breakfast, snacks and fika (coffee with cake), and can include cereal bars, smoothies, sandwiches, pieces of fresh fruit and vegetables, buns, and cookies (**Paper II**). However, if finger foods are going to be a long-lasting and effective strategy for those who need them on a regular basis, more substantial meals are required that can be served for both lunch and dinner (**Paper I**). Finger food meals should have to appeal to heterogenous populations. A finger food meal should, therefore, consist of several types of components, including both Swedish and ethnic flavours, that can be combined in several ways based on individual preferences and cultural background (**Paper II**). Moreover, several types of each meal component in a meal are needed to be able to achieve a varied and balanced diet. In addition, chemosensory impairments are common; it is therefore important to consider ways to enhance the flavour of the meals. This can be accomplished by balancing and contrasting basic tastes and combining several meal components. Presenting varied meals can also increase the food intake among older adults through sensory satiety being avoided (Hollis & Henry, 2007).

Attractive and functional finger food meals consists of components that older adults find appealing and are willing to eat with their fingers and in formats that are easy to grip and transport to the mouth without spilling. It was shown in **Paper I** that viscosity, size and temperature were the main barriers for finger foods. Choosing appropriate types of foods, preparation methods and serving presentations are, therefore, essential for older adults' acceptability of eating with the fingers. Moreover, the temperature has to be optimal to prevent the fingers from being burned.

Paper II showed that textural demands vary among those with motoric eating difficulties and chewing and swallowing difficulties are particularly common among those with major motoric eating difficulties (Kwon & Lee, 2019). There may, therefore, be a need for several different textures in a finger food concept to be able to meet the different demands. However, since those with major motoric eating difficulties may benefit most from finger foods, the texture of finger foods should be solid but soft thereby making them easier to chew and swallow. Based on the International Dysphagia Diet Standardization Initiative [IDDSI] (2019), the optimal texture for finger foods may be at levels 7 or 6. Food texture at level 7 is similar to regular food with a variety of textures, such as hard, crunchy and naturally soft, while food texture at level 6 is soft and bite-sized and can be mashed or broken up with a fork or spoon but requires chewing

(IDDSI 2019). Pouyet et al., (2014) offered pureed reconstituted finger foods. However, none of the participants in this thesis were prescribed pureed food and since texture may compensate for losses of chemosensory perception it is important to serve solid foods for as long as it is possible and safe. However, the possibility that there is a need for textures at levels 5 or lower for those with major eating difficulties cannot be excluded.

Since motoric eating difficulties have been found to be an important risk factor for malnutrition (Westergren et al., 2001), the nutritional content of the finger foods should be considered in the development in the development of finger foods. **Paper III** and **IV** showed that finger food components can be nutritionally adapted without compromising texture and flavour by choosing foods that are a valuable source of high biological value protein, such as beef and a combination of soy and whey protein (Gorissen & Witard, 2018), and by choosing foods that can be adapted further to comprise additional energy and protein.

8.1.2 The room, the meeting and the atmosphere

The attitudes of professional caregivers, spouses and relatives play an important role in the creation of a permissive and including environment, where those with motoric eating difficulties feel comfortable eating with their fingers (**Paper I**). This was also seen in the study by Visscher et al., (2020), who recommends that caregivers are involved in the development of the finger foods since their attitudes during serving influences the food's acceptance by the residents. Murphy et al., (2017) stresses the importance of professional caregivers communicating, encouraging and interacting with residents during meals. It may be even more important when serving finger food meal. They may also need time to adjust to this new way of eating as well as support to get started.

Finger food meals are surrounded by new and unfamiliar eating norms and culinary rules; in the order which they should be consumed, how they should be combined, which components can be used to grip other and so on. This can be challenging to learn. According to Medin (2010), new ways of mastering the eating situation are necessary and habits can change if the participants accept and get used to the new eating situation. The first step is to become familiar with the finger foods and how the different components can be used and combined and how to navigate the finger food meal.

According Palese, Bressan, Kasa, Meri, Hayter and Watson (2018) seating residents with different levels of eating dependence at the same table may help those with poor performance to eat independently by mirroring the movements observed in others. This may be a strategy that could be used for introducing finger foods in a care context, especially for older adults with severe cognitive decline. Seeing another person picking up the finger foods with their fingers and taking a bite may trigger a similar response in others (Palese, Bressan, Kasa, Meri, Hayter & Watson 2018). In Sweden, the meal is seen as an important pedagogical activity for communication of food and meals in preschool but may also be an effective approach in elderly care.

8.1.3 The management control system

According to Soltesz and Dayton (1995), implementing finger foods does not require extra resources and according to Jean (1997), finger foods can reduce the costs incurred by the provision of protein- and energy supplements. However, this thesis did not include implementation of finger foods into a large-scale catering establishment and care setting. No estimations of the resources of preparing finger foods and effort required (costs, time and personnel) by the food providers and caregivers were made. The implementation of complete meals will, however, demand more resources than the provision of sandwiches, cut up vegetables, quiches and cakes. This will need further studies to investigate.

8.2 Methodological considerations

8.2.1 Recruitment, gatekeepers and sample size

The intention was to include older adults with motoric eating difficulties in the studies so that their voices could be heard. They are a vulnerable population group with specific needs, and cannot, therefore, be replaced by another population. However, recruiting proved to be more difficult than anticipated. This was primarily because this group is difficult to reach and making connection with them requires contact through relatives or healthcare professionals. To facilitate the recruitment to the studies, gatekeepers were used who were able to make contact with the target population. Gatekeepers have either valuable connections with or membership in a research population and can therefore be essential mediators for providing access to study settings and potential participants (Andoh-Arthur, 2019). They have, therefore, the power to either grant or withhold access to the study population (Andoh-Arthur, 2019).

The Scanian Parkinson coalition and NEN were partners in the finger food project and able to function as gatekeepers in the recruitment of participants to the studies. The Scanian Parkinson coalition were able to communicate information about the studies to their members who consist of persons with Parkinson's disease and their relatives. NEN were able to forward information about the studies to unit managers of nursing homes and home care services, as well as dietitians in primary care in the north-eastern Scania municipalities. Despite the use of gatekeepers, it was still difficult to recruit to the studies and the Covid-19 pandemic made it even more difficult to recruit. This resulted in spouses being used as proxy respondents in the evaluation of the developed finger food components.

Gatekeepers can also influence the research in terms of choice of theoretical orientation (Andoh-Arthur, 2019). In **Study I**, due to a misunderstanding, the recruitment of two focus groups with relatives resulted in one large group with 13 participants and one small group with 3 participants. Although this was not optimal and two groups with 6-8 would have been preferred, the large group contributed contrasting data that may not have been as manifest in smaller groups. Moreover, one of the older adults recruited for an individual interview in **Study I** was under 65 years of age and was therefore excluded. The interview was conducted from an ethical perspective; however, no new information emerged.

8.2.2 Internal validity

Internal validity refers to how well the findings represent the truth of the participants in the studies (Patino & Carvalho Ferrerira, 2018). In this thesis, and in particular **Studies III**, **IV** and **V**, spouses have played an essential role in representing older adults who have motoric eating difficulties as a result of Parkinson's disease. The use of spouse proxy respondents could possibly threaten the internal validity. It is essential to be careful when using proxy respondents in subjective ratings and evaluations since this may lead to biased results. According to Graham (2016), proxy responses tend to be negatively biased. However, Elliott, Beckett, Chong, Hambarsoomians and Hays (2008) found that reports from spouse proxy respondents are more positive than reports from other proxies. In addition, the reports from spouse proxy respondents were found to be more similar to those of the recipients (Elliott, Beckett, Chong, Hambarsoomians & Hays, 2008). The goal was to include the older adults themselves to gain first hand data about their preferences, demands and requirements. This was accomplished in **Studies I** and **II**, although the sample size in **Study II** was small.

Since the target population was those with major eating difficulties, this presented difficulties with regard to communication. The main barriers were reduced energy levels, cognitive ability and voice capacity, which would have made it difficult to conduct focus groups and individual interviews. The spouses cared for the older adults in their own homes and had been doing so for many years. They had provided food and meals since they were first married and had accompanied them during the progression of the disease, from early stage to advanced stage Parkinson's disease. They had valuable insight into and, therefore, information regarding the participants' preferences, changing demands and requirements. In, addition the spouses held leading positions in the Parkinson's coalition and had good knowledge about the disease.

To manage these limitations, data have been triangulated throughout the data analyses in the different studies to increase the credibility and validity of the research findings. According to Noble and Heale (2019), credibility refers to the trustworthiness of the study and validity to the extent to which a study reflects or evaluates a concept or idea under investigation. Credibility and validity can be increased through the use of data triangulation, investigator triangulation, theory triangulation or methodological triangulation (Noble & Heale, 2019). In this thesis, triangulation has been used in the studies through combining several data collection methods and several researchers with different expertise.

8.2.3 External validity

External validity refers to the ability to apply the research findings to other individuals in other contexts (Patino & Carvalho Ferrerira, 2018). There are a few limitations in the thesis that may threaten the external validity. For example, the majority of the participants in the thesis were diagnosed with Parkinson's disease so the research findings may therefore only be applicable to those with Parkinson's disease and, in particular, those with major motoric eating difficulties. The model describing the development of motoric eating difficulties and self-acceptance over time (Figure 5) was developed based on **Study I,** which included those with a variety of diagnoses. The model should, therefore, represent several diagnoses, but needs be evaluated further to make any conclusions about its generalisability.

The observations in **Study V** included mostly older adults with dementia and the results can therefore not be fully applied to those with Parkinson's disease, atypical Parkinsonism or stroke. However, since cognitive decline is common for all these diagnoses it cannot be completely ruled out that some of the reactions and functional abilities may be similar to those with

Parkinson's disease, atypical Parkinsonism or stroke. Further studies with different population groups are therefore needed. Due to the small sample size and procedure, the actual effect of finger foods on food intake cannot be measured. However, important factors that could possibly influence the food intake of a finger food meal, such as not recognising food and utensils or unfamiliarity, were highlighted. Further studies are needed to evaluate the actual effect on autonomy, food intake and social interaction of finger food meals.

Credibility in qualitative research is related to the process of organizing data, that relevant data has been included and that the categories cover and describe the data well (Graneheim & Lundman, 2004). To increase credibility several researchers were involved in the procedure: reading transcripts, discussing the content, and creating categories. To validate the results, the research findings have been communicated throughout the project with the target population in different forums, for example through the Scanian Parkinson coalition and NEN. This way, the research findings can be either confirmed or discarded. Member checking is a technique that allows participants to verify the accuracy of the interpreted data that they have provided (Carlsson, 2010). Member checking was conducted both among the participants of the studies and among similar population groups, which made it possible to obtain confirmation of both internal and external validity.

9. Conclusion and future perspectives

In this PhD thesis, the aim was to develop and evaluate attractive, functional and nutritionally adapted finger foods based on the preferences, demands and requirements of older adults with motoric eating difficulties over 65 years of age. This thesis showed that it is possible to develop complete finger food meals for lunch and dinner, that older adults are willing to eat with their fingers. However, the finger food components have to be developed in regard to, type of food, viscosity, size and temperature. In addition, chemosensory losses and chewing and swallowing difficulties may require flavour enhancement and texture modification. In order to increase acceptability of finger food meals and to facilitate eating for those with visual and cognitive impairment, the components should be easily distinguished on the plate. This can be done by serving the finger food components separately on the plate, using colour to contrast the components, and serving sauce separately to avoid spreading to other components.

This thesis also showed that finger food meals can be nutritionally adapted without compromising the flavour or texture. The nutritional content, in regard to protein and energy, were in line with the

guidelines and can be increased further by adding additional flatbreads and beef rolls, or by serving appetizer and dessert. This thesis showed that finger foods have the potential to increase autonomy, food intake, and social interaction among persons with motoric eating difficulties. However, due to the small sample size, further research is needed to evaluate the actual effectiveness.

Since there are several different diseases causing motoric eating difficulties, the demands and requirements may vary depending on type of disease and severity of eating difficulties. It was shown that older adults with major motoric eating difficulties are more open to the idea of finger foods and may also benefit the most from eating finger foods since they were already eating with their fingers to some extent. This was especially seen among those in advanced stages of Parkinsons disease, atypical Parkinsonism and dementia. This may be because those with advanced Parkinsons disease have developed self-acceptance in relation to their disease over time. However, it may also be related cognitive deterioration and that this made them less aware of and sensitive to norms surrounding meals.

Finger food meals are surrounded by new and unfamiliar eating norms and culinary rules, which can either facilitate or hinder food intake. Thus, it may take time and encouragement from professional caregivers, spouses and relatives to adjust and adapt to this new way of eating. This can be encouraged by creating a permissive and including atmosphere: openly communicating the purpose of finger foods, seating residents with different levels of eating dependence at the same table and residents or professional caregivers can mirror the movements of finger food eating. Finger foods may also not be beneficial for all persons with dementia and that an individual assessment may be required before finger foods are prescribed.

For future perspectives, there is a need to develop several types of finger foods components that can appeal to diverse population and be combined to create several types of meals. This may be especially interesting for municipal food providers but also industrial food providers. However, there is also a need to further investigate the possibilities for implementation, both how finger foods can be implemented and produced in a large-scale catering establishment and prepared and served in a care setting.

There are no high-quality trails suggesting that finger foods can improve food intake and nutritional status and prevent malnutrition. There is therefore a need to investigate effectiveness in a larger population and on different population groups, for example among olde adults with

Parkinsons disease, stroke and dementia individually. Moreover, there is also a need to evaluate finger foods in relation to autonomy and social interaction.

It would also be interesting to further evaluate the model for classification of motoric eating difficulties in relation to the use of cutlery and/or fingers (Figure 5). This could be done by conducting a longitudinal study, to assess the development of motoric eating difficulties in relation to severity of eating difficulties and self-acceptance over time, among older adults with Parkinson's disease.

To facilitate the observations in **Study V**, an observation guide was adapted from The Minimal Eating Observation Form-Version II (MEOF-II). Aspects regarding atmosphere, handling of cutlery and finger foods, and social interaction with other care recipients, professional caregivers and spouses, were added. It would be interesting to evaluate the use of the observation guide and to conduct a larger observation study in the future.

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Paper I

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Perceptions and Attitudes about Eating with the Fingers-An Explorative Study among Older Adults with Motoric Eating Difficulties, Relatives and Professional Caregivers

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ABSTRACT

Difficulties of managing cutlery, manipulating food on the plate and transporting food to the mouth may negatively influence the ability for self-provision and nutritional status among older adults with motoric eating difficulties. The purpose was to explore perceptions and attitudes about eating with the fingers among older adults with motoric eating difficulties, and relatives and professional caregivers of older adults with motoric eating difficulties. Qualitative data was collected through individual interviews with older adults >65 years ($N = 14$) with motoric eating difficulties and focus groups with relatives ($N = 15$) and professional caregivers ($N = 15$). Data was analyzed using deductive and inductive content analysis. Although the older adults had normative ideas about proper eating and culinary rules, they regularly consumed several foods with their fingers without previously reflecting upon this. Using bread to grip or wrap foods and inserting skewers into foods may increase the acceptability of eating with the fingers. However, the importance of the disease causing the eating difficulties, how it was perceived, and its severity were crucial in understanding how eating with the fingers was perceived. Finger foods may be suitable for older adults with major eating difficulties because they have developed a self-acceptance in relation to their condition over time.

KEYWORDS

Eating with fingers; motoric eating difficulties; older adults; perceptions and attitudes; professional caregivers; relatives

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Supplemental data for this article can be accessed on the publisher's website.

Introduction

Eating difficulties are complex and comprise several difficulties related to the eating process that, either alone or in combination, negatively interfere with the preparation and intake of foods and/or beverages.[1,2] Westergren et al[3] found that 82% of patients >65 years old in hospital rehabilitation were found to have one or more eating difficulties and 46% were also at risk of malnutrition or had suspected or manifest malnutrition. Among patients who had suffered a stroke, 82% were found to have one or more eating difficulties.[4]

Tremors, rigidity, physical impairments, pain and weakness in the hands and fingers might result in motoric eating difficulties related to the pre-oral phase of eating, which often involves difficulties with sitting position, managing cutlery, manipulating food on the plate and transporting food to the mouth.[3] In a recent study among 5,956 nursing home residents and hospitalized patients, 14% had problems manipulating food on the plate, 12% transporting food from the plate to the mouth and 5% with sitting position.[5] In the study by Medin et al,[4] 66% had problems manipulating food on the plate, 55% with inadequate food consumption and 45% with sitting position. Motoric eating difficulties have also been significantly associated with assisted eating (OR = 11.24, $p = <0.0005$).[3] Assisted eating may in turn negatively influence the ability for self-provision and autonomy[6] and increase the risk of social isolation.[7] Finger foods may be a way to maintain autonomy, however little is known about the effect of using such foods among older adults with motoric eating difficulties.

Mealtimes are often seen as reinforcing the social norms related to eating. In the transition from independence to dependence, eating difficulties may challenge deeply rooted cultural habits and attitudes.[8] Several studies have shown that feelings of fear and shame resulting from changed physical and social appearance are common among persons with eating difficulties.[3,9] Rejection has also been seen among community-dwelling older adults when fellow residents with eating difficulties display undesirable physical behavior such as coughing, choking, vomiting and difficulties with transporting food to the mouth.[10] Previous research has described how different strategies are used to sustain or perform proper meal behavior. In order to maintain autonomy and act according to conventional norms, persons with eating difficulties struggle to hide and minimize changed behavior and appearance by consciously avoiding certain foods and beverages; planning what to eat, with whom and where; declining invitations to avoid exposing their shortcomings; and withdrawing from mealtimes.[1,9,11,12] Thus, eating becomes a struggle to both uphold proper table manners and consume sufficient energy and nutrients.

Modern ideas of proper eating and table manners in Western societies are products of a refinement process theoretically described by Elias[13] as

the civilizing process. As people in western societies became civilized, standards of appropriate behavior were established to provide a guide to social etiquette.[13] Eating with the fingers has been considered unacceptable in the table manners of western societies, where eating with a knife and fork has resulted from a distaste for dirtying one's hands and a need to restrict the use of a knife to limit dangers.[13] Permitted and forbidden table manners and behavior are often learned during childhood and are, in a way, routinized and non-reflective.[1] Culinary rules, such as specific dishes, ingredients and trimmings based on shared traditions and customs, are often taken for granted in a given culture.[14] Although these notions are modified during one's lifetime, for older adults, overlooking cultural and social aspects may lead them to skip meals which has nutritional consequences.[14] Foods that are easy to grip, hold and transport from the plate to the mouth using the fingers may be a strategy for maintaining autonomy, food intake, nutritional status and subsequently quality of life among older adults with motoric eating difficulties. Cluskey and Kim[15] investigated the use and perceived effectiveness of different strategies to enhance food and nutrient intake in older adults in long-term care facilities and, according to the registered dietitians and directors in the study, meals offered as finger foods were sometimes or usually effective.

Finger foods are foods that are specifically prepared to be eaten with the fingers and, in the literature, the concept of finger foods ranges from sandwiches, fruits and vegetables to semi-manufactured components and pureed and reconstituted solid meals.[16,17] Studies suggest that finger foods may increase food intake and autonomy, primarily among older adults with dementia.[16–18] Soltesz and Dayton[16] found that overall food intake increased among older adults with Alzheimer's when finger foods were included in the meals and those who had difficulty using cutlery benefited the most from finger foods. In addition, caregivers in the study by Murphy et al[18] perceived that finger foods helped maintain independence among persons with dementia. For finger foods to be a long-lasting and effective eating strategy for older adults with eating difficulties, sandwiches and snacks need to be supplemented with more substantial meals at lunch and dinner that are perceived appropriate and acceptable to eat with the fingers.

Further knowledge is therefore needed regarding eating norms and the physical and social contexts of eating to be able to understand the possibilities and barriers for eating with the fingers and for the development of finger foods with high acceptability among older adults with motoric eating difficulties. By also including the attitudes and perceptions of relatives and professional caregivers about eating with the fingers, a deeper understanding might be obtained, especially in relation to how knowledge gained can be implemented and understood in everyday life. The purpose of this study

is to explore perceptions and attitudes about eating with the fingers among older adults >65 years with motoric eating difficulties, and relatives and professional caregivers of older adults with motoric eating difficulties.

Material and method

Data collection and recruitment

Qualitative data was collected through individual interviews with older adults with motoric eating difficulties and focus group discussions with relatives and professional caregivers of older adults with motoric eating difficulties (see Figure 1). The older adults and relatives in the study were not related to each other.

Recruitment was conducted with support from the Scanian Parkinson coalition and the Network for Eating and Nutrition (NEN), a platform for cooperation over organizational borders in healthcare sectors in the northeast of the Swedish province of Scania.[19]

Sample I

Fourteen older adults with motoric eating difficulties were recruited for individual interviews by the representatives for NEN and the Scanian Parkinson coalition (see Figure 1). Inclusion criteria required that the older adults were 65 years or older, had some type of motoric eating difficulty, were able to communicate in Swedish and consent or assent to an interview (see Table 1). Three older adults received support from a spouse during the interview; one participant wanted emotional support and two participants needed support due to verbal and cognitive deterioration related to Lewy body dementia.

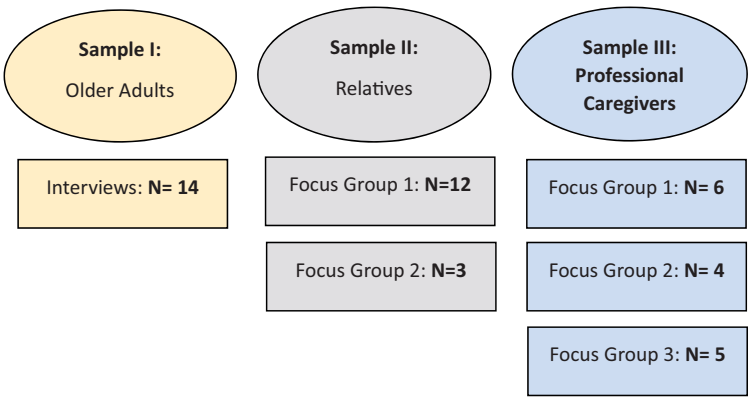

Figure 1. Overview of the data collection; Samples and *N* = number of participants in the study.

Table 1. Description of the participating older adults.

Interviewee	Gender	Age	Diagnosis	Difficulties*	Accommodation	Marital status
1	Female	78	Parkinson's	Moderate	Nursing home	Widowed
2	Female	79	Parkinson's	Minor	Ordinary home	Widowed
3	Male	85	Stroke	Moderate	Nursing home	Widowed
4	Male	75	Parkinson's	Minor	Ordinary home	Single
5	Male	69	Parkinson's	Major	Ordinary home	Widowed
6	Male	79	Parkinson's, Lewy Body Dementia	Major	Ordinary home	Partner
7	Female	77	Stroke	Minor	Nursing home	Widowed
8	Female	74	Stroke	Moderate	Ordinary home	Married
9	Male	77	Parkinson's	Moderate	Ordinary home	Married
10	Male	72	Parkinson's	Moderate	Nursing home	Single
11	Male	71	Parkinson's	Minor	Nursing home	Married
12	Male	73	Parkinson's, Lewy body Dementia	Major	Ordinary home	Married
13	Female	94	Frail/no strength	Major	Nursing home	Widowed
14	Female	90	Rheumatoid arthritis	Minor	Nursing home	Widowed

*Minor = ability to handle a knife and fork; Moderate = ability to handle a fork and/or spoon; Major = ability to handle a spoon and/or fork with help from fingers.

The eating difficulties were categorized into minor, moderate and major based on the participant's ability to handle cutlery. Participants with the ability to handle a knife and fork were categorized as having minor eating difficulties, participants with the ability to handle a fork and spoon as having moderate eating difficulties, and participants who ate with a spoon or a fork complemented by their fingers as having major eating difficulties (see Table 1).

Sample II

Fifteen relatives were recruited by representatives for the Scanian Parkinson Coalition to two focus groups (see Figure 1). The inclusion criteria were that the persons were either related or close to an older adult with some type of motoric eating difficulty and were able to communicate in Swedish. The sample included 11 women and four men, and the majority were spouses.

Sample III

Fifteen professional caregivers were recruited for three focus groups by representatives of NEN (see Figure 1). The inclusion criteria were that the caregivers had professional experience of older adults with some type of motoric eating difficulty and were able to communicate in Swedish. The sample included 14 women and one man and consisted of managers, nurses, assistant nurses and trainee assistant nurses from both the home care service, nursing homes and short-term nursing homes.

Informed and written consent was obtained before the individual interviews and focus groups were scheduled. The interviews (sample I) were held in the older adults' ordinary homes or nursing homes and lasted approximately 30–60 min. The focus groups (samples II and III) were

conducted in facilities provided by the Scanian Parkinson Coalition and NEN and lasted approximately 1 h and 30 min. Both the individual interviews and the focus groups were digitally recorded using an audio recorder and then transcribed verbatim. All personal information that could possibly be linked to any individual participant was removed.

Interview guide

A semi-structured interview guide with open-ended questions was created to explore the participants' perceptions and attitudes about eating with their fingers. The same interview guide was used with all three groups of participants; however, the focus was on the older adults' perceptions. Perceptions are defined as the central cognitive process in which information is interpreted through sensory systems, while attitudes are defined as evaluative responses toward someone or something.[20,21] Central aspects of the meal relating to the physical and social context, table manners, and the food and drink were summarized into four key concepts: why, what, whom and where and provided a framework for the interview guide. During the interviews and focus groups, pictures of various dishes that are common in Swedish cuisine and different eating contexts were used to facilitate the discussions. Pictures and photographs can function as "triggers" for discussing food and eating in everyday life. As the parts of the brain that process visual information are evolutionarily older than the parts that process verbal information, images can evoke deeper elements of human consciousness than words.[22]

The interview guide started with an open question about the participants' experiences of eating with their fingers. It continued with pictures of six dishes where the main question was: which dishes can be eaten with the fingers and when do you need cutlery? The dishes were (1) a stew, (2) tacos, (3) an open sandwich with egg, shrimps and mayonnaise, (4) a dish including a chicken leg or a chicken fillet, (5) meatballs with potatoes, gravy and lingonberries and (6) a salad (see Figure 2). Additional questions concerning the importance of size, shape and consistency were asked as were the following questions: What determines which foods can be eaten with the fingers? Which foods do we eat with our fingers today? and Which foods cannot be eaten with our fingers?

The second part of the interview guide consisted of pictures of six different *meal contexts* and the main question was: in which contexts is it appropriate or inappropriate to eat with the fingers? The contexts were (1) an á la carte restaurant, (2) a Christmas meal with family, (3) home alone, (4) a picnic, (5) a romantic dinner, (6) a "fika" (Swedish word meaning coffee and cake) and (7) an ethnic meal shared with many and eaten with the

fingers (see Figure 3). Additional questions concerned what determines when and where it is appropriate to eat with the fingers, the importance of the setting and people, and the perceived benefits and disadvantages of eating with the fingers (see Appendix I for the full interview).

The interview guide was pilot tested for usability during the first focus group with relatives. Since no revisions were made to the interview guide, the results from this focus group were included in the study.

Content analysis

The data analysis was inspired by the procedure of Elo and Kyngäs[23] and involved both deductive and inductive approaches. The data analysis was divided into three phases: preparation, organizing and reporting (see Figure 4).

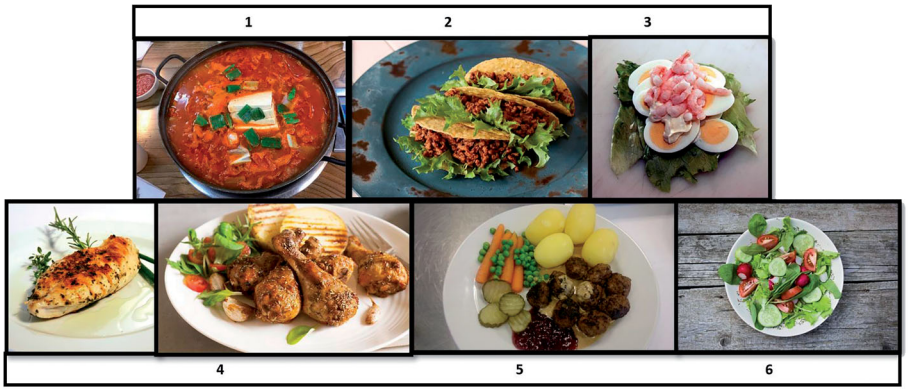

Figure 2. The six pictures of dishes that were used in the interview guide for both the individual interviews and the focus groups. Photo courtesy of Pixabay.com.

Figure 3. The seven pictures of meal contexts that were used in the interview guide for both the individual interviews and the focus groups. Photo courtesy of Pixabay.com.

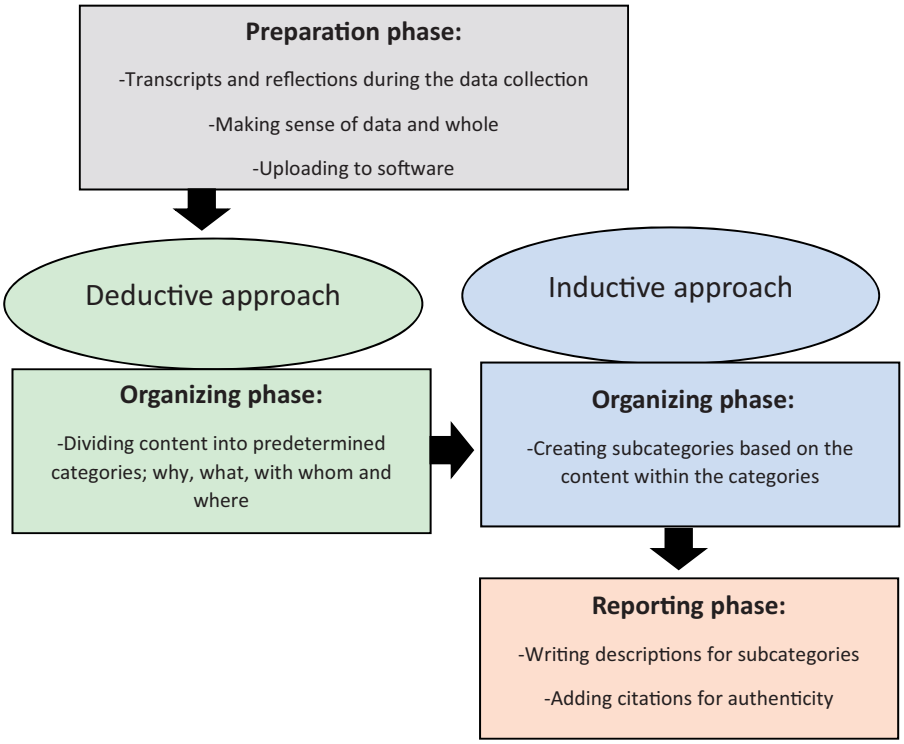

Figure 4. Overview of the Content Analysis Process with both a Deductive and Inductive Approach, inspired by Elo and Kyngäs.[23]

Preparation

The analysis was ongoing throughout the data collection process and a short summary of the overall reflections of the interviews and focus groups was compiled after every session to prompt and capture insights. The transcripts and summaries were read through to obtain an understanding of the overall meaning of the data. The transcripts were then uploaded into ATLAS.ti 8, a software for qualitative analysis, and the transcriptions were coded line by line.[24]

Organizing

A deductive approach was used to organize the data into predetermined categories based on the key concepts: why, what, with whom and where. An inductive approach was then used to identify and construct subcategories of the data in the predetermined categories (see Table 2).

Reporting

Descriptions of all the subcategories were written and citations were added to create authenticity and credibility.

Table 2. Categories and subcategories identified in the data.

Categories:	Subcategories:
Conduct while eating (why)	• Learned norms and table manners • Previous life-course experiences and health trajectories • Feelings of reverting back to childhood
Food acceptance (what)	• Conflicting views and practices • Food properties and perceived appropriateness • Strategies to increase acceptance
The social context (with whom)	• Importance of feeling comfortable and commensality • Striving for normality and a sense of belonging
The physical context (where)	• Avoiding formal meal settings • The freedom of Informal Meal Settings

Ethical considerations

Ethical approval was received by an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019-01691). The study was performed in accordance with the Helsinki Declaration of Ethical Principles, including informed and written consent.[25]

Results

The older adults' perceptions and attitudes about eating with the fingers were structured into four categories based on why, what, with whom and where. An overview of the subcategories describing the content of these categories is presented in Table 2 and is explained in more detail in the following text.

Conduct while eating (why)

Learned norms and table manners

Family values, table manners and eating behavior during both formal and informal dinner settings were frequently discussed during the interviews with the older adults. They had learned proper table manners during childhood, including how to set the table, how to serve guests and how to handle cutlery properly, and although many ate their meals alone today they still valued a beautifully set table with tablecloth, candles or flowers.

> There is nothing nicer than sitting at a beautifully set table with flowers or a potted plant in the middle of the table [Individual interviews, interviewee 7]

> It is nice to eat at a beautifully set table, if it is a dinner for 6-8 people it is nicer to come to a set table rather than just a plate [Individual interviews, interviewee 4]

Eating properly with both a knife and a fork and holding the cutlery in the correct hands were perceived as implicit rules and the ability to manage cutlery was often taken for granted by those with no or only minor eating difficulties.

> It is learned behavior, one takes for granted that everyone eats with cutlery … the people who are able to eat with a knife and fork do so [Individual interviews, interviewee 3]

> Well one could eat with one's fingers, but I feel it is a bit too much, I prefer to eat with cutlery, and I think it is better, one could at least use a fork [Individual interviews, husband of interviewee 8]

Some older adults with limited ability to manage cutlery considered eating with the fingers as something that children and ill-mannered people do, which resulted in mixed feelings about the issue. Even if some of the older adults with moderate or major difficulties recognized that they might benefit from eating with their fingers during mealtimes, they still persisted with trying to handle a spoon and fork and eating with their fingers was seen as a last option to avoid assisted eating.

> I eat with my fingers in everyday life but when I eat out or away from here, I try to manage the cutlery, but it is difficult [Individual interviews, interviewee 13]

> I think it is a disadvantage to eat with your fingers if you are able to eat with a fork or a spoon, so if you are able to eat with a fork or a spoon then you should, if not then you can eat with your fingers [Individual interviews, interviewee 3]

The professional caregivers were, overall, positive to finger foods because such foods might increase food intake and autonomy and, in the long-term, quality of life among their care recipients.

> The advantages are that the recipients can eat by themselves instead of us caregivers having to put the food into their mouths, it must feel so much better to be able to do it themselves [Professional caregivers, focus group 3]

However, the professional caregivers admitted that they sometimes praise care recipients for eating and behaving properly at the table, and sometimes even encourage them to use cutlery instead of eating with their fingers, which they realized could send negative signals. Moreover, they also suggested that relatives might be a potential barrier as some relatives would probably not feel comfortable with, for example, their parent eating with their fingers. The professional caregivers acknowledged, therefore, that they have an important role in informing both colleagues and relatives about the benefits of finger foods so that they can support and encourage older adults with motoric eating difficulties to eat with their fingers.

> I think it is important to give information from the start, to inform them and their relatives already when they move in that, if or when they gradually get worse, there is a possibility to receive finger foods and that this is not at all strange [Professional caregivers, focus group 1]

Previous life-course experiences and health trajectories

Both older adults and relatives described life-course events and experiences that had helped shape their attitudes and perceptions about finger foods and eating with the fingers. Most of them had traveled around the world and

encountered cultures where hand-to-mouth dining is the norm. Even if they did not prefer to eat with their fingers, they thought it was important to respect and conform to local cultures and dining etiquettes while traveling.

> My husband and I went to India and they eat with their fingers there, we sat on the floor and the food was served on banana leaves and the food was made so it was easy to dip and scoop up with one's fingers [Relatives, focus group 1]

The older adults were also influenced by current food trends, such as convenience foods and eating with one's hands "on the go." They perceived eating with the fingers as more acceptable and less stigmatized nowadays.

> It has become much better during the past years, fifteen years ago it was a different mindset … it is the influences that have been derived from foreign countries where they only eat with their hands [Individual interviews, interviewee 4]

Type of disease, stage of disease and severity of difficulties strongly influenced the older adults' attitudes to eating with their fingers. Older adults with minor difficulties from early stage Parkinson's disease and rheumatoid arthritis found it difficult to see themselves eating with their fingers as they were still able to eat independently with a knife and fork or modified cutlery.

> I do not eat with my fingers, I have modified cutlery for people with rheumatoid arthritis [Individual interviews, interviewee 14]

Older adults with moderate difficulties caused by middle stage Parkinson's disease or impairments after a stroke were more understanding and open to the idea of finger foods. However, they had difficulty imagining themselves eating with their fingers since they were still able to eat with a fork or a spoon.

> I eat with a fork, I cannot manage a knife since this arm is paralyzed after my stroke so I can only use my left arm and that works fine, so I don't eat with my fingers … since I don't eat with my fingers I have a hard time imagining not being able to eat by myself and trying to put myself in that situation [Individual interviews, interviewee 3]

> I think this is something one has to consider when the time comes, it is not something that I can say now [Individual interviews, interviewee 2]

Furthermore, older adults with major difficulties caused by late stage Parkinson's disease were already eating with their fingers to some extent.

> When I am home alone, I eat with my fingers [Individual interviews, interviewee 5]

> There are a lot of foods that I have told him he has to eat with his fingers because it (the food) falls off his spoon, he eats meat and such with his fingers, but he tries to eat with a fork and spoon [Individual interviews, partner of interviewee 6]

During the focus groups with relatives, it was also evident that the different stages of Parkinson's disease influenced the degree of difficulties and how the older adults ate.

> My wife has had Parkinson's disease for 17 years, but it has developed slowly which I am glad for, she does not have any problems with swallowing and such so it is okay so far [Relatives, focus group 1]

> I am married to a man with Parkinson's disease and he has a hard time cutting meat and he tries to rip it apart, when he lifts his fork from the plate to his mouth the food falls off the fork so he has started to eat with a spoon instead [Relatives, focus group 1]

Relatives of older adults with minor eating difficulties were overall less open to the concept of finger foods and had more difficulty seeing the beneficial aspects of eating with the fingers, whereas relatives of older adults with major eating difficulties described how they were already modifying foods for them to make them better suited to eating with their fingers.

Feelings of reverting back to childhood

According to the professional caregivers, finger foods might trigger negative feelings as a result of the common perception that it is only small children who are allowed to eat with their fingers. They described how their care recipients reverted back to childhood as they became more and more dependent on help and that eating with their fingers might add to the feeling of going back to being a child again.

> I think when you go back to eating with your fingers, you go back to being a baby or a child and elderly people already feel like children sometimes as they need help to change incontinence pads and help to wash and dress themselves and to start eating with their fingers might cause feelings of being a child again [Focus group 1, professional caregivers]

> Small children are allowed to eat with their fingers as they cannot handle cutlery and it should be the same when you are old and have other difficulties, it should be natural to be able to go back to eating with their fingers again as they can get a bitter grip and be able to put it (the food) in their mouths without dropping food in their lap or on the floor [Professional caregivers, focus group 3]

Food acceptance (what)

Conflicting views and practices

Regardless of upbringing and previous life experiences, all the older adults disliked having greasy fingers and feared becoming messy eaters as a consequence of their disease. The acceptance of finger foods depended on what type of food was being served. Interestingly, most of the older adults first responded that they did not have any experience of eating with their

fingers; however, during the interviews they recognized and recalled several foods that they regularly ate with their fingers. Foods such as tacos, sandwiches, pork chops, chicken legs, ribs, vegetables, hot dogs, hamburgers, pizza, fruits, French fries, cookies and buns were already being eaten with their fingers.

> I can only eat with a fork, but I do not eat with my fingers … when we grill burgers then they have to cut the burger in two so that I can hold it easily in one hand … or a sausage in bread, I can handle that [Individual interviews, interviewee 8]

Food properties and perceived appropriateness

In practice, more or less all foods could be eaten with the fingers; however, not all foods were considered appropriate according to socially determined norms and table manners.

> There are a lot of foods that you can eat with your hands and many of the things you eat with cutlery can be eaten with your fingers as well; however, I think it is a question of etiquette and manners [Individual interviews, interviewee 4]

> You can eat everything with your fingers if you want to, it is all about the circumstances and where you are [Individual interviews, interviewee 10]

Several important factors that affect appropriateness were discovered. Foods such as chicken legs and wings, ribs and pork chops with bones were categorized as foods that are allowed to be eaten with the fingers, since bones function as handles providing distance between the meat and the fingers. In addition, meat components such as meatballs and brunch sausages were considered typical finger foods. Pieces of vegetables such as cucumber, tomatoes and peppers were also considered appropriate to eat with the fingers.

> Chicken and ribs are the only foods I remember that we were allowed to eat with our fingers … and pork chops are also okay to hold in your fingers and gnaw from the bone [Individual interviews, interviewee 7]

> He eats with his fingers when it is the Christmas buffet, he eats eggs, meatballs and brunch sausages with his fingers [Individual interviews, partner of interviewee 6]

"Fika" and desserts such as soft cakes, cookies and buns were often perceived as being appropriate to eat with the fingers as people anyway do this. However, cakes and pastries filled and piped with cream, mousse, frosting or icing were considered inappropriate to eat with the fingers. Smaller bite-size pastries were therefore preferred.

> "Fika" is something you eat with your fingers, you can get sticky fingers but there are napkins to wipe your hands on but I want a spoon if it is cake with a lot of cream because you can't eat a cream cake with your fingers [Individual interviews, interviewee 3]

Strategies to increase acceptance

Size, temperature and viscosity were important for the acceptability of finger foods. The components should not be too big since too much topping and too many layers make it difficult to hold the finger foods firmly; many suffered from tremors and coordination difficulties and those who had had a stroke could only use one hand. Open sandwiches, burgers and tacos with too much topping made eating messier as the toppings squirted to the sides and fell into their lap. Bite-sized foods, one to three bites, were considered optimal as finger foods for those with weak handgrip and tremors.

> It is actually not a problem to eat an open sandwich with your fingers, but open sandwiches are often well decorated and that can be difficult [Relatives, focus group 1]

> The shrimp sandwich is difficult to balance so I usually get it in smaller pieces and then it is easier to handle, otherwise it will fall into my lap [Individual interviews, interviewee 10]

Temperature was also important so that the different components could be picked up and held with the fingers without burning them. Soups, stews and gravy with low viscosity were considered inappropriate to eat with the fingers since they disliked getting greasy fingers. However, if the dishes were modified to a higher viscosity and served separately, the older adults were open to the idea of using bread or potato wedges to scoop up soup, stew and gravy.

> Maybe gravy, potatoes and meatballs can be served separately, and you can dip the meatballs in the gravy or something, the components must be separated [Relatives, focus group 1]

> Soup is difficult but then you have to have a piece of bread to dip in the soup [Individual interview, interviewee 2]

Chicken fillets and pork chops without a bone needed a handle, such as a skewer, to make it appropriate to hold it in their hand and take bites. Bread of all sorts was also considered appropriate to add to any dish, either to scoop up something or to wrap foods since it provided a nonstick surface for components that were inappropriate to eat with the fingers.

> I think everyone would find it appropriate to eat a chicken fillet with their fingers if it was served in bread [professional caregivers, focus group 2]

> If a skewer was inserted into the chicken fillet it would be appropriate to hold it and take bites out of it without having to take hold of it again [Individual interviews, interviewee 5]

The focus groups with relatives resulted in an exchange of tips and tricks for how to modify different foods to improve the meals for their loved ones. This also made them aware of the differences between their loved ones eating difficulties in relation to the severity of their diseases.

The social context of eating (with whom)

Importance of feeling comfortable and commensality

Social aspects were also important for the older adults' acceptability of finger foods. Overall, most of the older adults felt comfortable eating with their fingers if necessary when among family members and close friends who were familiar with the underlying circumstances related to their disease and eating difficulties.

> The family are aware of my difficulties and therefore I would eat with my fingers if I needed to [Individual interview, interviewee 1]

> Many people are restricted in their social life as they do not want to openly show that they have eating difficulties, it is easier to eat with your fingers in a small group where you are accepted than in wider company [Relatives, focus group 1]

Regardless of disease, symptoms and severity of eating difficulties, most of the older adults were uncomfortable eating with their fingers among people they did not know since they worried about people looking at them and judging them for not being able to eat properly. Thus, being perceived as ill-mannered or disrespectful to other guests was something they wanted to avoid. A common view among the older adults was that a restaurant meal is shared with all the other guests present and that the meal experience would be ruined for everyone if they did not behave properly.

> If you eat in a restaurant, you have to pay respect to other people too and then you don't eat like a slob [Individual interview, interviewee 14]

> I really don't mind too much if my husband starts grabbing something with his fingers, I would think more about what people around us were thinking [Relatives, focus group 1]

Relatives of older adults with minor or moderate eating difficulties did not want to put their loved ones in situations where they risked standing out. However, neither the relatives nor the older adults said they would mind if someone else ate with their fingers. Older adults with major symptoms due to late stage Parkinson's disease had already overcome the fear of other people's opinions as they had no other option left but assisted eating. They reasoned that either they can let the difficulties isolate them or they can accept their difficulties and enjoy life for as long as possible. As they were at a late stage of Parkinson's disease, their physical difficulties were harder to hide, therefore people just have to accept them as they are.

> It doesn't matter to me if someone lacks the ability to eat in any other way and therefore has to eat with their hands, then it doesn't matter where we are, that's how I feel and if it bothers someone else they can choose to look the other way. As long as it is not prohibited, it doesn't matter in a situation like this, he doesn't have leprosy [Individual interviews, wife of interviewee 12]

> I don't care about that anymore, I am past that now, people can look at us if they want to I don't care, however, we don't enjoy eating out because we are unable to eat together anymore, I have to help him and my food has to wait, I don't really like eating cold food [Individual interviews, partner of interviewee 6]

The professional caregivers described the mealtimes in institutions as challenging because the care recipients are forced to eat with people they would not normally have taken meals with. Even though there are other care recipients with similar difficulties in the ward, some of them still feel uncomfortable eating in the common dining room. According to the personal caregivers, from time to time, care recipients also commented on each other's table manners and openly showed their unwillingness to sit next to someone with eating difficulties. Some care recipients also regularly withdrew from common meals in the ward.

Striving for normality and a sense of belonging

The older adults were open to the idea of eating with their fingers in a setting where everyone ate with their fingers, both among people they know and strangers. One of the older adults with Parkinson's disease described the freedom he felt sitting in a restaurant eating with his fingers like everyone else and one of the relatives described how she would take her husband to fast food restaurants so that he could eat with his fingers without standing out. Another older adult described how he valued the opportunity to go on rehabilitation trips with other patients with similar difficulties because the food was prepared to be easily consumed with only a fork or a spoon and it was not considered inappropriate if he needed to use his fingers.

> It is also about the food, we can eat really easily at KFC with our fingers because there is no cutlery, so it is what and where we eat [Relatives' focus group 1]

> It was amazing because I got to meet similar people who eat the same way as I do, there are also dishes that were adapted and everything is organized, so you do not have to worry [Individual interviews, interviewee 5]

To create a comfortable and permissive environment, the professional caregivers arrange the seats and tables so that residents with similar difficulties are able to eat together; by doing so these residents acquire a sense of normality and belonging. According to the professional caregivers, finger foods with high acceptance might enable care recipients with major eating difficulties to take part in shared mealtimes.

The physical context of eating (where)

Avoiding formal meal settings

Formal settings such as exclusive restaurants, dinner parties and events were off-limits for most of the older adults. From their upbringing, they

were used to fine china, silverware, table decorations and dress codes for formal meals. They therefore felt that proper table manners were expected of them in places where the tables are set with white tablecloths, candles, cutlery and glasses because this indicated that this is a place where one eats with cutlery.

> Generally, it is about the context, if it is a more formal dinner party, it is not appropriate to eat with your hands [Individual interviews, interviewee, 9]

> A friend of mine only eats at restaurants with ironed napkins, I on the other hand avoid places like that *laughs* [Individual interview, interviewee 9]

Eating with their fingers in exclusive restaurants was therefore not an option for most the older adults. They also described different strategies that they used to avoid awkward situations. One of the relatives whose husband suffered from major eating difficulties described how, before going out for dinner, they would look at the menus online and choose restaurants with dishes that her husband would be able to eat independently. Another participant described how, when he received an invitation, he would call and ask what foods were going to be served at gatherings and events. If the foods were difficult to eat independently, he would decline the invitation.

> When I am home alone I eat with my fingers, I like it and if the food is easy to eat with my fingers it would be very helpful, I don't mind eating with my fingers, it is mostly other people who have a hard time accepting it and that makes me feel like an fool, I don't like that but if there were foods that were easy to eat with my fingers, it would help me enormously [Individual interviews, interviewee 5]

> It would be helpful as we could eat dinner together, as it is now I serve him first and I eat when he is done or sometimes, when there is a bit more for him to chew, I can eat a bit but my food gets cold [Individual interviews, interviewee 12]

The relatives did not mind dining in nicer restaurants with their loved ones, but they did not want to put their loved ones in situations where they would feel uncomfortable.

> I think it important to show respect to a person who suffers from difficulties like that, no one should have to be in a situation where they are being stared at [Relatives, focus group 1]

The freedom of informal meal settings

Informal meals, on the other hand, were considered to be more relaxed, casual settings in everyday life. All the older adults thought it was appropriate to eat with their fingers in their own home, both alone when no one was there to see and also with their spouse, family and friends.

> You can eat however you want when you are alone [Relatives, focus group 1]

A dinner date with their spouse at home was appropriate because their spouse is committed "for better and for worse" and it was even seen as

being more intimate as they were able to be themselves. However, eating independently was deemed important as it makes the dinner more equal and having someone assist them with their meal was something they wanted to avoid as much as possible. Eating in fast food restaurants where the food is prepared to be eaten with the fingers was also not a problem since it was expected. Eating with the fingers outdoors at picnics was described as something natural and free, and the older adults who were uncomfortable with eating publicly were positive about picnics because table manners and the demand for cutlery were non-existent. Picnic food was also described as being prepared for the occasion, which meant being easy to grip, hold and eat with the fingers without getting them greasy. In an outdoor setting, it was considered less stigmatizing to grip less appropriate foods with the fingers.

> You do whatever you want out in the open … how do I explain it, when you are outside in the nature it becomes more natural [Individual interviews, interviewee 1]

> If I eat in the nature and people sit next to me, I don't mind, but if it is in a restaurant it bothers me *laughs* it is strange I haven't thought about that before, you can have coffee and eat as much as possible with your fingers [Individual interview, interviewee 13]

The interviewees suggested that meals would probably be more appropriate for their purpose if the concept "prepared for the occasion" that was associated with picnic food was applied when preparing formal meals.

> When you go on picnics you choose to bring foods that are simple and planned and prepared for the occasion [Individual interviews, interviewee 8]

Discussion

Normative ideas about eating

The purpose of the present study was to explore perceptions and attitudes about eating with the fingers among older adults >65 years with motoric eating difficulties, and relatives and professional caregivers of older adults with motoric eating difficulties. It was found that normative ideas regarding table manners and eating behavior were prevalent and deeply rooted among the participants. This is in line with previous studies reporting that childhood experiences often play a significant role in forming food-related values and culture.[26,27] According to Lupton,[28] these values are closely tied to the family as part of the acculturation process into society, including norms, expectations, preferences and practice around food and eating, and are learned and shaped from childhood to adulthood. This may explain why eating with fingers triggered feelings of reverting back to childhood. This may, therefore, be a reason why these notions remained an integral

part of the participants' identity even though they had adapted their eating norms over the years.

The conflicting views and practices in this study were striking since, initially during the interviews, most of the older adults firmly argued that they did not eat with their fingers, but later, to their surprise, could recall several foods that they ate with their fingers on a regular basis. This indicates that eating norms are not static, or even conscious, and that they do not necessarily correspond to actual behavior. Clearly, there has been a transition in Western society toward eating more foods with the fingers but without reflection. Finger eating seems to have unconsciously progressed over time, in part due to influences from other food cultures; however, although there are plenty of foods that are already eaten with the fingers, there are still norms concerning the proper way of eating, which most often include using a knife and fork.[13] In a way, these norms might hinder more conscious finger food eating and are therefore important to acknowledge in order to increase the acceptance of finger food eating among older adults.

Commensality and strategies for proper eating

This study found that eating "with whom" and "where" were factors of great importance for deciding whether to eat with fingers. The participants felt comfortable eating with their fingers together with their spouses, family and close friends, but not in the presence of acquaintances or people they did not know. This is in line with the findings by, among others, Herman et al[29] who found that the presence of other people during a meal can either facilitate or inhibit food intake. This can be understood by the complexity of commensality, i.e., the act of eating together with other people, and regulating social life and individual behavior that signify and create intimacy.[30] Sobal et al[31] found that commensality may include social facilitation, social support or social control, which can have either an encouraging or discouraging effect on healthy food choices. Translated to the context of the present study, the company of family and friends may be supportive and encourage eating with the fingers even though it is not considered proper, while, in contrast, the presence of acquaintances and unknown people may have a discouraging effect on eating with the fingers. Commensality can therefore be both inclusive or exclusive as it creates or sanctions inclusions in a group or community.[30]

In social contexts, people tend to model their intake on that of others in order to behave appropriately because social approval is important and the attitudes of others contribute significantly to the reestablishment of self-identity.[7,32] By negotiating new eating norms that they were able to relate to and manage, the older adults in the present study developed strategies to

maintain proper table manners as much as possible. This was also seen in the study of Medin et al[11] where persons who had suffered a stroke analyzed the consequences of their eating difficulties in order to find strategies for eating both properly and safely despite functional impairments. Moreover, Nyberg et al[1] found that conscious planning of what to eat and when, avoidance of certain foods and beverages, use of simple eating aids and social withdrawal during meals were important strategies to be able to maintain normality and proper eating behavior. Eating with the fingers may be beneficial for older adults with motoric eating difficulties since this may increase autonomy and food intake. However, this study shows the importance of an inclusive and permissive meal environment for persons with motoric eating difficulties that aims to create a comfortable atmosphere that allows eating with fingers. Relatives and professional caregivers of persons with eating difficulties, therefore, play an important role since their attitudes and approval are crucial for the acceptance of older adults by others and for the older persons' own self-acceptance.

Food properties and acceptance

Size, temperature and viscosity were important properties for the older adults' acceptance of foods meant to be eaten with the fingers. Among the older adults and the relatives, there was a normative idea that it was not appropriate to have greasy fingers and therefore it was important to avoid touching the foods with one's fingers. Eating meat with bones with the fingers was perceived as being allowed, however cutlery was needed to eat traditional Swedish dishes such as soups, stews, and meat and potatoes with gravy and lingonberries. Using bread to scoop up and wrap foods or inserting skewers into foods as a handle were considered appropriate strategies to increase the willingness to eat with one's fingers. Moreover, conforming to cultural norms was important when visiting cultures where it was considered more appropriate to eat with the fingers. Overall, most of the foods that the older adults ate with their fingers were of another ethnic origin, for example, pizza, tacos and kebabs.

The importance of the course of the disease

The older adults in the study experienced varying severities of eating difficulties depending on what type of disease they had and how far they were in the course of their disease, which also affected their attitudes and perceptions about and acceptance of eating with their fingers (see Figure 5). Older adults with minor eating difficulties were still able to eat with cutlery and were therefore unable to see the benefits of eating with their fingers.

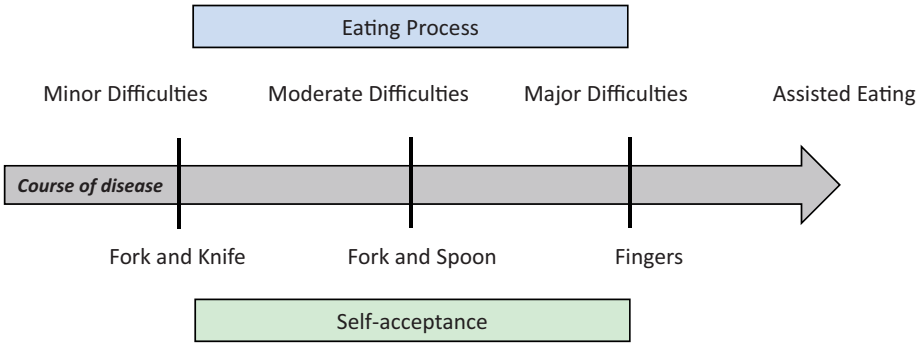

Figure 5. The model shows how the mental process of self-acceptance develops during the progression of disease.

Older adults with moderate eating difficulties were still able to eat with a fork and spoon but they were more open to the idea of eating with their fingers since they had already experienced some deterioration. However, older adults with major eating difficulties were overall positive to eating with their fingers since they were already using their fingers to some extent. This progression was particularly observed among older adults with Parkinson's disease, which might be explained by the fact that Parkinson's disease is progressive, starting with mild symptoms that gradually become more severe over time.[33] This variation in attitudes was also observed among relatives of older adults with Parkinson's disease during the focus groups.

It was evident that older adults with minor to moderate eating difficulties were more sensitive to table manners and behavior at mealtimes and to other people's opinions. Moreover, they preferred not to talk about eating with their fingers as they were not currently experiencing the need to do this. According to Charmaz,[7] chronic diseases may result in stigmatized identities and discretization due to reduced participation in everyday life, but also a loss of self as a result of struggling with a fading former self-image. This might explain why older adults with minor to moderate eating difficulties found talking about eating with their fingers challenging because the need to preserve one's self-identity might be important when the difficulties start to appear. Avoiding eating with strangers and away from the public eye might be a strategy for coping with the emotional burden of the disease and also upholding a façade. This corresponds with the study by Clarke et al[34] which found that some of the participants chose a strategy of taking each day as it comes to avoid stigmatization and maintain their self-image as a "healthy person" for as long as possible. Rejecting the disease as being part of their identity may therefore limit the emotional impact of the disease.[35]

It was shown that older adults with progressive deterioration and major eating difficulties had developed self-acceptance in relation to their

condition over time. According to Oris et al,[36] acceptance is strongly related to adaptive functioning, which may explain why the older adults with major eating difficulties were more comfortable with eating with their fingers. Older adults who have had a stroke may have more difficulty accepting their condition in the initial post-stroke period since a stroke can occur suddenly; however, there is also the possibility for rehabilitation which gives patients hope of recovery after a stroke.[37] In contrast, for patients with Parkinson's disease, the course of the disease can stretch over 20 years with no chance of recovery.[33] It was clear that the need to understand the course of the disease is crucial to be able to understand how older adults with eating difficulties perceive eating in relation to existing eating norms and how this impacts their attitudes to eating with the fingers. According to Nyberg et al,[1] the adjustment process is one of continuous re-adjustment since a person's identity may be challenged as new problems and challenges emerge. The present study also clearly demonstrates that older adults with major eating difficulties unconsciously negotiate, construct and reconstruct new eating norms to be able to obtain a sense of normality and belonging.

Strengths and limitations

The personal narratives of life, disease and eating used in this study have been essential to be able to understand attitudes and perceptions about eating with the fingers among older adults with motoric eating difficulties. Individual interviews were conducted to gain an in-depth understanding of the older adults perceptions and attitudes, and the focus groups enabled study of the contrasting perceptions and attitudes among relatives and professional caregivers that would not have been possible without interaction between the participants.[38] The pictures in the interview guide worked as "triggers" for the discussion but did not limit the participants to the actual dishes in the pictures. Adding photo elicitation to a research study is an alternative to verbal-only methods and helps to capture the perceptions and experiences of the participants.[39] To the best of our knowledge, the topic of this study is relatively unexplored and no previously validated interview guides relevant for the aim of this study were found. We, therefore, created an interview guide specifically designed for the purpose. The interview guide was pilot tested for usability and, since no revisions were made to the interview guide, the results from the pilot focus group were included in the study.

Norms are always culturally situated and need to be understood in a certain social and cultural context. Table manners and attitudes to eating with the fingers might vary to a large extent due to cultural values and learned

norms. However, even though this study takes place in a Swedish context, the norms described in this study build on ideals and etiquette that were formed through the civilizing process that has taken place in western Europe. This also strengthens the arguments for the relevance and applicability of the findings in relation to other western European countries where there are similar food- related cultural values. Importantly, since multiculturality is growing, food and eating behavior and values from other countries are also facilitating changes in manners and etiquette, which means this is an ongoing process of change. Eating with the fingers will, therefore, most likely be more accepted in the future.

Although a larger sample of people with different diagnoses related to eating difficulties might have been preferable, this study provides valuable insights into how the progression of Parkinson's disease impacts perceptions and attitudes about eating with the fingers. This was also important to be able to understand and explain differences in attitudes to eating with the fingers and to identify the "place" for a finger food concept, meaning when and for whom finger foods could be a valuable and acceptable option. The model that was used to classify the participants eating difficulties into minor, moderate and major was a result of the qualitative analysis and based on the participants' own descriptions of their eating situations. The application of this model was relevant for this study; however, it requires further evaluation.

Nonmotor features, such as cognitive decline, are widely accepted as part of the clinical picture of Parkinson's disease that might impact communication abilities.[40] One inclusion criterion for participation in the study was that the older adults were able to communicate in Swedish. However, due to ethical considerations and the fact that their spouses were willing to facilitate the interview, two older adults with Lewy body dementia were included in the study. Due to their slower communication, weak voice and decreased ability to reason, the spouses interpreted and answered the questions on their behalf. The inclusion of persons suffering from cognitive decline in the study may, therefore, have potentially influenced the results. However, since the spouses cared for the participants in their everyday lives, the spouses had valuable knowledge about the participants' attitudes and perceptions about eating with the fingers. If these participants had been excluded, vital information about their perceptions and attitudes about eating with their fingers would have been lost, since they were already eating with their fingers without expressing feelings of shame.

Except for the participants with Lewy body dementia, there were no signs indicating that any of the other participants suffered from cognitive decline. All participants were able to engage in a mutual discussion, recall memories, reason and describe their perceptions. However, the possibility that some of

the participants might have suffered from cognitive decline cannot be ruled out. In this study, we define "motoric eating difficulties" as having difficulties with the manipulation of food on the plate and/or transport of food to the mouth. However, it should be noted that such eating difficulties can be due to cognitive limitations and may or may not be related to motor function.

Conclusion

Although the older adults held normative ideas about proper eating and culinary rules, they still consumed several foods with their fingers regularly without reflecting upon it. Using bread to grip or wrap foods and inserting skewers into foods may increase the acceptability of eating with the fingers. This study also showed that the acceptance of finger foods is related to severity of eating difficulties and that self-acceptance is developed over time in relation to their condition. A positive attitude among relatives and care professionals to eating with the fingers is also crucial for obtaining a sense of normality and belonging for those with eating difficulties. However, more research on the composition, functionality and effect of finger foods among older adults with eating difficulties is needed, and also an evaluation of the potential benefits of such foods for the persons and their health. There is also a need for more knowledge about cultural aspects of eating with the fingers since this may be helpful in understanding the importance of norms and how norms are constructed, understood and shared within cultures. In addition, further research is needed regarding the classification of motoric eating difficulties in relation to the use of cutlery and/or fingers.

Take away points

- Cultural and social norms influence eating behavior among older adults with motoric eating difficulties.
- The paper provides insights about the target groups perceptions of and experiences from eating with the fingers.
- The research findings can be used to develop food, appropriate to eat with the fingers.
- The research findings can contribute with insights on how to improve the meal environment for the target group.
- Improving the meals for the target group may increase autonomy, food intake and quality of life.

Authors' contributions

All authors participated in designing the study and critically reviewing the manuscript during the writing process and the final draft. SF collected,

analyzed and interpreted the data and wrote the draft manuscript. AW, MN supervised the data collection, data analysis and participated in writing the manuscript. KW, WB supervised the study process.

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Paper II

Development of finger foods for Swedish older adults -Sensory preferences and requirements among those with motoric eating difficulties

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Conflict of interest

The authors have no conflicts of interest to disclose.

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Ethical approvement

Ethical approval was received by an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019-01691). The study was performed in accordance with the Helsinki Declaration of Ethical Principles, including informed and written consent.

Popular scientific summary

- A diverse range of flavours, flavour enhancement, a balance between the basic tastes and spiciness may increase the flavour perception.
- The development of finger foods should consider the full range of flavours available to the general older adults' population.
- Fine, soft and smooth textures requiring moderate chewing and easy swallowing are optimal for finger foods.
- Serving meal components separately on the plate is important for the appearance of lunch and dinner.

Abstract

Background: Finger foods that are easy to transport from plate to mouth may increase autonomy and food intake among older adults with motoric eating difficulties. In order to develop optimal finger foods, knowledge about sensory preferences and requirements is needed.

Objective: To assess sensory preferences and requirements among Swedish older adults with motoric eating difficulties and use the findings in the development of finger foods.

Design: Check-all-that-apply (CATA), a methodology that does not require much cognitive effort was used to collect survey data about sensory preferences and requirements for everyday meals from 15 older adults with motoric eating difficulties. The CATA-questionnaire was structured according to the Swedish meal order (breakfast, lunch, dinner, snack and fika) and consisted of 29 attributes compiled through a literature review.

Results: Through both qualitative and quantitative data analysis, it was found that flavourful, flavour intensity, spicy and both Swedish and ethnic flavours were important attributes related to food flavour. Although most participants preferred crispy and coarse textures, a few participants found soft, smooth and fine textures important. Moreover, colourful meals and serving components separated on the plate was important for the appearance of lunch and dinner.

Discussion: A diverse range of flavours, flavour enhancement, a balance between the basic tastes and spiciness may increase the flavour perception. Finger foods should be offered in the full range of flavours available to the general older adults' population. The variation in the demand for texture may be related to chewing and swallowing difficulties, textures that require moderate chewing and easy swallowing are therefore optimal for finger foods. Separating meal components on the plate may make it easier to distinguish the components.

Conclusion: Chemosensory impairments, chewing and swallowing difficulties and visual disturbances are important to consider in the development of finger foods.

Keywords

Motoric eating difficulties; older adults; product development; finger foods; sensory preferences and requirements; Check-all-that-apply; CATA; summative content analysis.

Introduction

Motoric difficulties, such as tremors, rigidity, functional impairments, pain and weakness in the hands and fingers, may influence the autonomy and food intake of older adults negatively since their ability to prepare food, manage cutlery and transport food to the mouth may be reduced (1-3). In a recent study, motoric eating difficulties were found to be the most severe forms of eating difficulties (4). Additionally, older adults with motoric eating difficulties were more likely to have other eating difficulties, such as with chewing and swallowing, and reduced appetite and energy (4). Westergren et al. (5) found that motoric eating difficulties were significantly associated with assisted eating and that 46% of the participants were also either at risk of being malnourished or had suspected or manifest malnutrition (5).

The use of eating aids, such as modified cutlery, sip cups and plates with high edges, is one way to help facilitate independent eating among persons with motoric eating difficulties. Nyberg et al. (6) found that eating aids were valuable for maintaining proper eating behaviour; however, eating aids were not commonly used by the participants. Instead, the participants adopted their own strategies, such as using both hands or a straw when drinking and cutting the food into pieces and eating it with a spoon (6). For older adults with minor or moderate eating difficulties, eating aids, forks and spoons may be helpful when adjusting to new circumstances. However, for those with major eating difficulties, finger foods that are easy to grip and transport from the plate to the mouth may be more ideal (7). Finger foods of high acceptability may also improve dignity in meal situations and, in turn, quality of life for older adults. However, for finger foods to have the desired effect, both nutritional and sensory aspects need to be taken into consideration.

Knowledge about individual preferences (8) and sensory perception (9) has been found to be important when tailoring meals of high acceptability for older adults. Research has shown that

a decline in sensory perception of olfaction and gustation is common among persons with Parkinson's Disease and after a stroke (10-13), but more knowledge is needed about how taste, smell, temperature, colour and texture influence the palatability of foods and food enjoyment among older adults with motoric eating difficulties. However, involving the target population in research can be challenging due to cognitive decline and physiological limitations.

The purpose of this study is to assess sensory preferences and requirements among Swedish older adults with motoric eating difficulties and use the findings in the development of finger foods.

Material and methods

Research design and methodology

A mixed method, convergent design was chosen for this study since both qualitative and quantitative data were needed to answer the research question. A convergent design merges data to gain information about the research problem from multiple angles (14). To facilitate the analysis of the survey data, the qualitative data was used to provide context for the quantitative data (Fig.1). Moreover, a combination of quantitative and qualitative methods was chosen as quantitative data alone requires a large sample size and qualitative data alone does not provide generalizable results.

< Insert Figure 1 about here >

Check-all-that-apply

Check-all-that-apply (CATA) is a consumer-friendly methodology used to obtain rapid product profiles from consumers (15). A CATA-questionnaire with a list of terms is presented where the consumers are able to indicate multiple words or phrases that apply to and describe their experiences of the product or sample being evaluated (16). This can include sensory attributes, hedonic and emotional responses or purchase intentions that the consumers associate with the product or sample (16). However, CATA has been seldom used with older adults (17).

Literature review

A literature review was conducted to gather relevant sensory attributes for the CATA questionnaire. Twenty articles and scientific reports concerning the preferences for and acceptability of food and meals among older adults in a Scandinavian context were assessed; 8 articles (8, 18-24) were included in the review (Table 1).

< Insert Table 1 about here >

Creating word list

Based on the literature review, the sensory attributes were structured in a word list according to appearance, flavour, texture, temperature and odour (Table 2). Sensory attributes of similar nature were grouped together and given a label. In total, 29 attributes were compiled and defined using a comprehensive contemporary Swedish-language encyclopaedia to make the survey as standardised as possible.

< Insert Table 2 about here >

Designing the survey

A survey was created in the software EyeQuestion® (25). The first part of the questionnaire consisted of demographic questions about gender, age, marital status, diagnosis and sensory function. The second part of the questionnaire was structured according to traditional Swedish daily meals, with a section each for breakfast, lunch, dinner, snacks and fika (coffee and cake). Each section started with an open-ended question so that the participants could report their food preferences for each meal, followed by a list of the 29 sensory attributes (CATA terms).

Recruitment and participants

The recruitment was conducted with support from representatives from the Scanian Parkinson coalition and the Network for Eating and Nutrition (NEN) (26). Inclusion criteria required that the older adults were 65 years or older, had some type of motoric eating difficulty and were able to communicate in Swedish and consent or assent to an interview. Nineteen participants gave their consent to participate in the study; however, 3 dropped out and 1 was unable to participate due to health concerns. Thus 15 older adults participated in the study.

Data collection

Data was collected during individual short interviews with the participants in their own homes. The first author asked the questions, documented the participants' meal preferences and checked off the sensory attributes that the participants considered important for each meal. The interviews lasted approximately 10-20 minutes and 6 participants received support from a spouse during the interview.

Data analysis

Descriptive statistics were analysed to describe the sample and the importance of the sensory attributes. Cochran's Q Test was conducted to assess the difference in proportion between related samples. A correspondence analysis was then conducted using CATA counts weighted variables to check for relationships. The data was analysed using IBM SPSS Statistics (Version 26). The level of significance was set to p-value ≤ 0.05 for all statistical analyses.

The answers to the open-ended questions were analysed with inspiration of summative content analysis (27) where the preferred food items/meal components were quantified based on the number of times they were mentioned. These were used to create context.

Ethical considerations

The study was performed in accordance with the Helsinki Declaration of Ethical Principles, including informed and written consent (28). Data was handled according to the guidelines of GDPR (29).

Results

The study was carried out with 15 older adults with eating difficulties (six female, nine male) aged 65-85 years. Nine of the participants were diagnosed with Parkinson's disease, two had atypical Parkinsonism and four had suffered strokes. In addition, ten participants reported that they suffered from decreased sensory functions (Table 3). Four participants lived in a nursing home and 11 participants in their own home.

< Insert Table 3 about here >

Self-reported meal preferences

Breakfast

The participants reported that they ate a substantial breakfast consisting of several types of components. Fourteen participants reported that they ate open sandwiches for breakfast, preferably made with dark and high fibre bread, with toppings such as cheese and ham with tomatoes and cucumber. Ten participants ate yoghurt with cereal and/or berries, 5 ate porridge and 4 ate eggs.

Lunch and dinner

Ten participants reported that they ate cooked, hot meals for lunch, while 5 ate lighter meals consisting of e.g. open sandwiches, omelettes, eggs or porridge. Eight participants ate cooked, warm meals for dinner, while 7 ate lighter meals consisting of e.g. open sandwiches, omelettes, eggs, salad or porridge.

Six participants appreciated a balance between the basic flavours and 6 participants appreciated condiments such as lingonberries or pickled cucumbers and beetroot with their meals. Seven participants wanted a lot of gravy as it made the food moist and easier to swallow. Ten participants reported that they appreciated a variation in texture of the components and 2 participants reported that they needed their meat cut into pieces.

Snack and fika

Snacks consisted of fresh fruit and open sandwiches, while fika was considered to be a cup of coffee with cookies or cake. Cakes and cookies with chocolate and nuts were especially appreciated.

Important sensory attributes

The most important sensory attributes for breakfast were cold, flavourful, crispy, coarse texture, sour, colourful, warm, creamy, juicy and dark colour (Fig. 2). The most important sensory attributes for lunch were warm, cold, flavourful, Swedish flavours, coarse texture, ethnic flavours, flavour intensity, spicy, crispy, colourful, salty, umami, juicy, separated on the plate and intense smell. The most important sensory attributes for dinner were warm, cold, flavourful, flavour intensity, salty, coarse texture, crispy, ethnic flavours, spicy, colourful, umami, Swedish flavours, sour and juicy (Fig. 2). The most important sensory attributes for snacks were cold, sour and sweet, while the most important sensory attributes for fika were sweet, cold and warm (Fig. 2).

< Insert Figure 2 about here >

Differences between meals

Significant differences between the meals for each attribute included in the CATA were identified. The distribution of the responses for light colour, in layers, aromatic, juicy, crispy, soft, firm, smooth and cold were the same for all the meals. However, the remaining attributes differed significantly between the meals (Table 4).

< Insert Table 4 about here >

The correspondence analysis estimated the relationship between the meals and the attributes. The plot shows the first two dimensions (Fig. 3), which capture 81.8% of the variance, and the third dimension which adds 13.8%, in total 96.6% of the variance. Since the remaining

dimensions only account for 4.4%, they are not considered relevant. The correspondence analysis confirms the results from the Cochran's Q Test.

< Insert Figure 3 about here >

Discussion

Sensory preferences and requirements

This study builds on qualitative data complemented with results from quantitative data. Although, the sample population was small, the qualitative findings supported the quantitative and thus the internal validity of the CATA methodology.

Food flavour

Flavourful meals were important for acceptability of breakfast, lunch and dinner by the participants (Fig. 2 and Table 4). Flavourful, in this study was defined as a diverse range of flavours as part of a meal. Hollis and Henry (30) found that older adults consumed significantly more food when they were presented with varied meals rather than a series of identical foods. Meals combined with diverse flavours and meal components may, therefore, stimulate appetite and increase food intake due to sensory-specific satiety being avoided, and promote a more balanced diet.

Flavour intensity was found to be significantly more important for lunch and dinner than for breakfast, snacks and fika (Fig. 2 and Table 4). This may be due to the flavour complexity in more substantial and cooked meals. Several participants reported that a balance between the basic tastes was preferred in cooked meals. According to Klosse et al. (31) flavours are well balanced in palatable foods. Balancing flavours to create a harmonious taste may therefore enhance the overall flavour intensity. In Sweden, savoury dishes are traditionally balanced with pickled sour-sweet condiments and lingonberries, although the specific condiment combinations will differ in other cultural contexts.

A majority of the participants experienced chemosensory losses and may therefore perceive flavours less intense. This may explain why flavour intensity and spicy were considered important. A decline in sensory functions including the chemical senses is frequently

occurring in older age (32-34) and may include losses in sensitivity to taste, olfactory and trigeminal stimuli (35, 36) and low recognition of salty, bitter, sour, and umami tastes among older adults compared with young adults (37). Yet, normal and gradual sensory losses do not cause a reduced food liking in older adults, as they continuously adjust to their diminished perception (38). Moreover, Broge et al. (39) showed that despite the decline in intensity perception for everyday food odours, the liking for the food odours, especially the savoury food odours, largely remained intact. However, nine participants in this study were diagnosed with Parkinson's disease, a degenerative disease with severe sensory disturbances (40) where olfactory impairment is a part of the clinical diagnosis (41). Flavour enhancement and aromas may therefore improve the palatability of meals for this group. Moreover, spicy food may have a positive impact on flavour perception, evoking activation of the trigeminus nerve, giving feelings of warmth, coolness and irritation (42). However, control over the spiciness needs attention as high levels of activation leads to pain sensation (43).

Both Swedish flavours associated with cooked warm meals and traditional ingredients and spices, and ethnic flavours associated with ingredients, spices and foods from cuisines around the world were appreciated for lunch and dinner (Fig. 2 and Table 4). Previous studies have found that Swedish older adults prefer home-cooked and traditional dishes, and familiar spices that they had in their childhood (8, 24, 44). Also, Hall (45) found that eating habits among Swedish older adults had not changed much in older age. However, some studies indicate that dietary patterns among Swedish older adults have changed over the years (46). For example, Swedish 70-year-olds food patterns correspond to Mediterranean dietary patterns (46), and convenience foods, such as pizza, hamburgers, kebabs, tacos and hot dogs from international cuisines, were enjoyed and frequently eaten by adults with motoric eating difficulties aged 65 years and older (7). Since older adults with motoric difficulties appear to

have similar meal preferences, the development of finger foods should consider the full range of flavours available to the general older adult population.

The distribution of responses for snack and fika were similar (Fig. 2) and the participants considered these meals to be more or less the same. However, some differences appeared. Cold, sour and sweet were the most important sensory attributes for snacks, while sweet, cold and warm were most important for fika (Table 4). Snacks consisted mainly of fruits and sandwiches, while fika consisted of coffee and something sweet.

Texture

A majority of the participants appreciated variations in texture. According to Klosse et al. (31) contrast in mouthfeel, a combination of crispy and crunchy together with juicy, creamy and moist, is crucial for the palatability of foods. Although, a hard texture was not appreciated, most participants preferred crispy and coarse textures over smooth and fine textures (Fig. 2 and Table 4). This indicates that the majority of the participants did not have chewing and swallowing difficulties, and that regular foods with a variety of textures is optimal for this group. However, a few participants found soft, smooth and fine textures important, which indicates a variability in texture perception among older adults with motoric eating difficulties that is important to acknowledge (Fig. 2 and Table 4).

According to Westergren and Melgaard (4) older adults with motoric eating difficulties are more likely to have other eating difficulties, such as with chewing and swallowing. Chewing and swallowing difficulties are common conditions after a stroke (1, 2, 47) and in the later stages of Parkinson's disease (48). For persons with atypical Parkinsonism, deglutition can be severely impaired even during early stages of the disease (48, 49). Two of the participants in the study suffered from atypical Parkinsonism, which may explain the variation in texture perception. According to the study by Authors (7) older adults with minor and moderate motoric eating difficulties were still able to eat with cutlery or spoon and/or fork, while eating

with the fingers were more common and acceptable among older adults with major motoric eating difficulties. Since chewing and swallowing difficulties are common in this population group, fine, soft and smooth textures that require moderate chewing and is safe to swallow are optimal for finger foods.

Appearance

Colourful was found to be a significantly more important attribute for breakfast, lunch and dinner than for snacks and fika (Fig. 2 and Table 4). The participants appreciated colourful presentations such as sandwiches decorated with vegetables, and yoghurt and porridge served with berries. This corresponds to several studies, for example Mahadevan et al. (50), which found that a variety of colours and garnishes were important for acceptability by older adults. Also, visual arrangements of minor food components like toppings have been shown to stimulate appetite in elderly (51). Moreover, colour has a profound effect on taste perception and plays a critical role in food acceptance (52); serving vegetables in a variety of colours may have a positive effect on food intake.

Serving meals where the components are placed separately on the plate was also found to be significantly most important for the appearance of lunches and also highly important for dinners (Fig. 2 and Table 4). This corresponds to previous studies by Höglund et al. (21) and Hall and Wendin (19). Separating the components on the plate makes it easier to distinguish the meal components (19). This may be particularly important for those with Parkinson's disease since the disease is associated with visual symptoms such as poor acuity, especially at low contrast and vision blurred for colour stimuli (53).

Strengths and limitations

Recruitment

Although the recruitment process was supported by the Scanian Parkinson coalition and NEN, only 15 older adults completed the survey. However, the sample population for this study is hard to reach due to disease and functional impairments. Six participants suffered from decreased cognitive ability but were able to adequately participate in the study with the support of spouses. Including these participants was a strength since the voices of the target group cannot be complemented with other older adult populations.

According to Berkman et al. (54), including family members and other caregivers as proxies may help to obtain the perceptions and experiences of older adults, although the use of proxy respondents may also affect the validity of the study (55). However, since the spouses cared for and assisted them in their everyday lives and during meals, they had knowledge about their sensory preferences and requirements. The answers given by the participants who were supported by their spouses should, therefore, be considered reliable.

Recruiting other older adult populations in order to increase the sample size was not an option since the result would not be representative of older adults with motoric eating difficulties. However, there is a risk that participants suffering from minor and moderate eating difficulties may not be representative for the target group in need of finger foods. That would explain the variability in demand for found in this study. Further studies with older adults with major motoric eating difficulties are therefore needed.

CATA

This study showed that CATA is an easy method to apply in research with older adults as it does not require as much cognitive effort. In this study, the attributes were not focused on specific products but rather on sensory preferences and requirements of foods eaten at every

meal during the day (breakfast, lunch, dinner, snack and fika). This approach has not been used previously for CATA. One limitation is that the foods eaten at every meal differ between people and it can be difficult to apply the sensory attributes to specific food items. To facilitate this, it was important to obtain information about food preferences and eating patterns for all meals, to be able to put the sensory attributes into a context. Summative content analysis was used to create context for the analysis, and by counting meal components a clear picture of the foods eaten at every meal was obtained. The food preferences and food habits reported in this study corresponded with previous research about Swedish eating patterns (45, 56, 57). To assure loss of information, the participants were also able to add or expand their views of the attributes in the open comments sections. This is a strength.

Another limitation is the binary response format as it does not allow measurement of the intensity of the attributes (58). Applying intensity measurements, such as Rate-All-That-Apply (59) may have offered more insights into differences between lunch and dinner, which were generally similar. However, the use of intensity scales was considered too advanced for the sample population since cognitive decline is common among older adults with diseases such as Parkinson's disease.

There are several studies reporting the food preferences and food choices of older adults, but with no details of the specific sensory preferences and requirements of older adults with motoric eating difficulties. Knowledge about sensory preferences and requirements is vital to be able to develop attractive finger foods that older adults are willing to eat. Despite the small sample size, this study offers an opportunity to apply statistics that can guide the development of finger foods which cannot be achieved by qualitative data collection alone.

Conclusions

This study found that a diverse range of flavours, flavour enhancement, a balance between the basic tastes and spiciness may increase the flavour perception, stimulate appetite and promote a more balanced diet among older adults with motoric eating difficulties. The development of finger foods should also consider the full range of flavours available to the general older adults' population. This study also found a variability in texture perception that may be related to chewing and swallowing difficulties occurring in advanced stages of Parkinson's disease and atypical Parkinsonism. Since finger foods may be more acceptable and beneficial for this population, fine, soft and smooth textures that require moderate chewing and easy swallowing are optimal. Finally, serving meal components separately on the plate may be important for lunch and dinner as it makes it easier to distinguish the components for those with visual symptoms. However, more research focusing on older adults with major eating difficulties are needed.

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Tables and figures

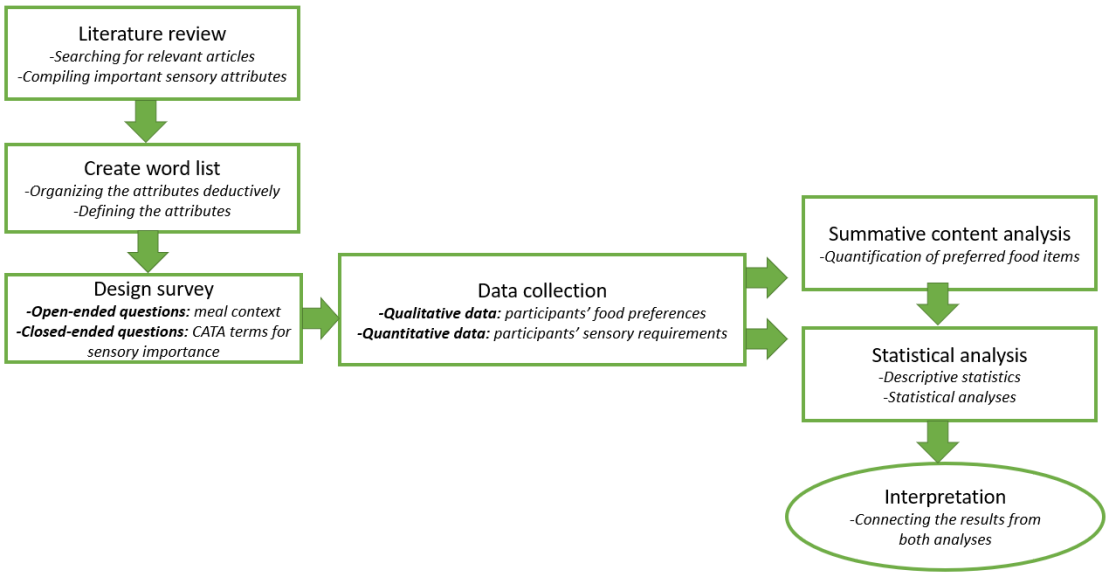

Fig. 1 Overview of the planning, data collection and data analysis of the study

Table 1 Overview of the literature review and collected sensory attributes.

Author and year	**Sensory attributes**
Forslin (17)	• Appetising appearance • Optimal texture • Chewiness • Hard • Soft • Warm food • Aromatic odours • Tasty • Crispy • Distinct flavours
Hall and Wendin (18)	• Particle size • Fatty • Juicy • Creamy • Smooth • Intense taste and flavour • Firm • Soft • Coarse texture • Appetising appearance • Tasty
Giacalone et al. (19)	• Overall taste and flavour • Cold foods • Saltiness • Sweetness • Odour intensity • Variation of flavours • Tasty
Höglund et al. (20)	• Colourful appearance • Served separately on the plate • Well-seasoned • Flavour intensity • Optimal sauce consistency • Visible components • Tasty
Armanyarahmadi and Wendin (21)	• Spicy food • Flavour • Texture • Well-seasoned • New flavours

	• Warm food
Okkels et al. (22)	• Texture: minced and moist and puréed • Temperature: warm, cold and frozen • Appearance: in layers-sprinkled • Basic tastes: sweet, sour and salty • Colourful: different colours • Several flavours
Edfors and Westergren (8)	• Appealing appearance • Not spicy • Well-known traditional flavours (Swedish) • Modern and unfamiliar flavours (ethnic flavours) • Texture: properly cooked • Flavourful • Chewy
Nordlander et al. (23)	• Culturally adapted food (Swedish) • Tasty/tasteful • Savoury foods • Colourful • Well-seasoned • Carefully salted • Too spicy • Too sour • Unbalanced • Tasteless • Sprinkled with herbs • Too hard • Unappetising appearance • Overcooked • Familiar

Table 2 Overview of the sensory attributes used in the CATA-questionnaire.

Appearance:	**Flavour:**	**Texture:**	**Temperature:**	**Odour:**
Light colour	Flavour intensity	Fatty	Cold	Intense smell
Dark colour	Flavourful	Juicy	Warm	Aromatic
Colourful	Umami	Creamy		
In layers	Sweet	Crispy		
Mixed on the plate	Salty	Hard		
Separated on the plate	Sour	Soft		
	Swedish flavours	Firm		
	Ethnic flavours	Smooth		
	Spicy	Fine texture		
		Coarse texture		

Table 3 Overview of the demographics of the participants, frequency (F) and percentages (%).

N=15	**[F]**	**[%]**
Gender		
Female	6	40
Male	9	60
Age		
81-85 years	3	20
76-80 years	5	33
71-75 years	4	27
65-70 years	3	20
Marital status		
Single	3	20
Married/ Domestic partnership	7	46
Widowed	4	26
Live-apart partnership	1	7
Accommodation		
Nursing home	4	73
Ordinary home	11	27
Diagnosis		
Parkinson's Disease	9	73
Stroke	4	26
Atypical Parkinsonism	2	1
Sensory function		
Yes, decreased sense of taste	3	20
Yes, decreased sense of smell	4	27
Yes, both decreased sense of taste and smell	3	20
No, neither	5	33

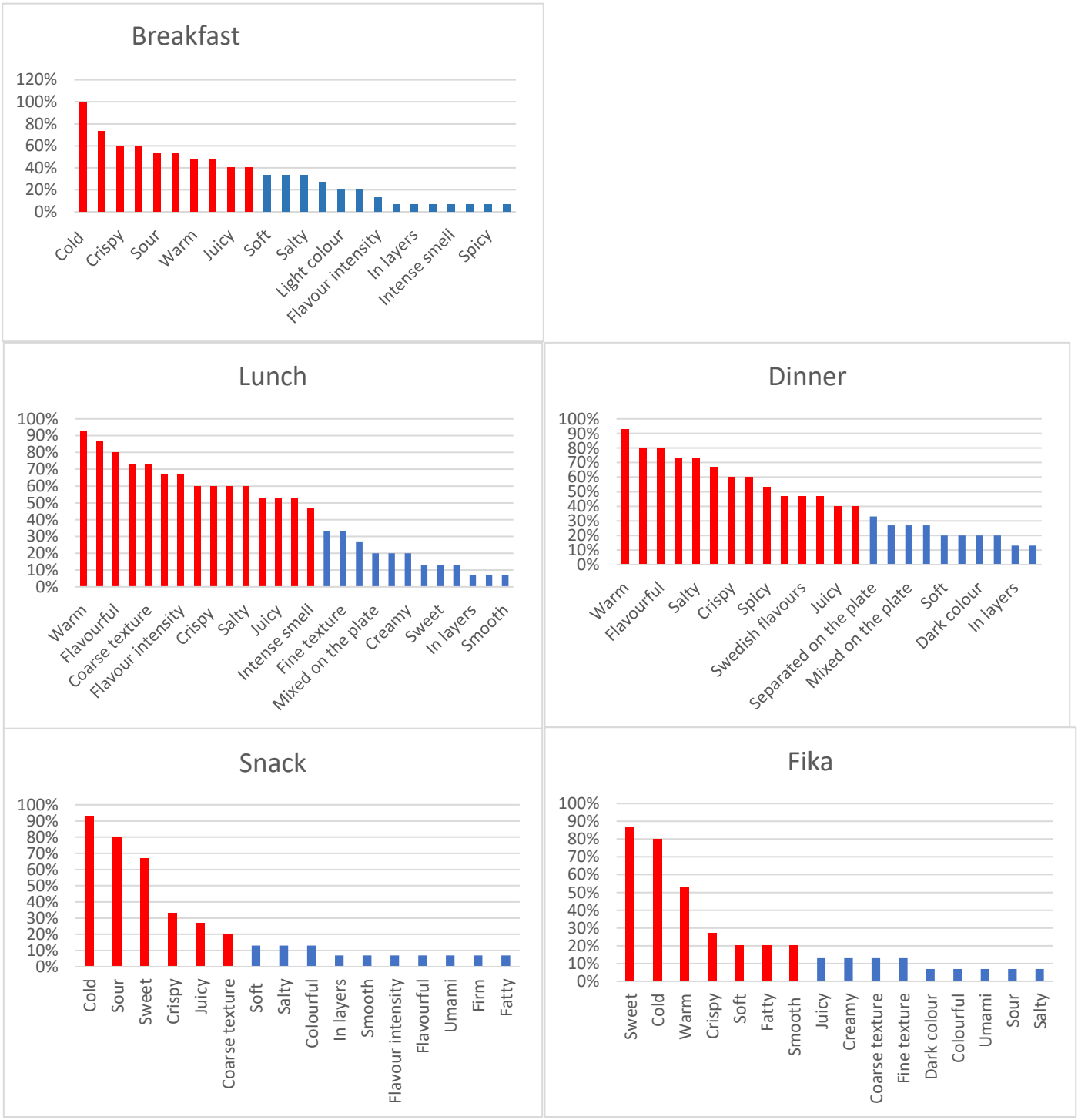

Fig. 2 An overview of the important sensory attributes for all the meals. Most important attributes for breakfast, lunch and dinner, range 100-40% in subsequent order (marked in red); less important attributes, range 39%-1% (marked in blue). For snacks and fika. Most important attributes, range 100-20% in subsequent order (marked in red); less important attributes, range 19%-1% (marked in blue).

Table 4. Overview of the frequencies [F] of the attributes in breakfast (B), lunch (L), dinner (D), snacks (S) and fika (F)

Sensory properties	[F]B	[F]L	[F]D	[F]S	[F]F
Light colour	3	1	3	0	0
Dark colour	6^{a}	3^{abc}	3^{abc}	0^{bc}	1^{c}
Colourful	8^{a}	9^{a}	7^{a}	2^{b}	1^{b}
In layers	1	1	2	1	0
Mixed on the plate	1^{ad}	3^{bd}	4^{b}	0^{ac}	0^{ac}
Separated on the plate	0^{a}	8^{bc}	5d^{e}	0^{a}	0^{a}
Intense smell	1^{a}	7^{b}	3^{a}	0^{a}	0^{a}
Aromatic	0	2	0	0	0
Flavour intensity	2^{a}	10^{b}	11^{b}	1^{a}	0^{a}
Flavourful	11^{a}	12^{a}	12^{a}	1^{b}	0^{b}
Umami	1^{a}	8^{b}	7^{b}	1^{a}	1^{a}
Sweet	5^{ad}	2^{ac}	4^{ac}	10^{d}	13^{b}
Salty	5^{ac}	9^{c}	11^{b}	2^{a}	1^{a}
Sour	8^{ab}	5^{b}	6^{b}	12^{ac}	1^{d}
Swedish flavours	0^{a}	11^{b}	7^{b}	0^{a}	0^{a}
Ethnic flavours	1^{a}	10^{b}	9^{b}	0^{a}	0^{a}
Spicy	1^{a}	9^{b}	8^{a}	0^{a}	0^{a}
Fatty	0^{a}	0^{a}	0^{a}	1^{a}	3^{b}
Juicy	6	8	6	4	2
Creamy	7^{a}	3^{b}	0^{b}	0^{b}	2^{b}
Crispy	9	9	9	5	4
Hard	0	0	0	0	0
Soft	5	2	3	2	3
Firm	3	4	2	1	0
Smooth	1	1	0	1	3
Fine texture	4^{a}	5^{a}	4^{a}	0^{b}	2^{a}

Coarse texture	9[a]	11[a]	10[a]	3[b]	2[b]
Cold	15	13	12	14	12
Warm	7[ab]	14[c]	14[c]	2[d]	8[a]

Significant differences are indicated by different letters.

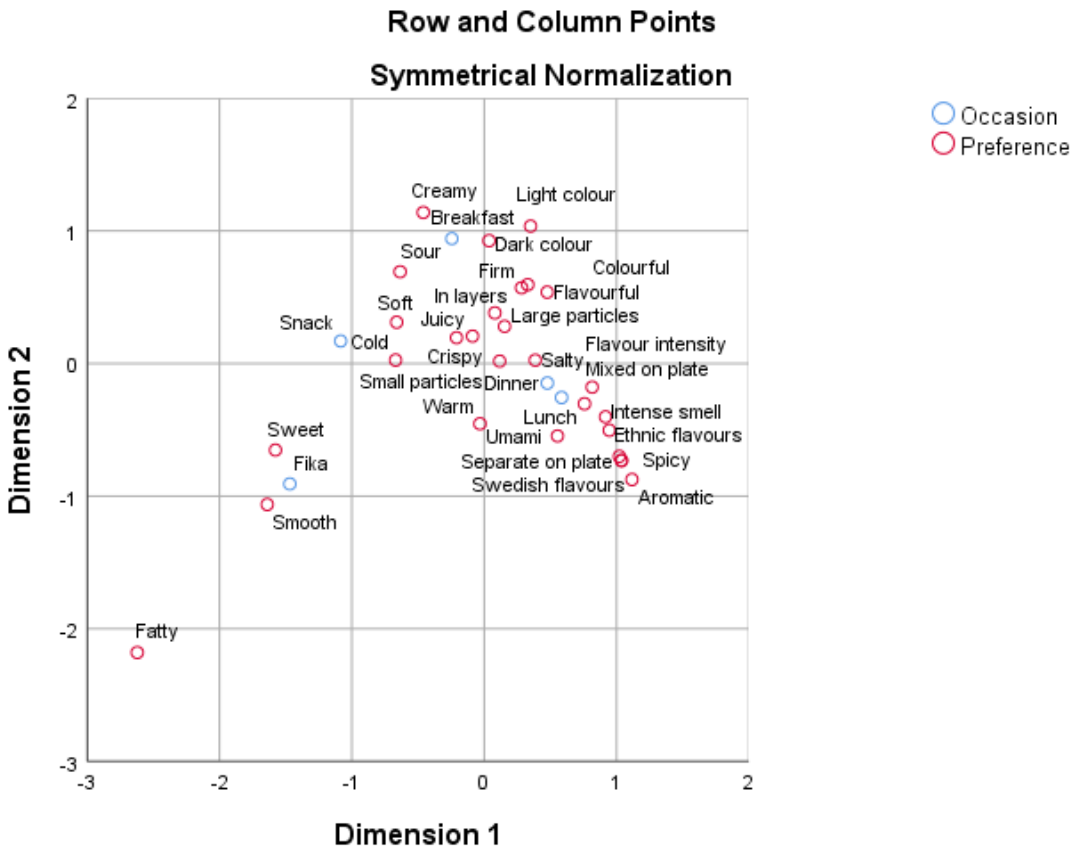

Figure 3. The variance explained by dimensions 1 and 2, accounting for 81.1% of the variance.

Paper III

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Proposal of development of finger foods for older adults with motoric eating difficulties -a study based on creative design

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ABSTRACT

The purpose of this study was to develop and evaluate finger food components as part of a complete meal for older adults with major motoric eating difficulties. Overall, the evaluation of sensory characteristics as well as texture analysis forms a valuable basis for further development of a meal that can be eaten without cutlery, comprising flatbread, beef rolls and brown sauce. The nutritionally enriched flatbreads were generally perceived as neutral in odour and flavour, while higher concentrations of protein and fat influenced the texture negatively. Although bread was not commonly eaten with a meal, the consumer evaluation stressed the importance of texture of flatbreads intended for wrapping. Differences between meat cuts were not pronounced; however, beef rolls made from inner thigh were perceived as more tender and crumblier than beef rolls made from outer thigh. Moreover, the odour and flavour intensity were thought to be higher in beef rolls braised in rolls due to the caramelised surface. However, tenderness was considered the most important parameter for beef rolls whereas crumbliness and dryness in tender meat can be compensated for by serving the meat with sauce. In fact, sauce was found to play an important role in a well-accepted meal. The addition of sweet, sour, or bitter tastes to brown sauces, to investigate the effect of basic tastes, reduced the perceived intensity of the original flavour profile of the brown sauces. Finally, combinations of the developed meal components could be investigated further to create attractive finger food meals for those unable to eat with knife and fork.

1. Introduction

Older adults with motoric eating difficulties suffer from impairments like tremors, rigidity, pain and weakness in hands and fingers that may influence their autonomy during food intake and thereby have a negative impact on nutritional status (Jacobsson et al., 2000; Westergren et al., 2001, 2016). Finger foods, specifically prepared for eating with the fingers, and easy to grip and transport from plate to mouth, may be beneficial for this group (Forsberg et al., 2022a). Several studies have shown that finger foods have a positive influence on food intake primarily among persons with dementia (Soltesz and Dayton, 1995; Cluskey and Kim, 2001; Pouyet et al., 2014; Murphy et al., 2017). However, the practice implications of the finger food concept, in terms of recipes and products, is sparsely represented in the literature.

This study aims to develop a complete finger food meal that can be served for lunch and dinner. For the meal to be successfully accepted in the target group, several aspects, including composition, functionality, sensory and nutritional factors, should be considered. Concerning composition and functionality, the foods should be tailored with regard to, manoeuvrability, texture and serving temperature. Forsberg et al. (2022a) found that low viscosity sauces, multiple layers and toppings should be avoided. Food items that require one to three bites were considered optimal for manoeuvrability and to prevent messy eating. Bread to wrap and scoop up food with was seen as a strategy to increase the acceptability of finger foods (Forsberg et al., 2022a). Finger foods should further be served at temperatures allowing them to be handled without burning the fingers.

The study by Forsberg et al. (2022b) showed that food flavour and texture were important parameters to consider in the development of finger foods. This included enhancing the food flavour by combining

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diverse flavours, high flavour intensity and a balanced blend of the basic tastes for lunch and dinner. Fine, soft, and smooth textures that require moderate chewing and is safe to swallow were primarily advocated by persons with major eating difficulties (Forsberg et al., 2022b).

Lastly, finger foods must meet nutritional requirements. Since previous studies have shown that major motoric eating difficulties were common among persons with progressed Parkinson's disease (Forsberg et al., 2022a), consideration of protein and energy intakes, and prevention of constipation should be integral to the development of finger foods (Gątarek and Kałużna-Czaplińska, 2021). Protein-enriched foods have been stressed due to their role in contributing to quality of life and independent living in older populations (van der Zanden et al., 2014). Enriching the diet with dietary fibre can reduce constipation, improve wellbeing and reduce laxative use (Sturzel and Elmadfa, 2008). Based on this, incorporating protein and fibres were considered important targets in the development of a complete finger food meal. Further, such a complete meal should comprise traditional flavours and components, meat, potatoes, vegetables and gravy. Through creative design scientific and practical knowledge can be combined in order to obtain a deeper understanding of the needs and preferences in regard to the sensory characteristics of an appropriate finger food meal.

The overall aim of this study was to develop and evaluate finger food components as part of a complete meal for older adults with motoric eating difficulties. The specific objectives were to evaluate the sensory quality and the end-user acceptability of the three selected finger food components; flatbreads, beef rolls and brown sauces.

2. Material and methods

2.1. Research design

This study is inspired by creative design (Naes and Nyvold, 2004), comprising three stages of development: 1) *Experimental cooking*, 2) *Sensory evaluation* and 3) *End-user acceptability*. The technique combines well-established experimental design with creativity and food knowledge; the experimental design ensures that the concept is properly spanned, focusing the design on the attributes rather than ingredients and process conditions (Naes and Nyvold, 2004).

2.2. Experimental cooking

The development was focused on a complete hot meal that can be served for lunch or dinner. According to preferences of Swedish consumers, a complete hot meal comprises a main component e.g., meat, fish and vegetables, staples e.g., potatoes, rice, pasta, bread and trimmings like gravy and condiments (Forsberg et al., 2022b; Mäkelä et al., 2001). A previous study by Forsberg et al. (2022a) showed that this type of dishes was especially challenging to transform into well accepted finger foods. Based on this, three components with promising functional and nutritional properties were selected: flatbreads, beef rolls and brown sauce.

Bread was considered appropriate to add to any dish to increase acceptance of eating with the fingers (Forsberg et al., 2022a). In addition, flatbreads can be fortified with proteins and fat and used to wrap and scoop up food with. Beef rolls comply with cultural preferences and can be stuffed with energy rich and flavourful ingredients such as cheese and vegetables. Red meat is potent in terms of stimulating muscle protein synthesis among older adults (Gorissen and Witard, 2018). Brown sauces can be fortified with prebiotics and energy, and the flavour profile is easily enhanced. Thus, the experimental cooking trials were then planned and conducted for each component respectively.

2.2.1. Flatbreads

Several flatbread recipes were baked and tested, and the recipe resulting in desired characteristics was chosen as the base recipe for the experimental design (Table 1). This base recipe contained 6.3% protein, 5.2% fat and 43% carbohydrate.

Table 1
Flatbread base recipe.

Ingredients:	Manufacturer:	Amount (g):
Wheat flour	Kungsörnen, Sweden	132.3
Graham flour	Kungsörnen, Sweden	29.5
Sugar	Dansukker, Denmark	7.75
Salt	Falksalt, Sverige	1.80
Ammonium carbonate	Santa Maria, Sweden	0.6
Fresh yeast	Kronjäst, Sweden	1.05
Milk (3%)	Skånemejerier, Sweden	108
Butter and rapeseed oil	Arla, Sweden	11.25
Total weight		**292.25**

After mixing, the dough was left to rest for 1 h before it was rolled out as thinly as possible (3–4 mm) and baked in a non-stick pan until both sides were browned (induction heat 5–6). After the flatbreads were baked, they were brushed on both sides with water and wrapped in a towel.

The flatbread base recipe was used in the development of 20 samples of protein and fat enriched flatbreads (see Table 2, Fig. 1). The aim was to enrich the flatbreads with 10% and 15% protein and 11.25 g and 33.75 g fat. Various amounts of protein powder were added to the flatbread base recipe (Table 2). The protein used was soy protein isolate (SPI) containing 84.1% protein (Star Nutrition, Sweden) and whey protein concentrate (WPC) containing 71.9% protein (SmartSupps, United Kingdom). Whey and soy proteins are commonly used in many ingredient applications for their functional and nutritional benefits (Madenci and Bilgiçli, 2014; Russell et al., 2006). Both types of protein

Table 2
Design parameters, the total protein and fat content of the fortified flatbreads.

Flatbreads	Total protein powder added (g)	WPC (g)	SPI (g)	Fat (g)
Low Protein (10%) Low Fat				
100% SPI	29.22	0	29.22	11.25
75% SPI 25% WPC	29.22	7.31	21.91	11.25
50% SPI 50% WPC	29.22	14.61	14.61	11.25
25% SPI 75% WPC	29.22	21.91	7.31	11.25
100% WPC	29.22	29.22	0	11.25
High Protein (15%) High Fat				
100% SPI	47.21	0	47.21	33.75
75% SPI 25% WPC	47.21	11.80	35.41	33.75
50% SPI 50% WPC	47.21	23.60	21.92	33.75
25% SPI 75% WPC	47.21	23.60	11.80	33.75
100% WPC	47.21	47.21	0	33.75
Low Protein (10%) High Fat				
100% SPI	31.47	0	31.47	33.75
75% SPI 25% WPC	31.47	7.87	23.60	33.75
50% SPI 50% WPC	31.47	15.73	15.73	33.75
25% SPI 75% WPC	31.47	23.60	7.87	33.75
100% WPC	31.47	31.47	0	33.75
High protein (15%) Low Fat				
100% SPI	43.84	0	43.84	11.25
75% SPI 25% WPC	43.84	10.96	32.88	11.25
50% SPI 50% WPC	43.84	21.92	21.92	11.25
25% SPI 75% WPC	43.84	32.88	10.96	11.25
100% WPC	43.84	473.84	0	11.25

SPI = soy protein isolate.
WPC= Whey protein concentrate.

Fig. 1. Flatbreads baked according to the design. *Upper row from left to right:* shows the low protein flatbreads (10%) comprising soy 100%, soy 75%/whey 25%, soy 50%/whey 50%, soy 25%/whey 75%, whey 100%. *Lower row from left to right:* shows the high protein flatbreads (15%) comprising soy 100%, soy 75%/whey 25%, soy 50%/whey 50%, soy 25%/whey 75%, whey 100%.

contain high amounts of essential amino acids that complement those present in cereals and are therefore of interest for adding nutritional value to bread. In order to increase the overall energy content, the flatbread base recipe contained 11.25 g of fat, corresponding to the low fat samples. To obtain high fat samples comprising 33.75 g of fat, 22.5 g of fat was added to the flatbread base recipe.

The fat was a mixture (80%) of butter (8%) and rapeseed oil (67%) (Arla, Sweden).

After baking, the flatbreads were stored in a freezer at −20 °C and thawed at room temperature for 5 h prior to sensory evaluation.

2.2.2. Beef rolls

Several cooking trials were conducted to assess the effects on beef rolls of meat cut, cooking techniques, cooking and core temperatures. Based on the trials, two experimental designs were developed, with a total of 16 beef roll samples (8 + 8) (Table 3). The meat cuts selected were, inner and outer thigh (*m. semimembranosus* and *m. biceps femoris*) of beef (breeder in Southern Sweden). When deciding which meat cuts to work with, inner and outer thigh were chosen as both are commonly used for beef rolls, are affordable and have good qualities for braising. Further this type of meat cut representing a more pronounced flavour and somewhat coarser texture are well accepted and suitable for beef rolls.

Table 3
The design parameters for the beef rolls.

Design 1	Meat cut	Cooking time (h])	Slice thickness (mm)
	m. biceps femoris	2	2
	m. biceps femoris	2	5
	m. biceps femoris	3	2
	m. biceps femoris	3	5
	m. semimembranosus	2	2
	m. semimembranosus	2	5
	m. semimembranosus	3	2
	m. semimembranosus	3	5
Design 2	**Meat cut**	**Inner core temperature (°C)**	**Slice thickness (mm)**
	m. biceps femoris	70	2
	m. biceps femoris	70	5
	m. biceps femoris	90	2
	m. biceps femoris	90	5
	m. semimembranosus	70	2
	m. semimembranosus	70	5
	m. semimembranosus	90	2
	m. semimembranosus	90	5

The beef rolls in the first design were made of 500-g and braised in whole pieces (BWP) (Table 3, Fig. 2) (inner and outer thigh from the same animal) that were browned in rapeseed oil (Martin&Servera, Sweden) and then braised in beef broth (Bong, Sweden) in a convection oven at 100 °C for 2 and 3 h respectively. The meat was then chilled before being sliced, rolled up and pinned with a toothpick. The beef in the second design was partially thawed and sliced raw, rolled up and pinned with a toothpick to be braised in rolls (BIR) (Table 3, Fig. 2). The rolls were browned in rapeseed oil and braised in beef broth at 100 °C in a convection oven until reaching an inner core temperature of 70 °C and 90 °C respectively.

All beef roll samples were prepared the day before the sensory evaluation and stored in the fridge overnight. The samples were heated to 60 °C, 15 min before the sensory evaluation.

2.2.3. Brown sauces

A mayonnaise base with crème fraiche and enriched with beta-glucans and inulin was used in the development of brown sauces (Table 4). Beta glucans and oligosaccharides such as galactose, fructose, lactulose and inulin are fermentable compounds that act as substrate for the intrinsic probiotic microflora and encourage their growth in the intestine (prebiotics) (Hamilton-Miller, 2004) affecting intestinal peristalsis favourably. The inulin was mixed with heated water to 50 °C and the beta-glucans were mixed with water heated to 90 °C before being added to the mayonnaise base. Thereafter, a brown sauce was developed by adding beef and red wine broth, and caramel colouring to the mayonnaise base (Table 4, Fig. 3). Using this brown sauce, 10 flavoured samples were made by adding ingredients to obtain the basic tastes: sweet, umami, salty, sour and bitter, in high and low concentrations (Table 4). The sauce samples were prepared the day before and stored in the fridge until 15 min before the sensory evaluation.

2.3. Sensory evaluation

Sensory profiles of the finger food components were established using consensus profiling (ISO, 2016) by using intensity scale from 0 to 100 cm, where the extreme samples were used as anchor points. An

Fig. 2. Beef rolls baked according to the design, 1) braised in a whole piece and sliced and rolled afterwards (left) and 2) sliced and rolled raw and braised in rolls (right).

Table 4
The recipe and ingredients of the mayonnaise sauce base, the brown sauce and the sauces flavoured with the basic tastes in high and low concentrations (the design parameters used for the brown sauces).

Ingredients	One batch mayonnaise sauce base	
	Manufacturer	Amount (g)
Whole egg powder	Källbergs, Sweden	45
Water	–	50
Dijon mustard	Grey Poupon, France	45
Vinegar	Zeta, Sweden	22.5
Rapeseed oil	Martin&Severa, Sweden	500
Salt	Falk, Sweden	1.5
Inulin	Cosucra Groupe Warcoing s.a, Belgium	30 g mixed with 30 g water 50 °C
Beta-glucans	Lyckeby, Sweden	6 g mixed with 24 g of water 90 °C
Crème fraiche	Skånemejerier, Sweden	250 g
Brown sauces:	***One batch of brown sauce***	
Ingredients		**Amount (g)**
Mayonnaise sauce base	–	One batch
Beef and red wine broth	Bong, Sweden	60
Caramel colour	Druvan, Sweden	5
Flavoured brown sauces:	***Recipes for 100 g sauce***	
Basic tastes:	**Ingredients and manufacturer**	**Amount (g)**
Sweet high	Apple juice concentrate (ICA, Sweden) Acacia honey (ICA, Sweden)	15 5
Sweet low	Apple juice concentrate (ICA, Sweden)	15
Umami high	Mushroom broth (Bong, Sweden)	10
Umami low	Mushroom broth (Bong Sweden)	7
Salty high	Salted capers fluid (Paradiso, Spain)	20
Salty low	Salted capers fluid (Paradiso, Spain)	10
Sour high	Fresh lime juice (ICA, Sweden)	17
Sour low	Fresh lime juice (ICA, Sweden)	7.5
Bitter high	Rosemary extract (Kalsec, USA)	2
Bitter low	Rosemary extract (Kalsec, USA)	1

Fig. 3. The original brown sauce used in the study. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

analytical sensory panel of 5–6 assessors with a minimum experience of two years was selected and trained according to the ISO standard 8586–2:2008 (ISO, 2012). The assessors participated voluntarily and written informed consent was obtained.

The evaluation was conducted over 2–3 days, depending on the product, and each session lasted 3 h. The first day included generation of attributes (appearance, odour, flavour and texture) to describe the products. The generation of attributes and training were conducted using samples that represented extremes for flatbreads and beef rolls, while the focus for the sauces was on attributes related to flavour and texture and started with assessing the original sauce. The panellists discussed the attributes and selected which should be included in the evaluation, defined them, and trained in how to use the intensity scale. The second and third days of the evaluation involved assessing approximately 10 samples a day. Water and neutral wafers were used to cleanse the palate and neutralise the senses.

2.3.1. *Flatbreads*

Thirteen descriptors were selected for the sensory evaluation of flatbreads (Table 5).

2.3.2. *Beef rolls*

Ten descriptors were selected for the sensory evaluation of beef rolls

Table 5
Attributes and definitions selected for the sensory evaluation of flatbreads.

Sensory modalities	Attributes	Definitions
Appearance	Brown areas	Effect of Maillard reaction on the bread surface
Appearance	Sticky	Unbaked or damp core
Appearance	Compact	Airy or compact cut surface
Odour	Wheat flour	Cooked or wet wheat flour
Odour	Pancake	Cold pancake
Odour	Roasted	Effect of Maillard reaction on aroma
Flavour	Pancake	Cold pancake
Taste	Sweetness	Basic taste sweet
Flavour	Wheat flour	Cooked or wet wheat flour
Texture	Springy	Flexibility
Texture	Dry	Stale bread
Texture	Compact	Mouthfeel: density while chewing
Texture	Gritty	Mouthfeel: grittiness

Table 6
Attributes and definitions selected for the sensory evaluation of beef rolls.

Sensory modalities	Attributes	Definitions
Odour	Cooked beef	Odour of cooked beef
Odour	Fried beef	Odour of fried beef
Appearance	Fibre	Visibility of muscle structure
Appearance	Collagen and fat	Amounts of visible collagen and fat
Flavour	Metallic	Iron flavour
Taste	Sourness	Basic taste sour
Taste	Umami	Basic taste monosodium glutamate (MSG)/ umami
Texture	Juicy	The amount of juices retained in the meat
Texture	Tenderness	Softness and easiness chewing
Texture	Crumbly	Mouthfeel: small fragments released during chewing

(Table 6).

2.3.3. Brown sauces

Nine descriptors were selected for the sensory evaluation of brown sauces (Table 7).

2.4. Texture analysis

2.4.1. Flatbreads

To assess the elasticity of the flatbreads, they were analysed in 3 different ways: 1) untreated, 2) treated in oil and 3) treated in water. The samples that were treated were put upside-down in 5 mm of water or rapeseed oil for 15 min before the texture analysis. The flatbread texture was analysed with a puncture test using an Instron universal testing machine model 5542 with a 500 N load cell (Instron Ltd., High Wycombe, UK). The flatbread samples were placed on the bottom plate with the treated side up. The plate had a 15.8 mm hole, and a 7.9 mm cylindrical probe penetrated the samples and the hole at 10 mm/min. For every flatbread sample, 8 to 10 replicates were analysed.

Table 7
Attributes and definitions selected for the sensory evaluation of the brown sauces.

Sensory modalities	Attributes	Definitions
Taste	Salty	Basic taste salty
Taste	Sweet	Basic taste sweet
Taste	Umami	Basic taste umami
Taste	Bitter	Basic taste bitter
Taste	Sour	Basic taste sour
Flavour	Soy sauce	Soy sauce overall, not specifically Chinese, or Japanese
Flavour	Beef bouillon	Bouillon, no specific brand
Texture	Fatty	Fatty or oily mouthfeel
Texture	Melting	Mouthfeel, how easily the sauce dissolves

2.4.2. Beef rolls

To analyse meat texture, Shear force measurements were conducted using 1 mm Shear Blades for a cutting-shear test and a texture analyser equipped with a 5000-g load cell (Brookfield AMETEK CTX, Middleboro, MA, USA). The test speed was set at 3.5 mm/s, the compressive deformation at 15.5 mm, and 173.47 N was used as the trigger force for the measurements. All the beef roll samples were cut into a standardized diameter of 1 cm (the core of the beef rolls), and the samples were analysed in 10 replicates.

2.4.3. Brown sauces

The viscosity was measured using a DV2T viscometer (Brookfield AMETEK, Middleboro, MA, USA); 16 ml of the sauces were put into a container and analysed using a SC4-25/13R spindle for 30 s at 50 rpm. The measurements were made in triplicate and the % torque value was over 10 for all the samples.

2.5. End-user acceptability

Focus group interviews were managed online in order to evaluate the finger food components from the end-user's viewpoint and to build an understanding of demands for further refinement. The focus group interviews were conducted in two smaller groups with three participants in each group, since it is known that large group sizes may be difficult to manage in an online environment and the interaction and depth of the discussion can be negatively influenced (Kite and Phongsavan, 2017). Smaller groups may also create a more intimate atmosphere when discussing sensitive subjects with hard-to-reach participants (Kite and Phongsavan, 2017). The recruitment was conducted by the Scanian Parkinson coalition. An information letter was sent out describing the study and the terms for participation and written consent and contact details were obtained according to an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019–01691). Six persons were able to participate, five of the participants were spouses of older adults with Parkinson's disease, while one was diagnosed with Parkinson's disease. The participants were all female, between 64 and 80 years old, and all held leading positions in two Parkinson coalitions. A PowerPoint presentation with pictures of the developed finger food components and questions were presented and the participants discussed the applicability, benefits and weaknesses of the components and their sensory properties in relation to the needs of persons with motoric eating difficulties. The focus groups were transcribed simultaneously and lasted approximately 1.5 h.

2.6. Data analysis

Data from the consensus profiling was compiled in spider plots. The texture data were analysed by calculating mean values and standard deviations. One-way analysis of variance (ANOVA) was then conducted to compare variability between the samples. A post hoc test, Tukey's HSD test was used with a significance level of 5%.

A classical transcript analysis with a sorting/clustering approach described by Lawless and Heymann (2010) was chosen for this study. It is a straightforward method abridged from the method described by Krueger and Casey (2009). The transcript notes and summaries were read several times before the main particulars concerning preferences in relation to the needs of persons with motoric eating difficulties were extracted from notes. Thereafter, descriptions of the key findings were created.

3. Results

3.1. Flatbreads

3.1.1. Sensory evaluation

Overall, a higher percentage of WPC resulted in springier texture than a higher percentage of SPI. In general, a higher fat content resulted in a sticky and unbaked core. Flatbreads with higher protein content (15%) comprising 100% SPI resulted in a more compact and gritty texture, however the addition of fat reduced this effect. The flatbreads were neutral in odour and flavour (Fig. 4).

3.1.2. Texture analysis

Generally, flatbreads with a high protein content (15%) and/or a high fat content (33.75 g) resulted in higher compression load values than flatbreads with low protein content (10%) and low fat contents (11.25 g) (Table 8). Comparing the different treatments of the flatbreads, flatbreads treated in water generally withstood lower compression loads better than untreated (Fig. 5). Flatbreads with high fat content were least affected by the water and there was no clear effect on the compression load of flatbreads treated in oil (Fig. 6).

3.1.3. End-user acceptability

Bread was not considered a natural component of a complete meal except together with soups or salads. However, for those struggling to eat with cutlery, bread was considered a good tool for finger eating. Flexibility is important as the bread has to be easy to wrap, fold or roll. The flatbreads should also be able to withstand pressure as those with motor symptoms and tremor hold on to a sandwich, wrap or roll tightly and spasmodically. If the texture is too soft, dry, or crumbly the bread will break and create a mess. Dry and hard bread can also be difficult to chew and swallow for those with swallowing difficulties, it may irritate their throats and result in coughing or choking. Flavourwise, a neutral flatbread is preferred since the bread should combine easily with several types of dishes and flavours. A pancake-flavoured flatbread was considered optimal for desserts and snacks, and a wheat-flavoured flatbread for lunch and dinner.

3.2. Beef rolls

3.2.1. Sensory evaluation

Overall, beef rolls BWP were perceived to have a high odour intensity of cooked beef while beef rolls BIR had a high odour intensity of fried beef. Higher core temperature and longer cooking time resulted in more tender beef rolls and beef rolls made of thicker slices resulted in juicer beef rolls. Beef rolls made of inner thigh were perceived as crumblier than beef rolls made from outer thigh. The muscle fibres were also perceived as more visible in beef rolls BIR than in beef rolls made of

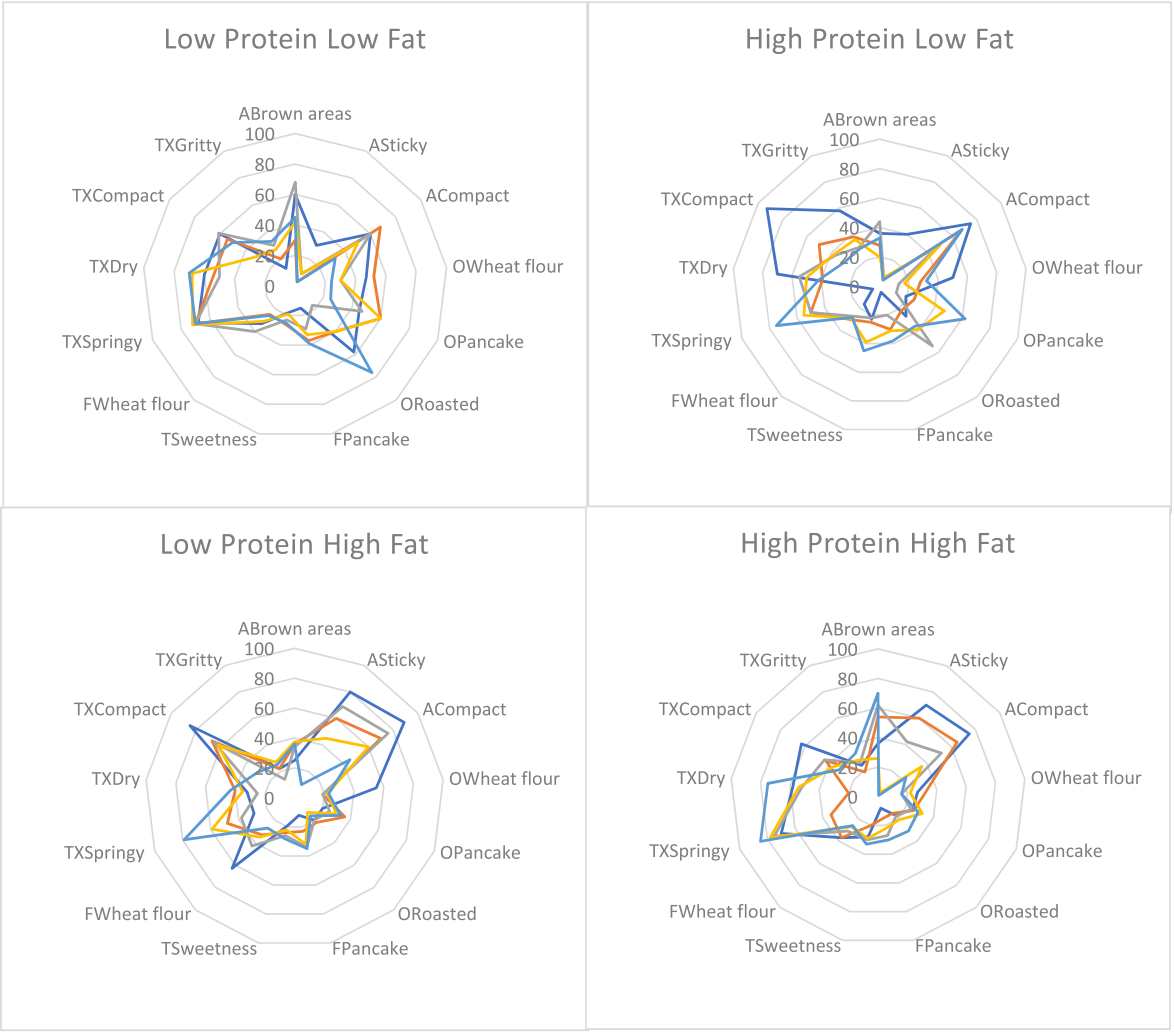

Fig. 4. Sensory profile for flatbreads baked with high (15%) and low (10%) protein content, and high (33.75 g) and low (11.25 g) fat content. **A**= appearance, **O**= odour, **T** = taste, **F**= flavour, **TX**= texture. Samples: **Dark blue**: Soy 100% **Grey:** Soy 50% and Whey 50% **Orange:** Soy 75% and Whey 25% **Yellow:** Soy 25% and Whey 75% **Light blue:** Whey 200%. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Table 8
The results of texture measurements of the flat breads presented as mean values and standard deviation [Newton].

Low Fat Low Protein (10%)	Untreated	Flatbreads	
		Oil	Water
100% soy	3.45 ± 1.28	3.92 ± 1.39	2.01 ± 0.74
75% soy 25% whey	3.00 ± 0.36	3.09 ± 0.43	1.89 ± 0.38
50% soy 50% whey	3.46 ± 0.61	3.25 ± 0.60	0.72 ± 0.36
25% soy 75% whey	2.07 ± 0.81	2.21 ± 0.67	0.63 ± 0.36
100% whey	3,91 ± 1.05	2.51 ± 1.31	1.09 ± 0.21
Low Fat High Protein (15%)			
100% soy	5.41 ± 0.42	4.78 ± 2.60	3.66 ± 1.36
75% soy 25% whey	4.87 ± 0.46	3.03 ± 0.34	2.66 ± 0.19
50% soy 50% whey	4.93 ± 1.73	2.87 ± 0.62	2.59 ± 1.40
25% soy 75% whey	3.24 ± 1.24	3.66 ± 0.72	0.93 ± 0.26
100% whey	3.18 ± 0.27	2.70 ± 1.00	0.82 ± 0.12
High Fat Low Protein (10%)			
100% soy	3.09 ± 1.66	3.15 ± 1.13	2.79 ± 1.02
75% soy 25% whey	4.40 ± 2.35	4.61 ± 1.74	3.70 ± 1.97
50% soy 50% whey	3.98 ± 2.14	3.38 ± 1.26	2.14 ± 0.81
25% soy 75% whey	4.09 ± 0.94	3.49 ± 1.36	2.93 ± 1.08
100% whey	1.89 ± 0.61	1.53 ± 0.74	0.80 ± 0.35
High Fat High Protein (15%)			
100% soy	4.56 ± 1.65	3.26 ± 1.74	2.58 ± 0.38
75% soy 25% whey	4.45 ± 2.37	5.59 ± 2.09	3.52 ± 1.33
50% soy 50% whey	4.29 ± 0.46	3.84 ± 1.49	3.46 ± 0.36
25% soy 75% whey	3.30 ± 1.66	2.76 ± 0.95	1.37 ± 0.21
100% whey	4.71 ± 0.99	5.10 ± 2.00	3.02 ± 0.83

BWP. Overall, beef rolls BIR were perceived to have a higher flavour intensity of umami (Fig. 6).

3.2.2. Texture analysis

The average maximum shear force was generally higher in beef rolls BWP and beef rolls BIR 5 mm. Beef roll samples made from outer thigh 5 mm (BWP and BIR) could not be assessed as penetration required more shear force than the maximum load cell (Table 9).

3.2.3. End-user acceptability

According to the spouses, whole meat, and especially beef, was generally avoided as the texture is perceived as tough, chewy and stringy, and not well suited to the target group. Juiciness in meat was seen as a positive property as it made it easier to chew and swallow but overall, tenderness was deemed most important. For beef rolls to be optimal they need to be soft and tender without falling apart when holding and dipping in sauce. Slice thickness was not important if the beef rolls were tender. Crumbliness and dryness in tender meat can be a negative property for those with swallowing difficulties. However, both juiciness and crumbliness can be compensated for by serving sauce with the meat. Due to the caramelised surface, odour and flavour intensities were thought to be higher in beef rolls BIR than beef rolls BWP.

3.3. Brown sauces

3.3.1. Sensory evaluation

The original brown sauce was perceived as having a high intensity of flavours, such as beef bouillon, soy sauce and umami. The addition of sweet, sour and bitter tastes reduced the perceived intensity of the original flavour profile of the brown sauce, and sour and sweet tastes markedly overruled the flavour profile. The addition of saltiness to the sauce affected the flavour profile somewhat, since the sauce lost some of its complexity related to the flavour profile. However, the addition of umami maintained the flavour profile and also increased the intensity of the flavour profile (Fig. 7). The mouthfeel of sauces with low viscosity was perceived as spreading and melting more rapidly in the mouth than sauces with high viscosity.

3.3.2. Texture analysis

All sauces, except for bitter high, had a lower viscosity than the original sauce. Moreover, the mean values of the viscosity showed that sauces with low concentrations of the basic tastes had lower viscosity than those with high concentrations, except for umami high, which had a higher viscosity than umami low (Table 10).

3.3.3. End-user acceptability

According to the spouses, sauce was considered the most important component in a meal. Sauce contributes a large amount of flavour to other meal components and at the same time lubricates the food. A perfect brown sauce was described as well balanced, which was accomplished by the small addition of sweetness and acidity from lingonberries or pickled cucumbers to a savoury sauce based on juices from the meat. Furthermore, high viscosity was considered important for finger food sauces for the sauce to stick to the meat while dipping, but also to avoid spilling. The sauce was also important since it adds juiciness to the meal and binds small particles together, facilitating chewing and swallowing without choking. However, the viscosity of the sauces should not be too high as this may not be optimal for moistening the food in the mouth.

4. Discussion

4.1. Result discussion

4.1.1. Flatbreads

The specific objective was to evaluate the sensory quality and the end-user acceptability of flatbreads enriched with soy protein isolate (SPI), whey protein concentrate (WPC) and fat. As with all foods, flavour plays a large role in product acceptance and protein enrichment affects sensory properties of foods, resulting in decreased flavour intensity and altered food texture (Höglund et al., 2018). Both whey and soy proteins have been described as giving rise to sweet, aromatic, cardboard, and brothy flavours. Whey proteins were further characterized by metallic and soapy flavours, and soy proteins by adding sensory attributes such as cereal, malty, flour paste, and roasted (Russell et al., 2006). Sabanis and Tzia (2009) found that taste scores decreased when increasing the level of substitution of non-wheat flours, and soy flour supplemented bread was rated poorest in taste. Höglund et al. (2017) reported off-flavours in muffins enriched with whey protein. However, the present study did not observe any off-flavours. In fact, all flatbreads were generally neutral in flavour, which was a characteristic that was preferred by the focus group participants since the breads should be used with different dishes and flavours.

However, this study showed that protein and fat have a profound effect on the texture of flatbreads. Flatbreads with a high amount of protein and fat demanded more force to puncture, which may indicate that flatbreads high in protein and fat better withstand pressure. This is a positive characteristic since the flatbreads are intended to wrap other meal components. Flatbreads with high fat content were least affected by water, which may be due to polarity, and make the flatbreads withstand moisture better. However, overall flatbreads with a high fat content were not optimal due to the unbaked core.

It was further shown that the type of protein used for enrichment influenced the texture considerably. A high amount of SPI in flatbreads resulted in a compact and gritty texture. Although the addition of fat decreased the grittiness, a high amount of fat together with soy protein resulted in a sticky and unbaked texture. This is in line with Song et al. (2018) who showed that SPI enrichment increased the stickiness and compactness in rye bread. Several studies have also found that soy flour results in more compact texture (Sabanis and Tzia, 2009; Wendin et al., 2017; Tang and Liu, 2017). Moreover, Sabanis and Tzia (2009) found that as the substitution of soy flour increased, the crust and crumb texture also became harder. In contrast, a high amount of WPC resulted in flatbreads with a springier texture, which may be more ideal for

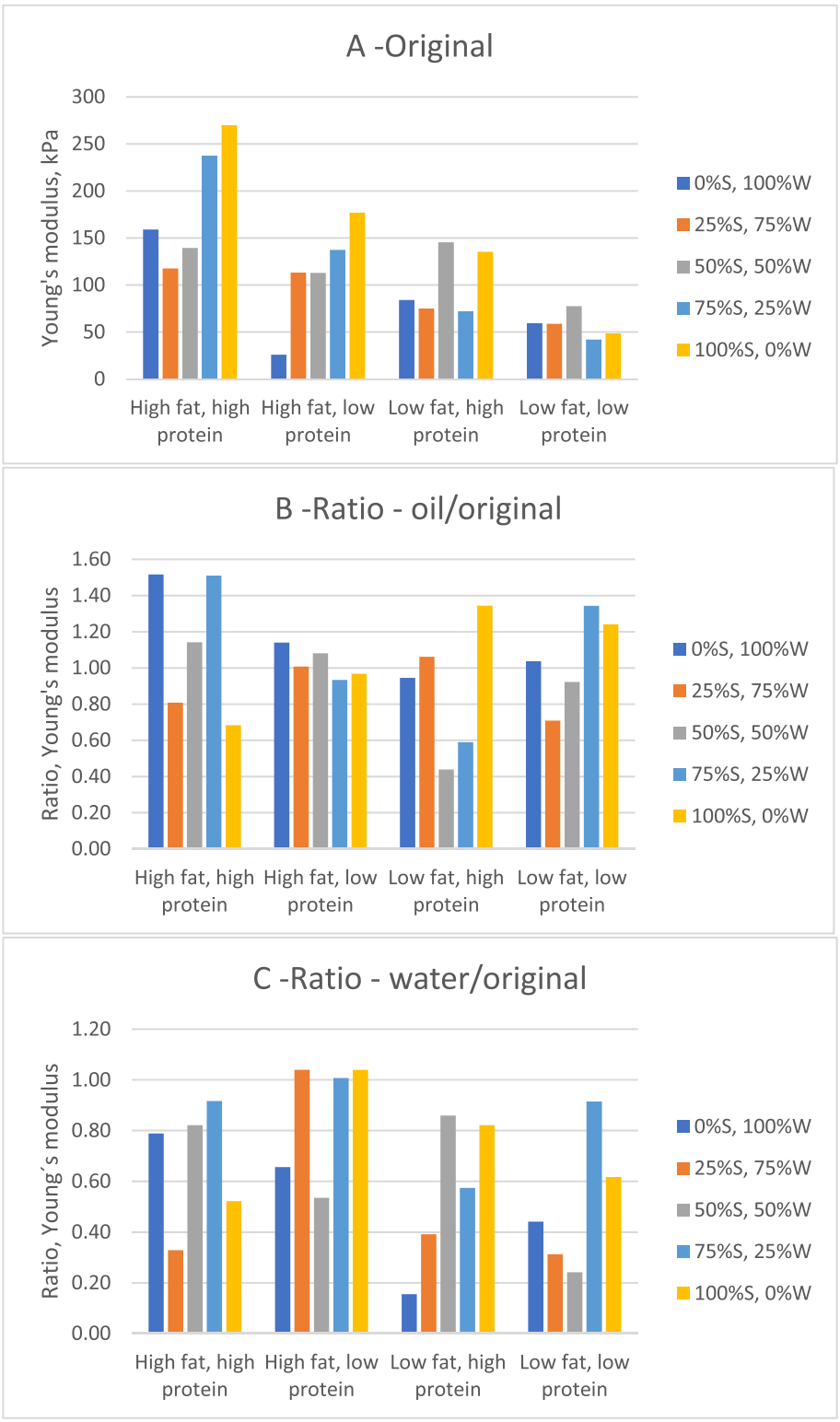

Fig. 5. **A**= The modulus is shown for the different compositions of flatbreads. A higher value indicates a stiffer bread. **B**= The ratio of the modulus of the oil treated bread and the untreated bread. **C**= The ratio of the modulus of the water treated bread and the untreated bread. B and C values under 1.00 shows that the bread is easier to penetrate after the treatment and values over 1.00 shows that the bread is harder to penetrate after treatment.

folding and wrapping. Increased elasticity in ryebreads enriched with whey protein hydrolysate (WPH) and whey protein isolate (WPI) was previously observed by Song et al. (2018). They also found that WPH and WPI increased the hardness, dryness, and crumbliness in ryebread, however this was not seen for WPC in flatbreads. Similar effects were also observed in the preparation phase. A high percentage of SPI resulted in dry and brittle doughs that were difficult to roll out as thinly as the other doughs. A high composition of WPC resulted in a batter that was too moist to roll out and lift over to the pan without baking paper and a spatula.

Based on the findings related to texture in this study, a combination of SPI and WPC may be the optimum for further development of a finger

Fig. 6. Sensory profile of beef rolls made from m. biceps femoris (O) and m. semimembranosus (I). **A**= appearance, **O**= odour, **T** = taste, **F**= flavour, **TX**= texture. The beef rolls were either braised as whole meat pieces (BWP) and sliced and rolled or braised in rolls (BIR). The whole meat (BWP) was braised for 2 and 3 h respectively and sliced into 2 mm and 5 mm and rolled. The braised rolls (BIR) were sliced in 2 mm and 5 mm before being braised to an inner temperature of 70 and 90 Celsius respectively. **BWP samples: Blue:** 2 h and 2 mm, **Grey:** 3 h and 2 mm, **Orange:** 2 h and 5 mm, **yellow:** 3 h and 5 mm. **BIR samples: Blue:** 70 Celsius and 2 mm, **Grey:** 70 Celsius and 5 mm, **Orange:** 90 Celsius and 2 mm, **yellow:** 90 Celsius and 5 mm. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

food flatbread. Song et al. (2018) found promising results with blends of WPI, WPH and SPI in equal amounts. Moreover, a combination of SPI and WPC is a nutritionally favourable combination. Both soy and whey contain all essential amino acids, but the composition of amino acids varies, and a blend of soy and whey may therefore be beneficial.

4.1.2. Beef rolls

The specific objective was to evaluate the sensory quality and the end-user acceptability of beef rolls made from two types of meat cuts and cooking techniques. Tenderness is an important parameter to consider in the development of beef rolls for the target population (end-user). The sensory evaluation indicated that beef rolls made from inner thigh, sliced thinly (2 mm) and cooked for 3 h or to an inner core temperature of 90 °C were most tender. In addition, thicker slices of beef rolls (5 mm) made from outer thigh tended to demand more shear force to cut through than beef rolls made from inner thigh, which may be because outer thigh is a coarse textured muscle compared to inner thigh. Inner thigh may therefore be the optimal choice meat cut for beef rolls. In a study of Sullivan and Calkins (2011), beef muscles were grouped into three tenderness groups based on instrumental tenderness measurements. Tender <37.31 N, intermediate 37.49–44.54 N and tough meat. > 44.98N. According to that classification, the meat in this study would be classified as intermediately tender, highlighting a need for further development to suit the intended end user.

The sensory evaluation also indicated that the odour of beef rolls was influenced by the amount of meat surface exposed during cooking. Beef rolls BWP were characterized by a cooked (boiled) beef odour while the odour of beef rolls BIR was described as fried beef. In the study by Klosse et al. (2004) beef poached in a strong beef stock was considered less palatable than pan-fried beef and also lacked odour sensations from the caramelised surface (Maillard). Among older adults, Honnens de Lichtenberg Broge et al., (2021) found a pattern of decline in intensity perception of odours such as fried meat with increasing age. Browning of the surface may therefore be important to increase both the odour and flavour release from the meat. Based on visual assessment by the spouses, beef rolls BIR were also perceived to have a more intense flavour and odour due to the caramelised surface. This study suggests that browning of the beef rolls may act as a visual stimulus for odour and flavour. Moreover, appearance may compensate for sensory loss (Gottfried, 2010), therefore in choosing familiar foods, in this case beef rolls,

Table 9
The results of texture measurements of the beef rolls presented as mean values and standard deviation in Newton [N].

Beef rolls braised in whole pieces	Peak mean (N)
Outer thigh	
2 h 2 mm	36.8 ± 5.0
2 h 5 mm	*
3 h 2 mm	26.6 ± 4.3
3 h 5 mm	31.3 ± 7.3
Inner thigh	
2 h 2 mm	44.8 ± 2.9
2 h 5 mm	43.0 ± 10.0
3 h 2 mm	30.5 ± 5.4
3 h 5 mm	41.4 ± 4.6
Beef rolls braised in rolls	
Outer thigh	
70 °C/2 mm	38.1 ± 7.2
90 °C/2 mm	31.0 ± 3.4
70 °C/5 mm	*
90 °C/5 mm	40.7 ± 7.5
Inner thigh	
70 °C/2 mm	30.6 ± 5.3
90 °C/2 mm	36.9 ± 6.1
70 °C/5 mm	42.7 ± 4.8
90 °C/5 mm	30.5 ± 6.3

* = Unable to measure the beef rolls as it required more than a 5000 g cell load to cut through the meat.

a traditional dish may restore odour perception despite olfactory decline (Honnens de Lichtenberg Broge et al. (2021). Moreover, Klosse et al. (2004) found that beef poached tender lacked texture from the roasted crust. The caramelised surface of BIR may therefore also have a positive influence on the texture.

4.1.3. Brown sauces

The specific objective was to evaluate the sensory quality and the end-user acceptability of prebiotic mayonnaise-based brown sauces flavoured with high and low concentrations of basic tastes. The results from the sensory evaluation showed that brown sauces with high taste intensity of umami, and to some extent salty, resulted in a flavourful sauce by enhancing the flavour profile. Moreover, acidity, sweetness and bitterness overruled the flavours, decreasing the flavour profile markedly. This is in line with the findings of Klosse et al. (2004), indicating that the presence of umami together with a good balance in flavour components was important for the palatability of foods. This may be especially important for the development of finger foods since Honnes de Lichtenberg Broge et al., (2021) recently found a decline in intensity perception of savoury odours, such as fried meat, mushroom, and onion, in older adults. Additionally, intensity perception of savoury odours seems to diminish earlier than that of other food flavours (Honnes de Lichtenberg Broge et al., 2021). The recent study by Thomas, Boobyer, Borgonha, van den Heuvel and Appleton (2021) also showed that older adults used sauce to enhance the food flavour of meals. To obtain a flavourful sauce with a high intensity of umami it is therefore important to be cautious when adding acidity, sweetness and bitterness.

According to the spouses, sauce also contributes juiciness to a meal, which is especially important for those with chewing and swallowing difficulties. High viscosity sauces may be more optimal for finger foods as they remain on the food when dipped in the sauce. However, the panellists perceived that sauces with higher viscosity had a slower melting point than sauces with lower viscosity, which may affect lubrication during mastication. This is in line with Weenen et al. (2003) who found that sauces of high viscosity, such as mayonnaise, were slow melting compared to sauces with low viscosity. Melting was described, as the gradual process of spreading, becoming thinner in the mouth with dilution by saliva (Weenen et al., 2003). Moreover, mayonnaise was described as “mouth-watering and prickling”, two attributes that were highly correlated, indicating an effect of the relatively high acidity (Weenen et al., 2003). Acidity may therefore have a positive effect, increasing saliva production which in turn makes it easier to lubricate and swallow foods. Bozorgi et al. (2020) found that sourness and carbonation can manipulate the signal for secretory events and swallowing. However, acidity should be carefully added to avoid compromising the intensity of the flavour profile of the sauce.

4.2. Methodological considerations

In consensus profiling the sensory evaluation is applied by a trained panel and the sensory ratings are made in consensus rather than independently in duplicate or triplicate (Meilgaard, 2006). The low credibility of the method is related to the small number of panellists, and lack of consistency and reproducibility (Meilgaard, 2006). Although there is no testing of statistical significance across the products with this method, it is a rapid way to obtain insights that can guide the product development. This limitation also exits in other rapid sensory methods in product development. In this study the sensory results together with textural measurements and the end-user evaluation all pointed in the same direction and offered important insights for the selection and further development of the components, all in line with the creative design setup. In addition, the lack of consistency and reproducibility can be overcome by training and including the opinions of all panellists (Meilgaard, 2006).

In product development, consumer testing is the most important tool for obtaining information about how consumers rate products (Naes and Nyvold 2004). Conducting hedonic tests with the actual end-user under standardized circumstances would have been preferred, however, recruiting enough participants for hedonic tests may not be possible since the end-users often are physically restricted due to their disease. Moreover, due to Covid-19 pandemic health restrictions, consumer testing could not be conducted in a standardized manner. To gain end-user feedback the best option was therefore to conduct online focus groups. This allowed us to gain insights for further refinements and selection of components for the final evaluation.

Since recruitment of the target group has been difficult previously under normal circumstances (Forsberg et al., 2022a; 2022b), spouses were welcomed to participate. Spouses who have nursed their partners at home for several years have vital knowledge and experience of acceptability and demands in relation to food and meals. Indeed, there was a risk that some important insights and demands could be missed, however the spouses who participated in the study were in leading positions in the Parkinson’s coalition where they had regularly witnessed the struggles of the target group.

5. Conclusions

Flatbreads enriched with 10% protein, comprising 50% whey and 50% soy protein, and 11,25 g fat had a favourable texture, optimal for wrapping. Tenderness is an important parameter to consider in the development of beef rolls for the target population. Beef rolls made from inner thigh, sliced thinly (2 mm) and cooked for 3 h or to an inner core temperature of 90 °C may therefore be the most optimal option. Moreover, beef rolls braised in rolls (BIR) is recommended over beef rolls braised in in a whole piece (BWP) as odour and flavour intensity were evaluated higher due to the caramelised surface. Sauce was considered important for the end-users as it increased the flavour and lubricated the food. However, since the addition of sweet, sour or bitter tastes reduced the perceived intensity of the original flavour profile of the brown sauce, these should be added and balanced carefully. Finally, combinations of the developed meal components could be investigated further to create attractive finger food meals for those unable to eat with knife and fork.

Implications for gastronomy

Gastronomy can be defined as including the science of food and

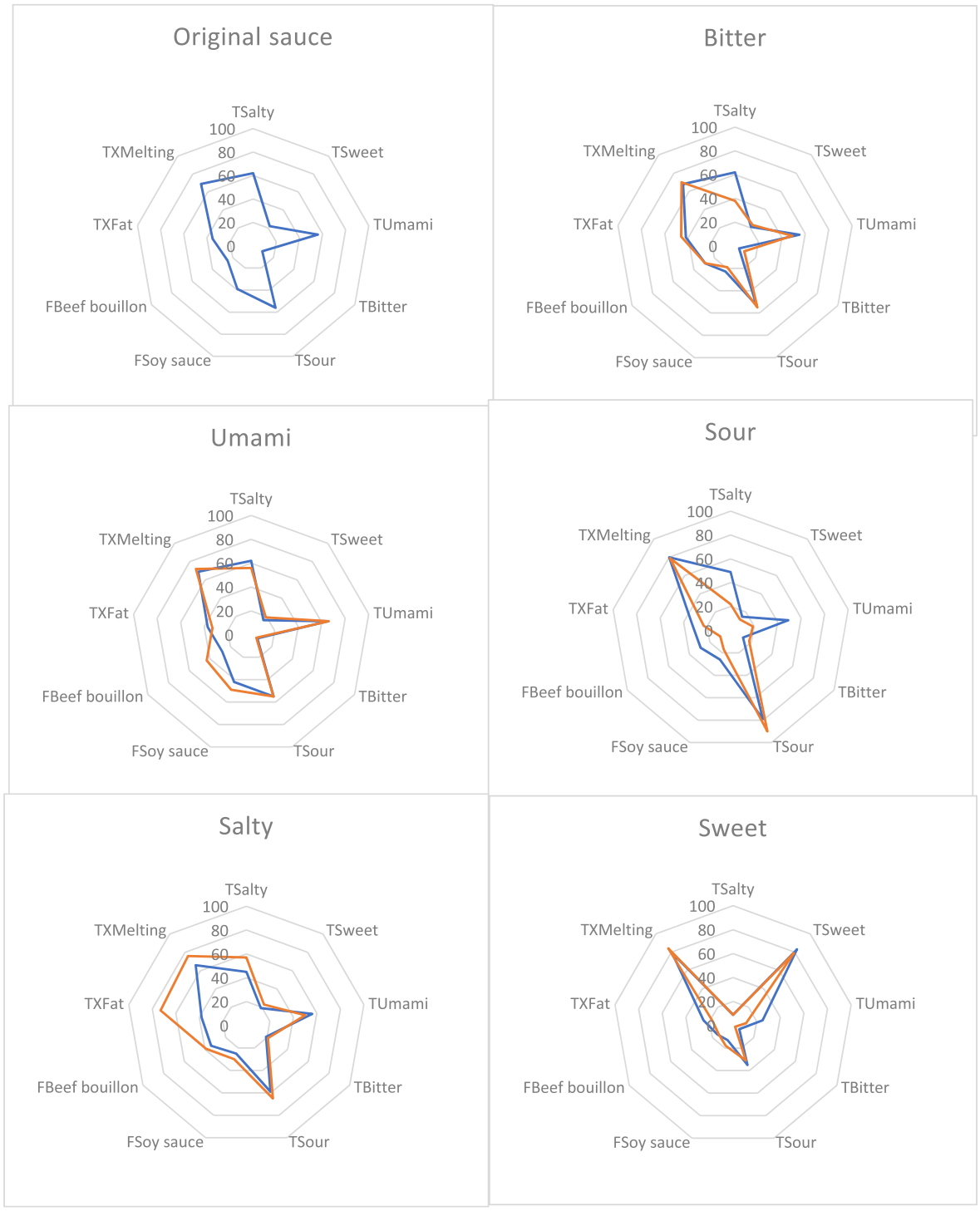

Fig. 7. Sensory profile for prebiotic beef sauces, control and sauces flavoured with the basic tastes, both low and high concentrates. **T** = taste, **F** = flavour, and **TX** = texture.

meals, craftmanship and art. It is holistic and interdisciplinary and includes the acts of preparing meals and eating as well as cultural, nutritional, and sensory aspects. This paper describes the development of finger foods as part of a complete meal for older adults with motoric eating difficulties, contributing knowledge to the subject area of gastronomy and food and meal science. The development builds on functional, nutritional, and sensorial demands, and the results add insights that can bridge cultural barriers and culinary rules and improve the meal situation for the target population.

Ethical approval

Ethical approval was received by an advisory statement from the Swedish Ethical Review Authority for the evaluation of the end-user acceptability (Dnr: 2019–01691).

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Table 10
Results from the viscosity measurements for sauce samples in mean values and standard deviation in mPas.

Samples	Viscosity (mPas)
Original	5049 ± 159
Umami high	4384 ± 164
Umami low	3734 ± 91
Bitter high	5174 ± 141
Bitter low	4976 ± 61
Sweet high	1254 ± 65
Sweet low	1610 ± 120
Salty high	1055 ± 63
Salty low	1904 ± 146
Sour high	1805 ± 116
Sour low	2652 ± 181

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Author statements

SF- Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Software; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing. VO- Conceptualization; Methodology; Resources; Data curation; Formal analysis; Supervision; Writing - review & editing. WB- Conceptualization; Methodology; Writing - review & editing; Supervision. EV- Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Roles/Writing - original draft; Writing - review & editing. AK- Investigation; Data curation; Resources; Formal analysis; Writing - review & editing. KW- Conceptualization, Funding acquisition, Project administration; Resources; Supervision; Writing - review & editing.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

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Paper IV

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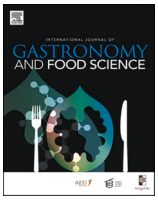

Vegetable finger foods - Preferences among older adults with motoric eating difficulties

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ABSTRACT

Older adults, who have developed motoric eating difficulties as in Parkinson's disease have difficulty consuming foods with common tableware. They may be offered alternative servings developed for eating by their fingers. The present study investigated which kind of vegetables and cooking techniques suited this consumer group in order to accomplish a high level of acceptance. Vegetable preferences in Swedish adults older than 65 years (n = 97) were initially measured by a survey tool followed by digital focus groups. The findings were used to develop vegetable finger foods for older adults with motoric eating difficulties. The vegetable preferences among those with motoric eating difficulties did not differ in comparison to a more general older adult population. Among the vegetables, broccoli, carrot, tomato, cauliflower and red bell pepper were highly appreciated. However, for those with major eating difficulties, the choice of vegetables was restricted to fewer textures, which were more easily processed in the mouth. Vegetables served as snacks, traditionally on the plate, or deep-fried were considered most appropriate as finger foods. Finally, attractive meals for older adults unable to eat with common cutlery should also be accompanied with other nutritive finger foods servings.

1. Introduction

Vegetables are an important component of a healthy diet (World Health Organization [World Health Organization, 2019). They are good sources of vitamins, minerals, fibre and other beneficial non-nutrient substances, such as plant sterols, flavonoids, and other antioxidants (Barrett et al., 2010; Boeing et al., 2012; Aune et al., 2017). The inclusion of plant foods naturally rich in fibre as part of a daily diet reduces the risk of cardiovascular disease (Hartley et al., 2013; Aune et al., 2017), type 2 diabetes (Cooper et al., 2012; Li et al., 2014) and some forms of cancer (Bradbury et al., 2014; Aune et al., 2017). In addition, soluble fibre can help maintain normal intestinal function by reducing constipation (Sturzel and Elmadfa, 2008) and encourage the growth of intrinsic probiotic microflora (Hamilton-Miller, 2004). Studies suggest that adequate fruit and vegetable intakes in older adults can prevent the onset or exacerbation of geriatric conditions, such as cognitive impairment, falls and walking disability (Nicklett and Kadell, 2013). According to Loef and Walach (2012), an increased intake of vegetables may be associated with a lower risk of dementia and slower rates of cognitive decline in older adults. However, a survey of Swedish older adults indicated that most do not eat the recommended amount of vegetables (National Food Agency, 2018).

According to the Swedish Board of Agriculture (2015), the consumption of fresh vegetables has increased by 170% and prepared vegetables by 200% since 1960. A national survey of the dietary patterns in Sweden showed that older adults aged 65–80 years eat more fruit and vegetables than younger adults aged 18–30 years (National Food Agency, 2012). However, only 24% of older women and 15% of older men had a fruit and vegetable intake in line with the dietary guidelines (National Food Agency, 2018). Several studies have also shown that older women generally eat more fruit and vegetables than older men (Nicklett and Kadell, 2013; Swedish National Food Agency, 2012). The national survey of dietary patterns in Sweden in 2011 showed that the mean intake of vegetables among older men aged 65–80 years was 169 g a day and the mean intake among older women aged 65–80 years was 178 g a day (National Food Agency, 2018). Strategies to increase vegetable intake are therefore essential. However, since the older adult population is heterogenous and ranges from those who are younger and healthy to those who are older and ill (Koehler and Leonhaeuser, 2008), various strategies targeting different populations are needed.

It is widely known that declining physical and cognitive abilities have a negative impact on older adults' food practices and dietary

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intakes (Appleton et al., 2016). Older adults with functional limitations and disabilities face difficulties in procuring, preparing and eating food and meals (Nicklett and Kadell, 2013). For older adults with motoric eating difficulties, handling a knife and fork, and eating according to the cultural norms surrounding a meal, can be challenging (Forsberg et al., 2022a). This population group may, therefore, benefit from finger food meals, where the meal components are easy to grip with the fingers and transport to the mouth (Forsberg et al., 2022b). Knowledge about preferences and demands are essential in order to design attractive vegetable finger foods that are functionally acceptable and will be appreciated by older adults with motoric eating difficulties.

This study, therefore, addresses vegetable preferences among adults older than 65 years of age with motoric eating difficulties. An explanatory sequential mixed method design was used, which involves collecting quantitative data initially and then exploring the quantitative results by collecting qualitative data. In the first phase of the study, a survey regarding overall vegetable preferences was conducted in a general older adult population. In the second phase, focus groups were held to explore the survey results based on the preferences and demands of older adults with motoric eating difficulties.

2. Material and methods

Older adults with motoric eating difficulties have previously been difficult to recruit for quantitative studies (Forsberg et al., 2022b), which can make it difficult to generalise research findings to the target population. A mixed method explanatory sequential approach, as described by Creswell (2014), was therefore chosen. The design builds on two phases; first a quantitative phase investigating vegetable preferences in a more general older adult population and then a second qualitative phase discussing the quantitative results from the perspectives of those with motoric eating difficulties (Fig. 1).

2.1. Survey

A survey created in EyeQuestion® (version 4.11.68, Logic8 BV, The Netherlands) was digitally distributed to Swedish adults aged 65 years and older using social media, such as Facebook and Messenger. The goal was to obtain 100 respondents during the test period (November 18, 2020–February 1, 2021).

2.1.1. Questionnaire

The first part of the questionnaire included demographic questions about gender, age, living accommodation and chewing difficulties. The second part, reported in Table 1, included five closed-ended questions concerning vegetable preferences regarding type, colour, preparation methods, texture and finger food presentation, followed by open-ended questions to provide respondents with the opportunity to add comments. The participants were able to pick as many options as they wanted. The twenty-nine vegetables selected for this study were based on the study "*Fruit and vegetables liking among European elderly according to food preferences, attitudes towards food and dependency*" (Mingioni et al., 2016). However, potatoes, spinach, onion and kale were excluded from the study because potatoes are traditionally included in most Swedish dishes, and onion, spinach and kale were considered difficult to use in the development of more intact finger foods. Pictures of the vegetables were presented in the questionnaire with the question "which vegetables do you like?"; the photos were taken from Pixabay.com.

Table 1
An overview of the questionnaire and response options used in the survey.

Questions:	Options:
What colours of vegetables do you like?	Dark green/light green/yellow/orange/red/purple/white
Which vegetables do you like?	Broccoli/Brussels sprout/carrot/green, yellow, orange, red bell pepper/tomato/corn/asparagus/zucchini/cucumber/aubergine/peas/Haricot verts/celery/celeriac/beetroot/parsnip/Romanesco/cauliflower/mushroom/sweet potato/butternut squash/avocado/beets/artichoke/fennel/radish
If other vegetables, which?	
What preparation methods for vegetables do you prefer?	Raw/boiled/fried/stir-fried/oven baked/puréed/other technique
If other preparation methods, which?	
Why do you like the chosen preparation methods?	
Which textures of vegetables do you like?	Crispy with a lot of chewing resistance/crispy with some chewing resistance/soft/smooth/other texture
If other texture, which?	
If you are going to eat vegetables with your fingers (finger foods), which ways of serving finger foods do you prefer?	Served … traditionally on the plate/vegetable snacks/skewer/wrapped in bread/in croustades/deep-fried/stuffed vegetables/wrapped in lettuce/with gripping tool/nachos/other serving suggestion
If other serving suggestion, which?	

2.1.2. Respondents

Ninety-seven older adults aged between 65 and 84 years (31% male and 69% female) participated in the study. All of them lived in their own home and only 5% reported that they had some minor chewing difficulties (Table 2). Of those reporting minor chewing difficulties, four suffered from dental problems, such as missing teeth, brittle teeth, waiting for implants, and one suffered from jaw arthritis.

2.1.3. Statistical analysis

Initially, descriptive statistics were analysed using frequency (F) and percent (%) to describe both the sample and vegetable preferences. Group comparisons were conducted in SPSS (IBM SPSS Statistics,

Table 2
Demographic data of the total sample (n = 97) and gender, presented in frequency (F) and percent (%).

Age	Total [F, %]	Male [F, %]	Female [F, %]
65–74 years	71 (73)	16 (23)	55 (77)
75–84 years	26 (27)	14 (54)	12 (46)
Gender			
Male	30 (31)	–	–
Female	67 (69)	–	–
Living accommodation			
In their own home	97 (100)		–
Chewing difficulties			
No chewing difficulties	92 (95)	29 (32)	63 (68)
Yes, minor chewing difficulties	1 (1)	0 (0)	1 (100)
Sometimes, certain foods	4 (4)	1 (25)	3 (75)

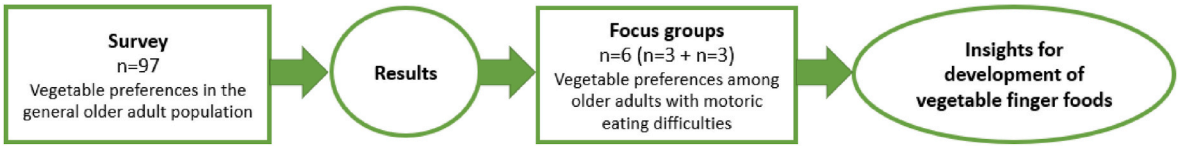

Fig. 1. Overview of the study design.

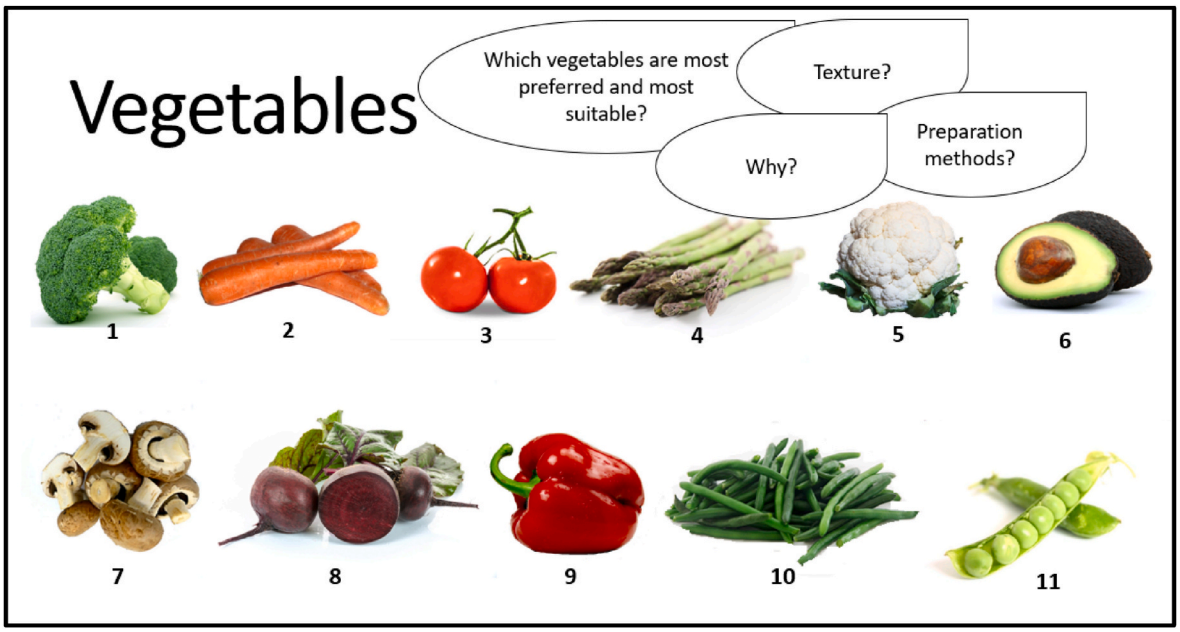

Fig. 2. Picture used to discuss and select the vegetables that are most preferred and most suitable. Photo courtesy of Pixabay.com.

version 26, USA) using Chi-square for independence, calculating the Yates Correction for Continuity and Phi-coefficient value (2 by 2 tables) to explore differences in preferences between men and women.

2.2. Focus groups

Online focus groups were used to explore the survey results from the viewpoint of the target group and to build an understanding of their demands in the development of finger food vegetable components.

2.2.1. Digital interview guide

A digital and interactive interview guide, building on the survey results previously obtained in the study was used to facilitate the focus groups. The slides displayed the most liked vegetables (chosen by a frequency [F] of 70–89 respondents) and preferred serving suggestions for vegetable finger foods (chosen by F 21–69 participants) (Figs. 2 and 3). The discussion focused on the relevance of the results, vegetable preferences, and demands in relation to persons with motoric eating difficulties. Keywords, including texture, preparation methods, and function, were added to the slides to facilitate the discussion. The vegetables and finger food serving suggestions that were most liked and considered optimal for their relatives were selected by the participants in consensus. Three other finger food components (flatbreads, beef rolls and brown sauce) were evaluated during the focus groups, but these results have been published separately (Forsberg et al., 2022c). The focus groups, which were transcribed simultaneously, lasted approximately 1.5 h. A short summary of overall reflections of the discussion was compiled after the focus group.

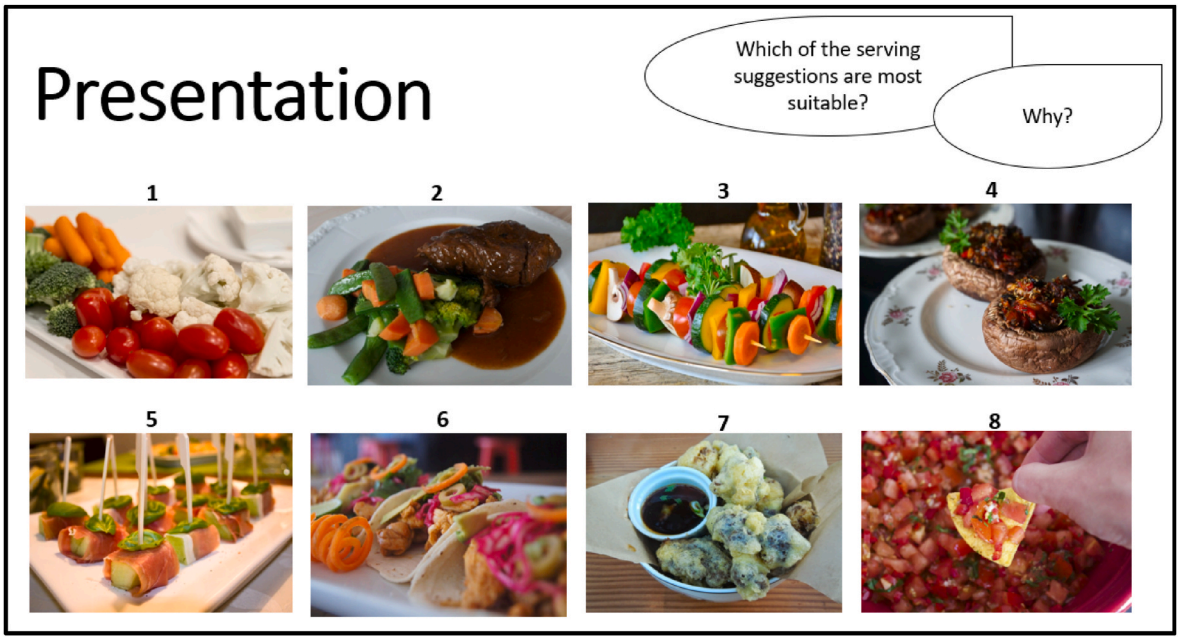

Fig. 3. Picture used to discuss and select the most suitable ways of serving vegetable finger foods. Photo courtesy of Pixabay.com.

Table 3
The older adults' (n = 97) vegetable preferences presented in frequency (F) and percent (%) for the total sample and in percent for males and females.

Vegetables	Total [F, %]	Male [%]	Female [%]
Broccoli	89 (92)	87	94
Carrot	89 (92)	97	90
Tomato	85 (88)	97	90
Asparagus	83 (86)	90	84
Avocado	80 (82)	80	84
Cauliflower	80 (82)	87	81
Mushroom	79 (81)	80	82
Beetroot	76 (78)	73	81
Red bell pepper	73 (75)	77	75
Haricot verts	71 (73)	77	72
Peas	70 (72)	77	70
Brussels sprouts	69 (71)	67	73
Cucumber	69 (71)	77	69
Radish*	65 (67)	87	58
Parsnip	64 (66)	63	67
Artichoke	57 (59)	73	52
Yellow bell pepper	54 (56)	57	55
Fennel	51 (53)	63	48
Orange bell pepper	50 (52)	47	54
Zucchini	49 (51)	50	51
Celeriac	48 (49)	57	46
Corn	47 (48)	50	48
Aubergine	43 (44)	53	40
Beets	43 (44)	37	48
Green bell pepper*	33 (34)	57	24
Celery	31 (32)	37	30
Sweet potato	29 (30)	30	30
Romanesco	22 (23)	10	28
Butternut squash	12 (12)	13	12
Other vegetables	5 (5)	–	–

*Chi-square analysis indicates a significant difference ($p<0.05$) in proportion between male and female and within gender

2.2.2. Focus group participants

Six participants, divided into two focus groups, were recruited; five were spouses of older adults with Parkinson's disease, while one was diagnosed with Parkinson's disease. The participants were female, between 64 and 80 years old, and all six held leading positions in two Parkinson coalitions. Recruitment was conducted by the Scanian Parkinson coalition. An information letter was sent out describing the study and the terms for participation. Written consent and contact details were obtained according to an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019–01691).

2.2.3. Qualitative data analysis

A classical transcript analysis with a sorting/clustering approach, as described by Lawless and Heymann (2010), was chosen for this study. This is a straightforward method abridged from a method described by Krueger and Casey (2009). The transcript notes and summaries were read several times before the main particulars, concerning vegetable preferences in relation to the needs of persons with motoric eating difficulties, were extracted from the notes. Descriptions of the key findings were then produced.

3. Results

3.1. Survey

3.1.1. Vegetable preferences

The most preferred vegetables were broccoli, carrot, tomato, asparagus, avocado, cauliflower, mushroom, beetroot, red bell pepper, haricot verts and peas (Frequency [F] 70–89) (Table 3). When asked to state other vegetables that they liked, the participants reported different kinds of lettuce, kale, cabbage, onions, leeks, wax beans and Jerusalem artichokes. Apart from radish and green bell pepper, there was no significant difference between the preferences of male and female respondents.

Table 4
The older adults'(n = 97) preferences regarding colour, preparation method and texture of vegetables. The results are presented in frequency (F) and percent (%) for the total sample and in percent for males and females.

Colour	Total [F, %]	Male [%]	Female [%]
Red	88 (91)	77	84
Dark green	79 (81)	60	52
Yellow	58 (60)	83	94
Orange	56 (58)	50	61
Light green	53 (55)	57	61
White	25 (26)	30	24
Purple	16 (16)	20	15
Preparation methods			
Oven baked	83 (86)	77	90
Raw	80 (82)	87	81
Boiled	71 (73)	77	72
Stir-fried	52 (54)	50	55
Fried	50 (52)	47	54
Puréed	24 (25)	27	24
Other cooking techniques	7 (7)	–	–
Texture			
Crispy with some chewing resistance	78 (80)	83	79
Crispy with a lot of chewing resistance	38 (39)	37	40
Soft	18 (19)	30	13
Smooth	8 (8)	13	6
Other texture	2 (2)	–	–

3.1.2. Colour, texture, and preparation methods

Red, dark green, yellow, orange, and light green were the colours of vegetables that were most liked (F 53–83) (Table 4). Oven baked, raw and boiled were the most preferred preparation methods for vegetables (F 71–83) (Table 4). Although differences were small, male respondents preferred raw vegetables and female respondents oven baked. Other preparation methods that were appreciated were grilled, steamed and pickled vegetables and also soups, gratins and spreads/dips. The most preferred texture was crispy with some chewing resistance (F 78), followed by crispy with a lot of chewing resistance (F 38) (Table 4). A variety of different textures were appreciated. There were no significant differences between male and female respondents.

3.1.3. Finger food presentations

The finger food serving suggestions that were most preferred were as vegetable snacks, traditionally on a plate, or on a skewer (F 41–69) (Table 5). Another serving suggestion that was appreciated was oven-baked vegetables as finger foods. Some type of gripping tool and croustades were liked more by male respondents than by female respondents, but there was only a significant difference for croustades (Table 5).

Table 5
The older adults' (n = 97) preferences regarding ways of serving vegetables as finger foods. The results are presented in frequency (F) and percent (%) for the total sample and in percent for males and females.

Finger food presentations	Total [F, %]	Male [%]	Female [%]
Served as vegetable snacks	69 (71)	67	73
Served traditionally on the plate	63 (65)	63	66
Served on a skewer	41 (42)	40	43
Served as stuffed vegetables	31 (32)	30	33
Served with some type of gripping tool	28 (29)	49	27
Served wrapped in bread	23 (24)	23	24
Served deep-fried	22 (23)	30	19
Served with nachos	21 (22)	23	21
Served wrapped in lettuce	16 (16)	13	18
Served in croustades*	11 (11)	23	6

* Chi-square analysis indicates a significant difference ($p<0.05$) in proportion between male and female and within gender

3.2. Focus groups

The vegetables that were liked most in the survey were validated by the focus group participants and they found the results to be representative of the vegetables that they ate on a regular basis. In addition, when the participants were asked to select six of the 11 vegetables for further development of finger food components, five of the six chosen - tomatoes, red pepper, cauliflower, broccoli, and carrot - were the same in both focus groups. However, the first focus group also chose peas whereas the second focus group chose haricot verts.

The demand for texture varied; four of the participants reported that their spouses had severe chewing and swallowing difficulties. They described potentially life-threating situations relation to the swallowing of foods. They avoided haricot verts and asparagus, because they were considered too stringy, and some tomatoes with thick skins due, to the risk of choking. Rucola was not included in the study but was also mentioned as potentially unsafe to eat. Choosing the right vegetables, based on their texture, was therefore considered important. According to the participants, some vegetables, such as carrot, broccoli and cauliflower, needed some preparation to be rendered optimal due to their harder texture. Oven-baked and blanched carrots, broccoli and cauliflower were preferred since this made the vegetables tender but still firm to bite. In addition, vegetables that were considered difficult to eat, such as peas and avocado, could be prepared as purees and used as dips. Grated vegetables were also avoided since they could potentially cause choking. Oven-baked vegetables were appreciated and commonly eaten since this method of preparation enhanced the flavour of the vegetables and they were considered easy to eat with the fingers.

The participants in both focus groups were generally in agreement regarding the serving suggestions for finger foods. Both focus groups thought that the most beneficial serving suggestions for vegetables as finger foods were as vegetable snacks, breaded/deep-fried vegetables, or with some sort of gripping tool; however, a gripping tool needs to be modified so that the handle is motorically optimal. For persons with more severe eating difficulties, a gripping tool was not considered a good option. In the focus group with spouses of persons with major eating difficulties, serving the vegetables traditionally on the plate as part of a regular meal was considered a beneficial option. They did not see a difference between serving cooked vegetables on the plate and serving vegetable snacks, as long as the other components (sauce, meat) were placed separately on the plate. Moreover, one focus group thought that stuffed vegetables were beneficial as these were bite sized and could be combined with different flavours and textures. The stability and capacity of dips and topping to stick to, for example, a nacho chip was considered important for manoeuvrability. The spouses also described how persons with visual difficulties, such as blurry vision and colour and distance acuity, found it complicated to eat independently (See Fig. 4).

4. Discussion

4.1. Vegetable preferences

In this study, vegetable preferences among older adults with motoric eating difficulties did not differ in comparison to the preferences of a more general older adult population. The preferred vegetables were broccoli, carrot, tomato, asparagus, cauliflower, avocado, mushrooms, beetroot, red bell pepper, haricot verts and peas. Most of these findings are in line with the preferences of Finnish older adults as reported in the

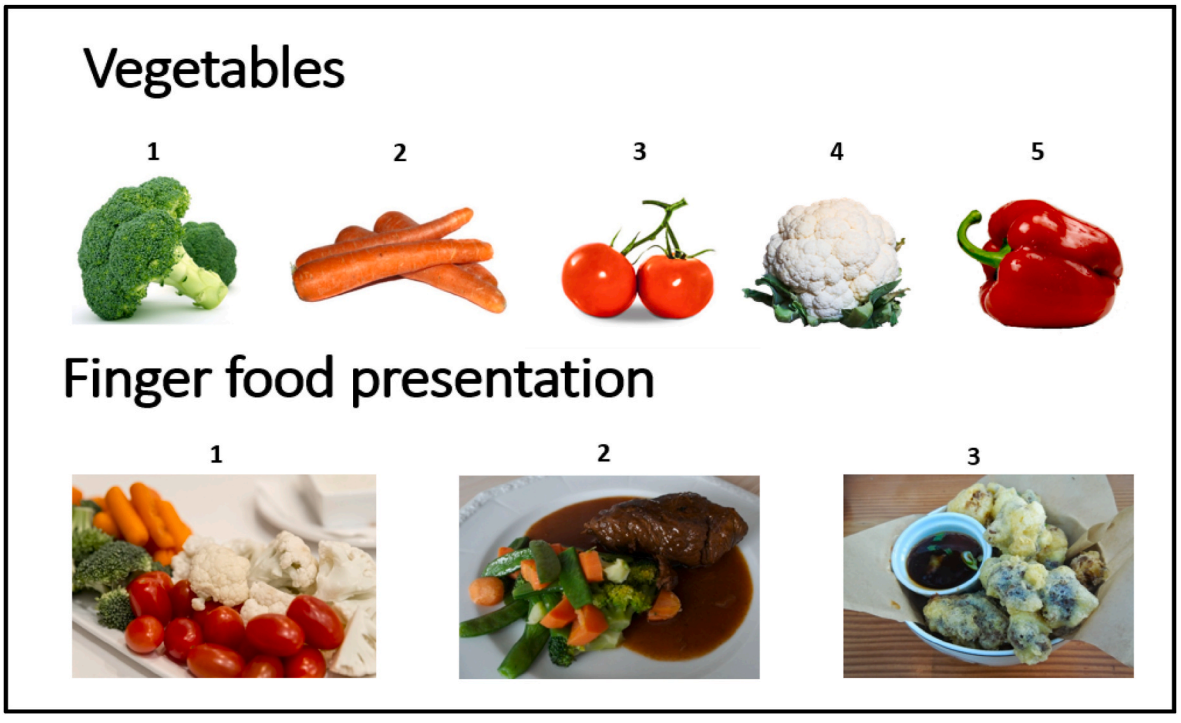

Fig. 4. The most appreciated and optimal vegetables and vegetable finger food presentations for those with motoric eating difficulties. Photo courtesy of Pixabay.com.

study by Mingioni et al. (2016). In addition to cabbage, potatoes and parsley, which were not included in the present study, the vegetables that were preferred by Finnish older adults were cucumber, cauliflower, carrot, beetroot, broccoli, green peas, mushrooms, red bell pepper, Brussels sprouts and green beans (Mingioni et al., 2016). Azzolina et al. (2010) found that the preferences for fruits, vegetables and legumes varied between countries, highlighting that knowledge concerning cultural preferences is important in being able to meet nutritional recommendations. Sweden and Finland share a cultural background and climate, which may be reflected in similar preferences for vegetables. However, numerous group and individual-level predictors, such as health status, geographic/physical environment, gender, marital status, household composition, social support, ethnicity, socioeconomic status, and dietary knowledge, will influence vegetable intake (Nicklett and Kadell, 2013).

Mingioni et al. (2016) found that Finnish older adults were more selective and neophobic towards fruit and vegetables than older adults from Poland, Spain, the United Kingdom and France. According to Elmadfa and Freisling (2009), this may be because the availability of fruit and vegetables has been limited in the Northern countries. The consumption of vegetables was low in the Nordic countries before the 20th century and often limited to peas, cabbage, leeks, onions, carrots, rutabaga, parsley roots, turnips, kale, and pulses. In the first third of the 20th century the interest in vegetables grew and tomatoes, cucumbers and peppers became frequently consumed, followed by broccoli, lettuce and Chinese cabbage (Andersen et al., 2019). However, a recent study found that there has been a linear increase in the intakes of vegetables, fruits, pulses, nuts, and berries among 70-year olds between 1971 and 2016 (Samuelsson et al., 2019).

Avocado, chicory, turnip, sweet corn, lentils, artichoke, aubergine, fennel and spinach were less preferred by Finnish older adults (Mingioni et al., 2016). However, in the present study, avocado was highly appreciated, with 80 participants reporting that they liked avocados. An explanation for this difference may lie in that, for quite some time, Swedes have been seen as so-called “early adopters” due to their willingness to try novel foods (Ritchey et al., 2003). Nevertheless, somewhat more modern or sensorially characteristic types of vegetables, such artichoke, corn, fennel, and aubergine, were only moderately appreciated, while butternut squash, Romanesco, sweet potato, celery, and green bell pepper were clearly those that were least liked.

Although radish and green bell pepper were significantly more appreciated by male respondents, this study did not show any large, general differences in vegetable preferences between female and male respondents. The finding that older males favoured pungent vegetables, such as radish and green bell pepper, was interesting in relation to the recent findings by Appleton et al. (2019), which suggest that adolescent males prefer vegetables with more subtle sensory properties. According to that study, the promotion of vegetables with sweeter tastes, more delicate flavours and brighter colours may be a promising route for increasing vegetable consumption specifically in males.

4.2. *Importance of texture and functionality*

The vegetable preferences did not differ among a more general older adult population. Among those experiencing major eating difficulties, texture was however found to be an important factor for determining vegetable choice. In this group, asparagus and haricot verts were avoided due to the stringy texture and peas and avocado were considered difficult to eat, due to lack of fine motoric skills. After excluding the least preferred and functionally suboptimal vegetables, this group was left with a considerably narrower range of choices, limiting vegetable options significantly (Fig. 5). Since chewing and swallowing difficulties are common among those with progressed Parkinson’s disease and atypical Parkinsonism (Kwon and Lee, 2019), fine, soft and smooth textures that require moderate chewing and is safe to swallow may be optimal for finger foods (Forsberg et al., 2022b). With regard to preparation methods, oven baked, raw and boiled were the most preferred preparation methods for vegetables among both a general older adult population and those with motoric eating difficulties. Mingioni et al. (2016) found that all preparation methods, including steamed, fried, raw, gratin, baked, braised, plain boiled and soup, were well liked by European older adults. However, braised and boiled vegetables and vegetable soup received the highest mean liking scores. This may indicate that the choice of cooking technique depends on the type of vegetable and dish. Moreover, due to their low viscosity, soups are not optimal as finger foods and are difficult to manage for those with motoric eating difficulties (See Fig. 5).

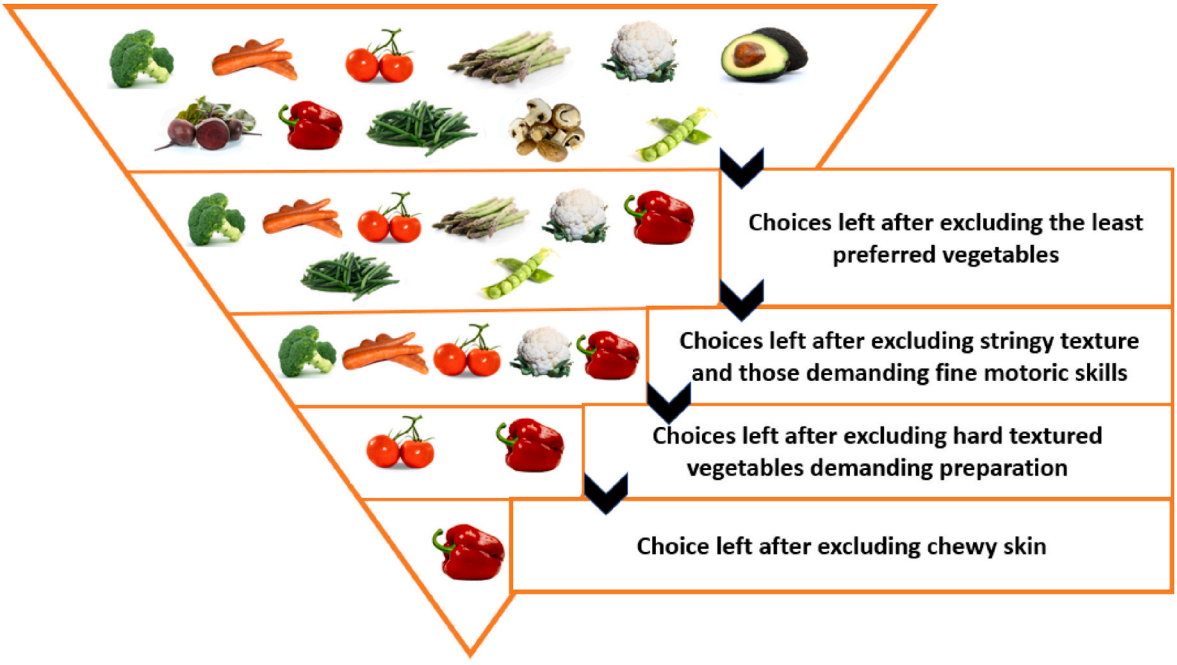

Fig. 5. The vegetable choice process model for older adults with eating impairments, inspired by that of Sobal and Bisogni (2009). Photo courtesy of Pixabay.com.

According to the focus group participants, vegetables as finger foods were preferably served as vegetable snacks, traditionally on the plate, deep-fried, or with some type of gripping tool/skewer. Forsberg et al. (2022a) found that, unlike other foods, eating vegetables with the fingers was not considered inappropriate. Several of the participants reported that they regularly ate fruit and vegetables with their fingers (Forsberg et al., 2022a) and that the appropriateness of finger foods was dependent on texture, size, shape, and manoeuvrability (Forsberg et al., 2022a). Vegetables are also easily prepared in handy chunks or sticks and often have a non-sticky surface. Gripping tools and skewers may not be functionally possible for those with major motoric eating difficulties who experience severe motor symptoms, such as tremor and reduced fine motor skills.

A variety of colours of vegetables were appreciated by the participants in this study. This corresponds with several studies reporting that colour is important for meal acceptability and food intake (Wendin et al., 2021; Meiselman and MacFie 2012; Nordlander et al., 2019; Mahadevan et al., 2014; Forsberg et al., 2022b). It may, therefore, be optimal to use a variety of colours of vegetables when tailoring vegetable finger foods, both to increase acceptance and the intake of vitamins and minerals. However, Parkinson's disease is associated with various visual symptoms, such as reduced visual acuity for all colours tested at various levels of contrasts except for yellow at low contrast (Armstrong, 2011; Gupta et al., 2019) (See Fig. 5). A previous study concerning important sensory attributes among older adults with motoric eating difficulties showed that it was important to separate the meal components on the plate. This may help in distinguishing the different meal components and facilitate autonomous eating for the target population.

4.3. Generalisability, validity and transferability

Since it has been difficult to reach out to the target group in our previous studies, we decided to apply a new approach in the data collection for this study. By conducting a mixed method sequential design, where the first quantitative phase was conducted with a more general older population, we were able to reach a larger sample. Although the survey was not conducted with the target population, the preferences for type, preparation methods and colour did not differ from the target groups' preferences. These may, therefore, be representative of an overall Swedish older adult population. Since all participants were of Swedish descent, the preferences of those who were born abroad may differ. However, in the study by Johannesson et al. (2021), 48% of older adults migrating to Sweden 20 years ago reported that they had changed their food habits since moving, and their fruit and vegetable intake had increased. There were also more female participants in this study, which may have resulted in less pronounced gender differences. The findings in this study may, therefore, only be transferable to Swedish and Scandinavian older adults. Generalisability of the requirements related to texture may also depend on type of disease causing the motoric difficulties and severity of eating difficulties.

The focus groups offered important insights into the texture and functional requirements of vegetables and vegetable finger foods that are important to consider in the development of vegetable finger foods for the specific target population. Although only one of the six participants in the focus groups had been diagnosed with Parkinson's disease, and the preferences and demands described in the study are not from a primary source, the descriptions come from spouses with experience of caring for their partners. Since they currently prepare the meals on a daily basis and have done so for a long time during the progression of the disease, the descriptions should be considered reliable. This approach may compromise generalisability and transferability, however it is a feasible way to make the voices of the target group heard.

It can be difficult to manage large focus groups online (Kite and Phongsavan, 2016) so it was decided to conduct the focus groups in small online groups. In addition, large groups may also negatively influence the depth of the discussion (Kite and Phongsavan, 2016), leading to results that are less in depth. Smaller groups gave the participants time to elaborate on their partner's preferences and experiences on a deeper level. This was valuable for the purpose of the study and, since contrasts in the demand for texture and function were observed, did not influence interaction.

5. Conclusion

The present study has added valuable insights to guide the development of vegetable finger foods that are enjoyed by the target population and acceptable to eat with the fingers. For those with major motoric eating difficulties, vegetable choices are clearly affected by the reduced ability to grip and hold, as well as to chew and swallow. The development of vegetable finger foods requires careful selection of the types of vegetables and preparation methods to ensure products that are safe and that will be appreciated. This study shows that vegetables as finger foods are preferably served as vegetable snacks, traditionally on the plate, or deep-fried. However, the vegetable finger foods should be further refined and combined with other finger food components to create attractive finger food meals.

Ethical approval

Ethical approval was received by an advisory statement from the Swedish Ethical Review Authority (Dnr: 2019–01691).

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Implications for gastronomy

This paper adds knowledge to the subject of gastronomy in several ways. Initially the paper describes preferences for vegetables, including colour, preparation methods and texture, among both a more general older adult population and those with motoric eating difficulties. This study also adds insights relating to the development of vegetable finger foods for older adults. For example, how to serve finger foods so that they are acceptable to eat with the fingers. In addition, older adults functional and textural demands regarding vegetables in relation to motoric eating difficulties are described.

Author statements

SF- Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Software; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing VO- Conceptualization; Methodology; Resources; Data curation; Formal analysis; Supervision; Writing - review & editing WB- Conceptualization; Methodology; Writing - review & editing; Supervision.KW- Conceptualization, Methodology; Funding acquisition, Project administration; Resources; Supervision; Writing - review & editing.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

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Paper V

Manuscript V

Finger food meals - A vehicle to improve autonomy, food intake and social interaction among older adults with motoric eating difficulties.

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Abstract

Introduction:

Purpose:

Material and method:

Result and discussion:

Conclusion:

Keywords

Motoric eating difficulties; older adults; finger foods; product development; evaluation.

1. Introduction

Motoric eating difficulties that result from symptoms such as paresis, weaknesses, pain, tremor, rigidity and slow movements may influence older adults' ability to handle cutlery and eat independently (Jacobsson, Axelsson, Österlind & Norberg, 2000; Westergren, Unosson, Ohlsson, Lorefält & Hallberg, 2002; Medin, Windahl, von Arbin, Tham & Wredling, 2011). Mealtimes become a struggle when the ability to eat according to established norms and manners decreases (Forsberg, Westergren, Wendin, Rothenberg, Bredie & Nyberg, 2022a; Nyberg, Olsson, Örtman, Pajalic, Andersson, Blücher, Lindborg, Wendin & Westergren, 2018). Motoric eating difficulties may result in loss of autonomy resulting in withdrawal from mealtimes, reduced food intake, and malnutrition, which impact quality of life (Nyberg, Olsson, Örtman, Pajalic, Andersson, Blücher, Lindborg, Wendin & Westergren, 2018; Nyberg, Olsson, Pajalic, Örtman, Andersson, Blücher, Wendin & Westergren, 2015).

There is a range of eating aids, such as modified mugs, plates and cutlery, that are specifically designed to support those with motoric eating difficulties. However, these types of aids may be difficult to use for those with major eating difficulties caused by severe motor symptoms. Finger food meals comprising components that are easy and acceptable for older adults with major eating difficulties to eat with the fingers may improve their ability to eat independently and result in increased food intake, which can in turn promote social interaction.

This study builds on previous studies focusing on the development of attractive, functional and nutritionally adapted finger food components as part of a complete meal (Forsberg, Olsson, Bredie, Verstraelen, Krona and Wendin, 2022b; Forsberg, Olsson, Bredie and Wendin, 2022c). These components comprised flatbreads, beef rolls, brown sauces and vegetables developed and evaluated based on the sensory preferences and requirements of older adults with motoric eating difficulties (Forsberg, Westergren, Wendin, Rothenberg, Bredie & Nyberg, 2022a; Forsberg, Bredie & Wendin, 2022d). The finger food components need, however, to be tested in terms of functional purpose and the potential benefits of such foods for older adults.

The aim of this study was to describe and analyse the eating situation with regard to autonomy, food intake and social interaction when using finger food meals compared to regular meals among older adults with major motoric eating difficulties >65 years of age.

2. Material and method

2.1 Observations

2.1.1 Data collection

The observations were conducted on two occasions during a lunch serving. On the first occasion a regular meal was served and on the second occasion a finger food meal was served. To facilitate the observations, an observation guide was created (Table 1) based on The Minimal Eating Observation Form-Version II (MEOF-II) adapted by Westergren, Lindholm, Mattsson and Ulander (2009). MEOF-II is used to assess eating difficulties among older adults and includes the components ingestion, deglutition, and energy. In addition, aspects regarding atmosphere, handling of cutlery and finger foods, and social interaction with other care recipients, professional caregivers and spouses, were added. Data were also collected through photographing the plates before and after the meals.

>Insert table 1 about here<

2.1.2 Recruitment

The recruitment was conducted in cooperation with help from the Network for Eating and Nutrition (NEN), which is a platform for cooperation over organisational borders in healthcare sectors in the northeast of the Swedish province of Scania (Pajalic & Westergren, 2014). An information letter was sent out to the unit manager of nursing homes describing the nature of the study and the need to recruit older adults >65 years with motoric eating difficulties for meal observations. The inclusion criteria were that participants were 65 years or older and had some type of eating difficulty. The personnel at the nursing home selected older adults that fulfilled the inclusion criteria and informed the older adults and their closest relatives about the study. Written consent was obtained by the relatives before the observations took place. The observations took between approximately 30 and 50 minutes. Notes were taken based on the observation guide.

2.1.3 Participants and setting

In total, six older adults participated in the observations (Table 2). Five females aged between 80 and 90 years, diagnosed with some type of dementia and living in nursing homes in southern Sweden, and one male aged 89 years, diagnosed with Parkinson’s disease and living in his own home with his wife.

>Insert table 2 about here<

2.1.4 Content analysis

Content analysis with a deductive approach was used to analyse the data (Elo & Kyngäs, 2008). The deductive procedure was divided into three phases: p*reparation*, *organising* and *reporting*. *The preparation phase* involved writing down short summaries of the main reflections after each observation. The *organising phase* involved sorting the observation findings for each participant into a template based on the main components in the observation guide; autonomy and food intake, energy, chewing and swallowing difficulties, and social interaction. The template was read through several times to obtain an understanding of the overall meaning of the data. The *reporting phase* involved describing the findings by contrasting regular meals and finger food meals. Descriptions of eating events from the field notes were used to visualise the meal situation.

2.1.5 Ethical considerations

Knläkmö'ä

3. Results

3.1 Regular meals

3.1.1 Managing to eat a meal using cutlery

Eating a regular meal was associated with a variety of difficulties and strategies. The difficulties observed were mainly related to slow movements, balance, stiffness and tremors, but there were also cognitive difficulties that were manifested by apathy and messiness. Most of the participants ate from a deep plate with a spoon and used their fingers to push the food up or poke the food down onto the spoon. The deep plate served as a substitute for the knife since by lifting and tilting the plate up and down and back and forth, the food would run down and collect on the edge of the plate. The edges of the plate were then also used to force the food onto the spoon, something that would have been impossible with a flat plate or if the plate had been lying flat on the table.

> "Participant 1 uses only one hand during the meal and therefore has difficulty getting the food up onto the spoon even if he presses the spoon against the edge. He rests the plate so that one side is raised. The brown sauce then runs down from the top of the plate and on the way down it collects the food which then settles on the edge. Then he pokes food from the edge onto the spoon by gently using his index finger."
>
> "Participant 2's hands shake, which makes it difficult for her to get the last bits of food off the plate. She leans over the plate, lifts up one edge, moves the plate back and forth with her hand

> so that the food collects on the edge and the food is then pushed onto the spoon by pressing it against the plate."
>
> "Participant 3 leans over with his mouth against the plate and tries to shovel the food into his mouth."

Participants spend a lot of time and energy consuming food while also trying to avoid spilling it. It is slow movements and balance problems that, above all, make it difficult for the participants to bring the food to their mouths once they have managed to get the food up onto the spoon. One scenario is that the food falls off the spoon or fork, often just when the spoon reaches the mouth. Another is that there are difficulties getting the spoon into their mouth; some insert the spoon obliquely into their mouth and others do not manage to open their mouth wide enough to get the spoon and the food in. As a result, the food falls from the mouth and the sauce run from the corners of their mouth and chin.

> "Participant 4 struggles to get spiral macaroni onto his fork, three macaroni lie on the fork but two fall off onto the table and the floor on the way up, only one macaroni ends up in his mouth."
>
> "Participant 3 eats blueberry soup with a spoon, the spoon goes crookedly into her mouth each time and half the soup on the spoon run down over her chin and apron, she tries to lift the plate up to her mouth to avoid spilling."

Not being able to get the food up onto the spoon and into the mouth leads to frustration. The fingers can help catch food that is spilled, pick up and push food into the mouth, or help the spoon go into the mouth by opening the mouth with the fingers and pushing the spoon in. Some of the participants even lifted the plate up to their mouths to take a bite of something, for example, a piece of meat. Another disadvantage of not being able to manipulate the food properly on the plate is that it is difficult to get some of every component onto the spoon. Instead, participants have to settle for one spoonful of each component at a time.

> "Participant 4 tries to balance a large piece of meat on the fork, she slowly and shakily moves the fork to her mouth but the piece of meat is too large and she has trouble getting it into her mouth."
>
> “Participant 3 has difficulty finding her mouth and getting the spoon in straight. She pushes the spoon forcefully into her mouth using her hand. She fills the spoon to the brim, with high piles of food, and then takes two smaller bites from it.”
>
> "Participant 2 expresses difficulties in getting larger pieces up onto the spoon. She leans over the plate and lifts one edge of the plate to help scoop the food onto the spoon. A little frustrated, she lifts the plate up to her mouth and takes a piece of chicken with her mouth instead."

3.1.2 Social interaction

Whether eating at a nursing home or in one's own home, there is not much time for social interaction. Instead, the conversation conducted at the table revolves mostly around the meal and the best way for it to be carried out. At a nursing home, professional caregivers regularly encourage and remind participants to eat, and help them put food onto the spoon. Some of the participants need full or partial help with feeding to be able to eat anything at all. One of the participants eats nothing and is difficult to communicate with, and the staff struggle to get the food into her.

> "Participant 6 is sitting and dozing throughout the whole meal, the staff remind her to eat. She takes a sip of her soup served in a mug and dozes off again. After more encouragement, she takes another sip before dozing off again."

Even in their own home, the relatives coach the participants about the best way to eat the food. Relatives portion out and divide up the food on the plate, and then serve the food at the table, encouraging participants to focus on the meal instead of the food being spilled.

> "The wife of participant 1 encourages him not to care about what he spills; "We'll sort it out later", "it can be washed." She says the most important thing is that he eats the food, and she encourages him to use his fingers to help."

The social interaction between the residents of the nursing homes varies between the different tables. At one table some of the residents sit together and talk, they stay for a long time after the meal and have a good time together. The observation participants are scattered throughout the dining room; they sit quietly and focus entirely on eating their meal. After the meal they sit and talk, even if they talk somewhat incoherently. The other table guests do not seem bothered but comment on a couple of occasions when food is spilled.

> "Participant 2 talks to the others at the table even though none of them talk about the same things. They also comment when there is food on the table and floor. She looks around and cuddles herself a little, dries and wipes around her mouth with the bib, and cleans up after herself, pushing a piece of chicken on the floor with her foot before asking for help from the staff."

3.1.3 Energy levels and difficulties chewing and swallowing

Despite the difficulties of manipulating the food and bringing it to the mouth, most people in nursing homes are able to consume a whole meal including both main course and dessert. Only one of the participants is unable to consume a whole meal and falls asleep during the meal. None of the participants ask for or accept an extra portion of food. Regarding chewing and swallowing difficulties, there are some participants who mainly have difficulty chewing,

with meat being especially difficult. In their own home, the participant eats well and takes an extra portion with the encouragement of his wife.

> "Participant 4 has no pronounced problems chewing and swallowing, but the ragu meat in the regular meal is dry and hard. She has difficulty chewing a large piece of meat and takes it out of her mouth with the help of her hand and puts it back on the plate again."

> "Participant 5 puts her finger in her mouth to show the nurse feeding her that the food has collected in her cheek, and she repeatedly expresses her concern about it getting stuck in her throat."

> "Participant 1 has a little difficulty chewing and swallowing according to his wife, so the food is adapted to his needs. He is given soft food and avoids food that can get stuck in his throat. He chews for a long time, but no food accumulates in his mouth or in his throat."

3.2 Finger food meals

3.2.1 Managing a meal with fingers

None of the participants reacted noticeably to being served a meal in which they were encouraged to eat with their fingers. Some began to eat immediately without any hesitation about what they should do, and they expressed themselves in a way that indicated that it was not at all strange for them to eat with their fingers.

> "Participant 1 does not react noticeably to his wife telling him to eat with his fingers, but he starts by feeling the whole plate with his fingers and feeling the components."

> "Participant 2 expresses no discomfort or reaction to eating with her fingers. When the plate is placed in front of her, she asks for a spoon, whereupon the staff tell her that it is a meal you can eat with your fingers. "I'm glad I washed my fingers," she said."

> "Participant 4 receives the food served on the plate at the table. They do not hesitate before the task of eating with their fingers and neither do they show any reaction."

Other participants sat and looked at the plate and did not really seem to understand what to do or what was expected of them.

> "Participant 5 is not sure what to do with the food. She sits and looks at the plate and takes the food, twisting and turning it. Then wipes her fingers on the bib."

> "Participant 3 seems to have difficulty understanding how the meal should be ingested, she sits and looks at the meal, touching the pieces gently with her fingers. She doesn't express any discomfort from touching the food with her fingers but says several times that she's not hungry."

There were many different ways to approach the finger food meal. Some of the participants ate one component at a time while some varied this by eating a little of each component. Some dipped the components in the sauce while others did not touch the sauce at all.

"Participant 2 lifts up the sauce bowl with her right hand and puts it in her left hand, then she uses her right hand to hold the components and dip them in the sauce. She eats a little of all the components, varying the intake. Picks up, dips, bites and puts back."

"Participant 1 starts by breaking off the bread and dipping it into the sauce and then eats one component at a time, he has no problem bringing the food up to and into his mouth."

"Participant 3 lifts up the bread and eats it as it is, then she continues with the deep-fried vegetables, potatoes, carrot and vegetables without dipping them in the sauce. She starts eating a beef roll but doesn't seem to understand what the bowl of sauce is for."

"Participant 4 eats with both hands, meat in one hand and carrot in the other. She holds the bread with both hands as if it's a hamburger, dipping it in the sauce, biting off a bit and putting it back on the plate."

"Participant 5 picks up a beef roll and dips it around on the plate, then she holds the ends in each hand like a rib and bites the beef roll in the middle. Next, she eats some oven-baked vegetables and deep-fried vegetables. She puts the glass on the plate and pushes the plate away. She pulls the plate out again and doesn't seem to understand that it's food."

Participant 6 feels the meat with their fingers and squeezes it a little, eats the deep-fried vegetables and bread, but is very reluctant to eat."

Although those in nursing homes were diagnosed with dementia and were partly oblivious of the requirements for table manners, there were times when it was possible to glimpse attempts to maintain normative eating during the meal.

"Participant 4 first eats with her fingers without any problems, then she uses the bib to lift a piece of potato into her mouth to avoid touching it with her fingers. She also tries holding two pieces of carrot and using them to lift a piece of potato into her mouth only to then start eating with her fingers again."

"Participant 2 states that their fingers are sticky after the meal and is given a napkin to wipe their fingers on."

The finger food meal was appreciated; several of the participants thought it tasted good and the finger food components worked well in that they could be held and brought to the mouth. The bread, oven-baked vegetables and deep-fried vegetables worked for all the participants: however, pieces of oven-baked broccoli and cauliflower that are too large are difficult to handle and bring to the mouth without spilling. The bread was not used to hold the meat as intended but no one expressed discomfort at taking hold of the meat with their fingers. Participants ate several pieces of bread, some dipped it in the sauce, others did not.

"Participant 1 starts by breaking off the bread and dipping it into the sauce. His wife encourages him to take the meat with the help of the bread, but he grabs the meat with his fingers and dips it in the sauce without thinking about it."

"Participant 2 states that the food is good and that the meat tastes good."

"Participant 2 picks up a piece of cauliflower that falls apart when it is brought to the mouth."

"Participant 3 lifts up the bread and eats it as it is."

The sauce was served in a sauce bowl so that it would not become sticky on the plate. The sauce was liked by the participants who had different approaches to eating it.

"Participant 1 feels for the sauce bowl on the plate and tries to dip the components in it, a little here and there on the plate. His wife takes his hand and brings it to the sauce bowl. He dips the meat into the sauce that sticks to the components without running off. He asks for more sauce."

"Participant 2 holds the sauce bowl in her left hand and brings it up to her mouth and she sucks the sauce up with her lips and then places the sauce bowl at the side of the plate next to the drink."

"Participant 4 lifts up the sauce bowl with her left hand and asks if she is allowed to dip her finger in the sauce. The staff say yes encouragingly and then she dips her finger in the bowl and lifts a large dollop of sauce up to her mouth."

At one of the nursing homes, the staff pour the sauce onto the plate to make it easier for the participants. This means that there is sauce on the vegetables and their fingers, and one of the participants, who does not seem to understand that it is food, starts to mess with the components on the plate.

"Participant 5 fills the sauce bowl with potatoes, carrot, meat and bread and presses everything down with her hands. She picks up and eats some oven-baked vegetables and deep-fried vegetables then she presses the food with a piece of bread and pushes away the plate. She gets sauce on her hands which she wipes away with a napkin and then pushes it onto the plate."

At home, a participant is able to grasp, hold and eat the components independently. However, his impaired vision makes it difficult for him to diminish the components on the plate.

"Participant 1 tries to grab an engraved flower bouquet in the chinaware, thinking it is deep-fried broccoli or cauliflower."

3.2.2 Social interaction

Even during a finger food meal, the meal at the nursing home revolved around making the meal work for the residents. The professional caregivers encouraged the participants to eat with their fingers and helped those who they perceived to be unsure and confused about what to do by showing them and putting the food in their fingers and dipping it in the sauce.

"Participant 5 is reminded by the staff that it is food and that she should taste it. They try to help her by putting a piece of potato, a piece of meat and some bread in her hand and encouraging her to dip them in the sauce and put them into her mouth."

"Participant 3 is encouraged to take more food and the staff show her how the sauce bowl should be used. The staff encourage her to eat with her fingers and help to show how she can hold, dip and bring the food up to her mouth."

The social interaction with relatives in their own home, demanded less coaching as the husband was able to eat the finger foods independently which opened up the possibility for other subjects in the conversation. The social interaction between the participants in the dining room of the nursing home is no different from the interaction at regular meals. No one reacts to the participants being served different food because they are used to many residents being prescribed other food for different reasons. However, during the meals at one of the nursing homes, one of the residents at another table reacts to the participants sitting and eating with their fingers. She wonders several times why they are eating with their fingers, which also directs the attention of others to the table where the participants are eating.

> "One of the residents at another table asks them why they are doing that? She and the other residents are also watching. Then she turns her chair around and sits and follows the meal with skeptical body language."

After the meal, the woman then looks for the staff in the kitchen to ask them why the residents ate with their fingers. The staff explain that they have been testing finger foods because they have difficulty eating independently with cutlery. The woman immediately softens and says that she wishes the staff had informed her so that she knew what it was about.

3.2.4 Energy levels and difficulties chewing and swallowing

There were no major differences between a regular meal and a finger food meal in terms of the energy required to consume an entire meal. One participant who received help with feeding because she was unable to consume a meal on her own was also unable to eat a finger food meal. The participant who received partial feeding help was able to eat a whole finger food meal on her own and also took more food on two occasions. One participant who had previously eaten a whole regular meal did not complete the finger food meal, saying several times that she was not hungry. Another participant who had previously consumed a liquid diet when she did not want to eat proper food ate oven-baked and deep-fried vegetables as well as the bread.

> "The professional caregivers refill the plate with deep-fried vegetables and bread for participant 6 because these seem easier for her to eat."

Only one of the participants expressed difficulty chewing the beef roll but was encouraged by his wife to use the sauce.

> "Participant 1 expresses that the meat is a little dry and is then reminded by his wife to dip the meat in the sauce so that it becomes easier to chew. He dips the beef roll in the sauce before putting it into his mouth."

The participants ate more when the food was presented in front of them than when the professional caregivers asked if they wanted a second portion.

4. Discussion

4.1 Results discussion

Aim of the study

Findings regarding the finger food meal.

Findings regarding food intake, autonomy

Findings regarding social interaction with spouses and professional caregivers.

Findings regarding social interaction with other recipients.

4.2 Methodological considerations

5. Conclusion

Cognitive impairment

Not for everyone, individual assessment important.

Care professional and spouses have an important role.

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Table 1. Observation guide used to facilitate the observations

PARTICIPANT UNDER OBSERVATION
Description of the observation participant (Age, gender, disabilities, diagnoses of relevance, chair/wheelchair, etc.)
BEFORE THE MEAL
Washing hands before meals
Location (how many people sit together? / How are they placed?)
Other
AUTONOMY AND FOOD INTAKE
Sitting position (sitting normally/ without support)
Eating support efforts (eating in seclusion for peace and quiet/ eating aids e.g. customised cutlery / help putting food on the plate / encouragement and reminding to eat and drink / orally and/or by physically guiding around the plate during meals / dividing the food on the plate / feeding, in whole or in part)
Manipulation of food on plate (no spillage, no aids, using both hands)
Transportation of food to the mouth (no spillage, finds the mouth directly, no aids)
How does the person keep hold of the food? (one hand/both hands/ when it is regular food - how is cutlery held)
Has difficulty taking food with the fingers? Are some things more difficult than others?
Uses the various food components to "help" transport the food from the plate to the mouth
In what order are the different components eaten? One thing at a time or mixed? (uses a new way to "navigate" among the food components on the plate?)
One bite in the mouth/or ”bites off” a piece of the food? Difficulties with this? How to deal with possible residue after "biting off")
Drink taken with the food (type, amount, how e.g. glass, mug, straw)
Other
CHEWING AND SWALLOWING
Manipulation of food in the mouth (chews, ordinary consistency, does not accumulate)
Swallowing (no coughing, no extra concentration, no/only small residue left in the mouth)
Are there difficulties chewing food due to problems with teeth, mouth or dentures? (Never, rarely, once in a while, quite often, very often)
Other
ENERGY/ APPETITE
Eats 1/1 serving (100%), 3/4 serving (75%), 1/2 serving (50%) or less
Energy (completes an entire meal without slowing down/fluctuating in execution of eating process, stops eating only when he/she feels full)
Appetite now compared to before? (greatly increased, increased, normal, reduced, greatly reduced)
How long does a meal take? (starts eating at …. And finishes eating at…..)
Other
SOCIAL INTERACTION
The interaction with the staff (encouragement, attitude, social interaction, staff's level of treatment or service during the meal, staff’s ability to interact with the individual and meet their needs)
The interaction with other guests at the dining room (other guests’ reactions, attitudes, social interaction)
Other

Table 2. Description of the participating older adults

Participants	Gender	Age	Diagnosis	Living accommodation
Participant 1	Male	79	Parkinson's disease	Own home
Participant 2	Female	89	Stroke/ Vascular dementia	Nursing home
Participant 3	Female	91	Unspecified dementia	Nursing home
Participant 4	Female	91	Vascular dementia	Nursing home
Participant 5	Female	82	Alzheimer's disease	Nursing home
Participant 6	Female	74	Alzheimer's disease	Nursing home