Food Quality and Preference 48 (2016) 345–358

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

The eating capability: Constituents and assessments

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ARTICLE INFO

Article history:
Received 28 May 2014
Received in revised form 13 March 2015
Accepted 14 March 2015
Available online 20 March 2015

Keywords:
Eating capability
Food oral processing
Texture modification
Mastication
Swallowing

ABSTRACT

With the rapid growth of elderly populations, the food industry is under increasing pressure to provide texture-modified food for safe consumption by these vulnerable populations. The imminent technical challenges to the manufacturing of food for elderly consumption are the lack of knowledge of the elderly's physiological capability to eat and swallow and, particularly, the lack of technical guidance in matching texture properties with the individual's capability of eating. This review proposes the term "Eating Capability" to represent the individual's abilities for food consumption. This term collectively includes the following four groups of quantifiable parameters: food handling capability (e.g., hand gripping, finger gripping, and coordination), oral manipulation capability (e.g., lips sealing, biting and mastication, tongue pressing, and swallowing), oral sensing capability (e.g., tasting and texture discrimination), and cognitive capability (e.g., information seeking and processing, opinion forming, and decision making). According to this definition, various capacities related to eating performance and, particularly, the implications of any impairment in such capability are discussed in detail in this paper; we pay particular attention to vulnerable elderly consumers. Another primary objective of the review is to introduce feasible techniques and methods that are currently available for quantitative assessment of these parameters. With the growing research activities in food for elderly, we hope that this review will stimulate new thinking and help the food industry to establish novel techniques to design and manufacture quality food for safe consumption by elderly people.

Contents

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http://dx.doi.org/10.1016/j.foodqual.2015.03.008
0950-3293/

1. Introduction

It is common knowledge that ageing will cause inevitable weakening of one's physical, physiological, and mental capability. This weakening is also true for eating and oral food consumption in many elderly people. An immediate effect of eating difficulty is reduced food intake, an increased risk of malnutrition and, possibly, more infections among elderly people (McLaren & Dickerson, 2000; Ono, Hori, Tamine, & Maeda, 2009), as well as a compromised quality of life. For these vulnerable consumers, texture modified diets are required to ensure safe consumption.

To date, eating difficulties have mostly been studied from the perspective of personal care, especially in nursing interventions with elderly (Westergren, Unosson, Ohlsson, Lorefält, & Hallberg, 2002) and in the stroke population (Jacobsson, 2000). For example, Westergren et al. (2002) studied eating difficulty among elderly living at home and in the hospital by observing individuals' eating habits during a regular meal. These researchers observed difficulties, such as in sitting, manipulating food on the plate, transporting food to the mouth, opening and closing the mouth, and swallowing, and found a close association of a high level of eating difficult with low energy intake and malnutrition. In a separate study, Jacobsson (2000) drew similar conclusions after studying the eating behaviour in people affected by stroke as well as in healthy elderly people. The author also video-recorded subjects consuming test-meals with different consistencies (thin liquids, thick liquids, jelly drinks, banana and crispbread) and analysed their eating performance. The proper identification of difficulty in eating actions helped both the carer and patient develop an appropriate rehabilitation strategy.

However, Jacobsson (2000) noted the lack of reliable instruments for eating assessments. Assessments of an eating processing and the capability of food oral consumption have thus far largely been experience-based and subjective. Assessments were qualitative and easily influenced by the observer (Jacobsson, 2000). Outcomes from such assessments were not often comparable between different studies. Therefore, it is desirable to establish easily quantifiable parameters and methods for objectively assessing these parameters. For this reason, the authors of this paper propose "*Eating Capability*" as a collective term to represent an individual's capability of oral food consumption. Based on the fact that eating involves a series of food–body interactions, the term eating capability should be a combination of one's physical, physiological, and mental-coordination capabilities in handling and consuming food. This paper will explain the physical and physiological meaning of these capabilities and important implications if one such skill is impaired. The main focus of discussion is on the feasible methods for quantitative assessment of these capabilities. Our long-term aim is to establish possible correlations between one's eating capability and the textural properties of food to ensure safe food consumption by vulnerable elderly consumers.

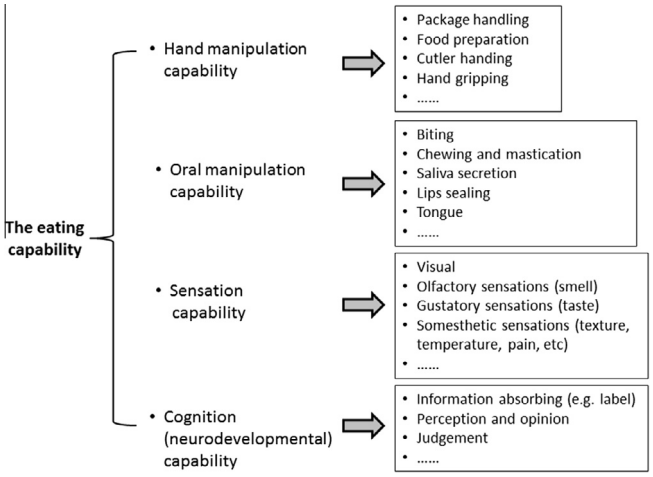

Fig. 1. An overview of the capability of eating, its major components and some representative parameters.

2. Constituents of the eating capability

During an eating process, one has to perform a sequence of coordinated actions. Before food ingestion, the following actions must occur: manipulating food on the plate with hands or cutlery, lifting up food for ingestion, jaw lowering for mouth opening, and more. After food is ingested in the oral cavity, the following are performed either sequentially or simultaneously: jaw lifting and mouth closing, biting, mastication, transporting, mixing, sensory detecting, saliva secretion, bolus formation, swallowing, and more. All of these actions also involve opinion formation and decision-making. To perform all of these actions, some specific capabilities (physical, physiological and mental) are needed for execution and precision.

The associated capabilities needed for an eating process can probably be grouped into the following four categories: the hand manipulation capability, oral manipulation capability, sensation capability, cognition (mental) and coordination capability. All of these capabilities can be collectively termed as the Eating Capability, as shown in Fig. 1. Each category of the eating capability can further be characterised by some associated measureable parameters. The meanings and implications of capability impairment will be discussed in detail in the following sections.

2.1. Hand manipulation capability

The hands are the most versatile parts of the human body, and they are essential tools for all sorts of situations in our daily life. Any injuries, diseases, or distortions of the hand can affect our quality of life (Olandersson et al., 2005). In relation to eating, the hand manipulating capability is important both before and during the course of a meal (food preparation and hand cutlery manipulation). This capability can be defined as the ability of an individual to exert an appropriate force, in a coordinated manner, to manipulate food from package opening until it reaches the mouth. In relation to self-feeding, the following four types of actions require hand manipulation: food package handling and opening;