Attractiveness and consumption of finger foods in elderly Alzheimer's disease patients

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A R T I C L E   I N F O

Article history:
Received 9 January 2013
Received in revised form 24 October 2013
Accepted 21 December 2013
Available online 3 January 2014

Keywords:
Finger food
Alzheimer's disease
Food attractiveness

A B S T R A C T

Finger foods are helpful for patients with Alzheimer's disease because they enable them to eat alone with their fingers rather than with cutlery, once this has become too difficult to use. By applying this solution, patients with Alzheimer's disease can gain in autonomy and rediscover the pleasure of eating on their own. However, the provision of attractive finger foods is essential to ensuring that these patients will be willing to choose and consume them. In this context, the aim of our study was to investigate the attractiveness factors of finger foods to Alzheimer's disease patients. Three parameters for the formulation of finger foods (the addition of a sauce, changes to shape and contrast) were thus studied as a result of interviews with 19 professionals in nursing homes. They were then tested separately using paired comparison tests in real-life mealtime situations. 114 Alzheimer's patients living in nursing homes participated in this study. The results showed that the finger foods with a sauce (vs. no sauce) and with two layers (vs. one layer where all ingredients were mixed) were more frequently chosen first and then consumed. By contrast, the shape (moulded vs. squared) of the finger foods had no significant impact on first choice and food consumption. These findings support the view that Alzheimer's patients are able to make food choices when offered alternatives; choosing first and consuming more of the alternatives most attractive to them. Future research efforts will focus on a more detailed investigation of food attractiveness related to the food perceptions of AD patients.

1. Introduction

Alzheimer's disease (AD) is a neurodegenerative disease characterised by a progressive loss of cognitive functions. In the elderly, AD is the principal cause of dementia; it affects 4% of people aged over 60 years, which represents 24 million people worldwide (Ferri et al., 2005; Wimo & Prince, 2010). Because AD leads to a loss of autonomy, residential care in an institution is sometimes considered the best solution for the elderly parents of a family.

Mealtimes in institutions for elderly people with AD are important for at least two reasons. On the one hand, meals need to provide a sufficient nutritional intake. Indeed, age and particularly AD, are risk factors for malnutrition (Pirlich & Lochs, 2001). Eating disorders such as anorexia, and other behavioural problems such as wandering, may both lead to a reduction in food consumption and an increase in nutritional needs, and are generally accepted as being major causes of the malnutrition observed in the context of AD (Ferry et al., 2007; Pohlmian & Dvorak, 2000). Moreover, a poor nutritional status is a risk factor for placement in an institution among elderly patients with AD (Andrieu et al., 2001).

On the other hand, mealtimes are important because they are often the only social activity of the day for AD patients in institutions. In this context, it is important that these events should be made as pleasant as possible, by encouraging food pleasure (Manthorpe & Watson, 2003). Thus the food offered during meals for elderly people with AD needs to take account of both their nutritional needs and its attractiveness to these patients; that is to say, their willingness to choose and then consume the food supplied.

Eating can be difficult for people with AD because of the psychological, physiological and physical changes that occur with age and disease. Elderly AD patients may suffer from chewing difficulties because of poor dental status and a loss of masticatory efficiency, due to age and disease, respectively (Mioche, 2004; Miura, Yamasaki, Kariyasu, Miura, & Sumi, 2003; Weijenberg, Scherder, & Lobbezoo, 2011). They may also suffer from xerostomia –
characterised by a dry mouth sensation – due to age and medication (Nagler, 2004), and from impaired swallowing because of AD (Easterling & Robbins, 2008). Impaired swallowing (dysphagia) can lead to aspiration and aspiration pneumonia, the principal cause of death among frail AD patients (Madhu, 2003). Elderly AD patients also present with sensory losses due to age and disease, with a decrease in gustatory and especially olfactory acuities which may be responsible for a lack of interest in food (Schiffman & Gatlin, 1993).

The cognitive impairments concomitant with AD can change food relationships for several reasons, such as a loss of concentration during mealtimes, difficulties expressing feelings or needs (aphasia), problems identifying foods (agnosia) or an inability to use cutlery properly (apraxia) (Aseilge & Amella, 2010). Because of these difficulties, elderly people with AD lose their ability to feed themselves, which results in a loss of autonomy that may be partially responsible for a reduction in food intake and poor nutritional status (Chang & Roberts, 2008). Indeed, being unable to bring food to the mouth and make choices have been shown to be correlated to an inadequate food intake and weight loss among elderly people with AD (Berkhout, Cools, & Van Houwelingen, 1998). Difficulties during mealtimes may therefore lead to a loss of autonomy and a reduction in food attractiveness, which in turn exert a negative influence on food intake and the nutritional status of AD patients.

Different strategies to overcome these problems have been described, such as adapting foods to swallowing difficulties by using modified textures (Pennman & Thomson, 1998). Offering food supplements between meals, or the protein enrichment of foods, have also been widely investigated (Hanson, Ersek, Gilliam, & Carey, 2011).

Another solution consists in offering food in a form that can be eaten easily with the fingers, or “finger foods”. This obviates the need to use cutlery and is helpful for patients with praxia disorders like those encountered in AD. Indeed, it has often been seen that these patients use their fingers increasingly when eating, even if the food is not suitable; e.g. puréed food. Even though providing food on a liquid form (such as food supplements with an appropriate presentation) might be a good solution to increasing food intake by these patients, finger foods offer an alternative means of providing solid food that is more similar to a standard meal. Many authors have considered the benefits of finger foods in improving the autonomy of people with dementia (Barratt, 2004; Benattar & Lemoine, 2009; Finley, 1997; Le Clerc & Wells, 1998). These authors postulated that by giving AD patients an opportunity to feed themselves, they will eat with more pleasure and so increase their food consumption. Moreover, an American study found that finger foods were a solution judged by health professionals (57 dieticians and 92 directors of nursing services) as being useful, cheap and easy to introduce into institutions (Cluskey & Kim, 2001).

Soltész and Dayton (1995) showed that an increase in food consumption and the maintenance of weight status occurred when more finger foods were offered in menus for 54 AD patients living in a specialised institution. Ford (1996) found that seven out of 10 patients with dementia in a medical centre improved their food intake and gained weight following the introduction of five small meals made up of finger foods. Jean (1997) also demonstrated an increase in nutrient intake and a reduction in weight loss after piloting a finger food menu for cognitively impaired residents in long-term care facilities. All these studies were designed to investigate the impact of a finger food menu on dementia patients by evaluating their food consumption and weight curves by comparison with a standard menu (foods in their original form).

There is every reason to believe that finger foods can help people with AD to improve their autonomy and increase their food intake. Finger foods can therefore constitute a real added value for healthcare professionals as this solution can integrate a care strategy which addresses the eating difficulties encountered by their AD patients during mealtimes, while at the same time sustaining their ability to eat alone and exercise their free will. However, the concept of finger foods is very broad; they may be sandwiches, layers of vegetables and fruits (Benattar & Lemoine, 2009; Ford, 1996; Soltész & Dayton, 1995) or specific products produced using puréed food and then reconstituted (Bakkine, 2011). Healthcare professionals may therefore be challenged when it comes to producing such finger foods, and the practicalities relative to their formulation. Is it better to offer textured-modified finger foods? What are the best shapes and sizes for finger foods? Will the finger foods I make be appreciated and eaten? etc. The views expressed by these professionals emphasise the fact that although finger foods can overcome the praxis disorders encountered in AD, many other factors related to food preferences and the changes which occur with age and disease (such as xerostomia, dysphagia, sensory and memory losses, etc.), must also be taken into account when offering foods that will ensure the willingness of AD patients to choose and then consume them.

To our knowledge, no scientific research has yet been carried out on how finger foods should be offered to AD patients. In particular, very few studies have tried to determine the modulation of sensory properties when AD patients eat finger foods and how attractive they are to these patients. Indeed, it is notably complex to investigate the attractiveness of foods to AD patients in institutions because of their cognitive impairments. In particular, direct measurements of food preferences are not possible in AD patients who suffer from aphasia. To study finger food attractiveness among people with AD, we therefore chose to perform an indirect evaluation by postulating that the more attractive the finger foods, the more the patients would choose and consume them.

In this context, the aim of our research was to investigate the attractiveness of finger foods to people with AD by studying the choices and consumption of different finger foods as a function of three formulation parameters. These parameters were selected following interviews with 19 professionals of nursing homes for their potentially positive influence on food attractiveness to AD patients. The three selected parameters were studied separately: the addition of a sauce (with vs. without), or a change in shape (squared vs. moulded) or contrast (in one vs. two layers), using paired comparison tests in real-life mealtime situations.

2. Materials and methods

2.1. Formulation parameters – preliminary interviews

The formulation parameters investigated during this study were chosen according to the findings of 12 preliminary interviews with healthcare professionals. The purpose of these interviews was to determine parameters that could have a positive effect on the attractiveness of foods to AD patients (depending on their modulations) and would include essential features to enable AD patients to taste the finger foods without being at risk of choking. The different formulation parameters were then applied to designing the finger foods that would be provided during the study.

Nineteen professionals from four different nursing homes participated in these interviews (11 auxiliary nurses, two registered nurses, three occupational therapists, two geriatricians and one manager). Three focus groups involved the auxiliary nurses in order to encourage exchanges on their experiences with AD patients during mealtimes. Eight medical staff were interviewed separately, in order to obtain practical and clinical information. The focus groups and individual interviews were divided into three phases: (1) presentation of the subject: “what are the difficulties encountered by
AD patients and how can they be managed?“ (ii) definition of the finger food solution for people with AD and (iii) investigation of the factors for food attractiveness (including finger foods) to people with AD. The focus groups and individual interviews were audio recorded and then analysed using a thematic analysis.

These interviews revealed three fixed parameters for formulation: the finger foods had to be easy to pick up with the fingers, they had to be produced using pureed food (as the most patients with AD and praxis troubles also suffer from dysphagia) and each unit of finger food had to be large enough to be eaten in a minimum of two bites (to stimulate the oral phase and avoid the risk of choking). These fixed parameters were therefore integrated in the formulation of all the finger foods given to patients during this study.

Three investigative parameters were then selected following the interviews: shape, the presence of sauce and the visual contrast of finger foods. These three parameters were identified as having a potential impact on food attractiveness because they could address some of the physical, psychological and/or physiological changes that occur with age and disease. According to the interviewees, shape was important to optimise food grasping (adaptation to physical disorders) and the visual appeal of the finger foods. The presence of sauce appeared to be an important element because older generations of French people are used to eating dishes that include a sauce (memory stimulation). Moreover, sauce can contribute flavour to finger foods and may compensate for sensory losses. Sauce was also identified as a way to moisten the foods and thus reduce the effects of xerostomia. The interviewees also felt that not mixing meat, fish, vegetables, etc. together in finger foods was important in order to gain the attention of people with AD (psychological changes) by offering visual cues for what they eat (memory stimulation) and creating a visual contrast to compensate for sensory losses.

For each selected parameter (sauce, shape and contrast), standard and alternative finger foods were offered to the participants during this study. For the sauce parameter, the alternative finger foods were presented with a sauce (which had been used in the classic menu and thickened by the addition of corn starch), while the standard finger foods were not. For the shape parameter, the alternative finger foods were cooked in individual cylindrical moulds (moulded finger foods) whereas the standard finger foods were presented with a sauce (memory stimulation). For the contrast parameter, the alternative finger foods were cooked in two separate layers of ingredients while the standard finger foods were not. For the shape parameter, the alternative finger foods were presented in two separate layers of ingredients while the standard finger foods were presented in one layer.

The addition of sauce and the shape and contrast parameters were investigated using paired comparison tests. On each day, the participants received both standard and alternative finger foods which only varied in terms of one parameter (Table 1).

The finger foods were prepared by the eight nursing homes which took part in the experiments. Only the second course of the meal (or part of the second course) was transformed into finger foods and evaluated. In order to take account of culinary variety, each parameter was tested using four recipes, i.e. four variants. The foods transformed into finger foods for each parameter were therefore not the same during the four test sessions. In order to ensure variety and an adequate nutritional intake, the experimental foods were based on the standard menus applied in the eight nursing homes, having been developed by dieticians for people with AD (i.e. ingredients and rotation of recipes). For example, for the contrast parameter, hake and spinach were offered on the standard menu in the first week, hake and mixed vegetables in the second week, salmon and leek in the third week and hoki and carrot in the last week of the experiments (Table 1). The finger foods were therefore prepared especially each week using the corresponded ingredients. Because the eight nursing homes belonged to the same commercial organisation, they shared the same menus and finger foods they produced were all the same.

2.3. Participants

Eight nursing homes in the Paris region (France) were involved in these experiments. Between 8 and 30 people were recruited in each home with the collaboration of the medical staff, and the experiments formed part of the introduction of a finger food diet into these facilities. Because the finger foods were prepared using puréed food, participants with swallowing and chewing impairments could be included. Participants who were unable to eat alone were excluded. Thus a total of 114 people, all with potentially advanced AD, participated in this study (88 females, 26 males), with ages ranging from 63 to 102 years (average age: 86 ± 6.71 years). Family consent was obtained for each participant, and no clinical data were recorded. Some of the participants did not participate in all the test sessions, the average participation being 10.1 ± 3.8 of the 16 test sessions.

2.4. Samples

The finger foods were prepared by cooks in the nursing home kitchens using standardised recipes and ingredients. The nursing home cooks were therefore responsible for producing the finger foods during this study and had followed special training for this purpose. The finger foods made in the eight nursing homes were all the same. The core ingredients used (vegetables, meat or fish) are listed in Table 1. These ingredients were first of all blended, in an uncooked or cooked state, depending on their type. The finger foods were then reconstituted by adding eggs and breadcrumbs before cooking. Each portion of finger food weighed about 30 g ± 5 g. Replacement dishes (standard menu) were also prepared for any participants who might refuse to eat the finger foods.

Individual plates were thus served, containing a fixed number of finger foods. This number had been calculated to provide at least the same quantity of core ingredients as the standard menu, so as

<table>
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<th>Standard finger foods</th>
<th>Alternative finger foods</th>
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<td>Moulded finger food</td>
<td>Finger food with a sauce</td>
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<td>Finger food in one layer</td>
<td>Finger food in two layers</td>
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Fig. 1. Finger foods formulated for each parameter.
Experimental design.

To ensure an adequate nutritional intake. For the sauce and shape parameters, where only part of a course took the form of finger foods, the plates contained three pieces of standard finger foods and three pieces of alternative finger foods ($2 \times 3$ finger foods). For the contrast parameter, the whole course was transformed, and one piece of standard finger food and one piece of alternative finger food were added compared to the other parameters ($2 \times 4$ finger foods). Additional finger foods were also prepared for any participants who might request more.

For the shape and contrast parameters, the two types of finger foods served to participants supplied the same amount of food and the same nutritional intake. For the sauce parameter, finger foods with sauce supplied around 5 g of sauce per unit of finger food than those served without sauce.

2.5. Mealtime procedure

After the first course of the meal, each subject received a plate on which there were two types of finger food which varied by only one parameter (sauce, shape or contrast). Because offering finger foods was a new experience for the participants, the care staff were asked to stimulate them verbally if they did not start eating the meal by themselves, but without influencing their choice between the two types of finger foods offered. The care staff also informed the participants that they could use their fingers to eat, although this was not an obligation (knives and forks were available next to the plate). If a participant refused to taste a finger food, the staff removed the plate and offered a replacement dish. If a participant finished his/her plate and asked for more finger foods, the care staff could supply them, but the different types of finger foods were always offered in equal quantities. Once the participant no longer wanted any finger foods, the care staff removed the plate and gave him/her the other part of the second course (when the shape and sauce parameters were being tested) or the next course (when the contrast parameter was being tested). The remainder of the mealtime did not change from its usual programme.

2.6. Questionnaire

The care staff were asked to complete a questionnaire on how the participants behaved during the mealtime. One questionnaire was filled for each participant and each test session. This questionnaire was divided into two sections.

2.6.1. First choice

The first section was dedicated to the first choice. Care staff answered the question that follows by ticking the correct answer (standard or alternative finger food): Which type of finger food did the participant put in his/her mouth first?

2.6.2. Finger food consumption

The second section focused on finger food consumption. The care staff recorded the amount of each finger food left on the plate by the participant, by ticking the appropriate numbers (1–4, etc.) in response to the following questions: How many of the standard (alternative) finger foods did the participant leave unfinished on his/her plate? How many of the standard (alternative) finger foods did the participant leave untouched on his/her plate? The care staff also noted if participants had requested additional finger foods.

2.7. Data analyses

2.7.1. First choice

For each parameter and each week, we calculated how many times the standard and alternative finger foods had been chosen first by the participants. The probability that the standard or alternative finger foods would be chosen first most frequently was calculated by the binomial law in a two-sided-hypothesis.

2.7.2. Finger food consumption

For each test session and each participant, the consumption of standard and alternative finger foods was measured from the number of finger foods given to a participant. A finger food left unfinished on a plate was counted as half a finger food having been consumed. The rate of finger food consumption was then calculated. A t-test between standard and alternative finger food consumption rates was then performed for each session and for the four sessions relative to a specific parameter. The average consumption rates for standard and alternative finger foods for all participants were then calculated for each session and for the four sessions relative to a specific parameter.

Statistical analyses were performed using XLSTAT version 2011.2.05, copyright Addinsoft 1995–2011.

3. Results

If all the test sessions and parameters were considered together, then the participants ate on average 80% of the finger foods offered to them. On average only 8% of the participants refused to taste the finger foods, which represented a low rate when set against the degree of food refusal generally observed in patients with AD. Refusal was independent of the four different test weeks ($\chi^2 = 5.574, p = 0.134$) and of the three parameters studied ($\chi^2 = 0.835, p = 0.657$).

3.1. Effect of sauce

The sauce parameter was investigated under two conditions: absence vs. presence of sauce with the finger foods.

3.1.1. First choice

Fig. 2a shows the distribution of the first choice between finger foods with and without sauce over the 4 weeks. The participants tended to choose finger foods with sauce first more frequently than those without sauce across all weeks (57% of the participants chose finger foods with sauce in the first week, 63% in the second, 55% in
3.1.2. Finger food consumption

Fig. 2b shows the rates of finger food consumption in the presence or absence of sauce over the 4 weeks. Although the average finger food consumption was always greater with sauce than without across all weeks, the results were only significant for the first and second weeks ($t_{(150)} = 2.331$, $p = 0.021$, mean difference = 0.122 and $t_{(126)} = 2.035$, $p = 0.044$, mean difference = 0.120, respectively). By contrast, in the third and fourth weeks, there was no significant difference between finger foods with and without sauce ($t_{(142)} = 0.808$, $p = 0.936$, mean difference = 0.005 and $t_{(150)} = 0.935$, $p = 0.351$, mean difference = 0.048, respectively). Considering all 4 weeks together, the participants consumed finger foods with sauce very significantly more than those without sauce ($N = 288$, $t_{(374)} = 2.646$, $p < 0.010$, mean difference = 7.3% or 6.6 g).

The presence of sauce thus had an impact on the food choices and consumption of the participants, although the results were not significant for all weeks. In fact, the recipes differed from 1 week to another, so that the ingredients used to design the finger foods were not the same each week, which may explain this heterogeneity.

3.2. Effect of shape

The shape parameter was investigated under two conditions: squared vs. moulded finger foods.

3.2.1. First choice

The results did not show that either squared or moulded finger foods were chosen first more often (Fig. 3a). Considering all the weeks together, 50% of the participants chose squared finger foods first and 50% chose moulded finger foods first ($N = 300$, $p = 0.954$).

3.2.2. Finger food consumption

The results for each week did not reveal any significant difference between squared and moulded finger foods in terms of consumption rates (Fig. 3b). Nor when all the weeks were considered together was there any significant difference between the consumption of squared and moulded finger foods ($N = 287$, $t_{(572)} = 0.946$, $p = 0.345$, mean difference = 2.4% or 2.2 g).

3.3. Effect of contrast

The contrast parameter was also investigated under two conditions: finger foods in one vs. two layers.

3.3.1. First choice

The results showed that finger foods with two layers were chosen first more often than those with one layer during the first week ($p < 0.001$) but not during subsequent weeks (Fig. 4a). When considering all weeks together, finger foods with two layers were chosen first significantly more frequently ($N = 206$, $p = 0.015$).

3.3.2. Finger food consumption

The results showed that finger foods with two layers were consumed significantly more than those with just one layer in the first week ($t_{(136)} = 2.285$, $p = 0.024$, mean difference = 0.119, Fig. 4b). However, in subsequent weeks there was no significant difference between consumption of the two finger foods. Considering all the weeks together, finger foods with two layers were consumed very significantly more frequently than finger foods with just one layer ($N = 211$, $t_{(420)} = 2.014$, $p = 0.045$, mean difference = 5.4% or 6.6 g).

Even though the results were not significant for each week taken separately, it appears that the organisation of food in two layers was a factor for food attractiveness among these AD patients. The difference between weeks could be explained by the small number of participants in the second and third weeks ($N = 30$ and $N = 35$, respectively). Moreover, the ingredients used to produce the finger foods were different each week, which might explain the difference in results between the first and subsequent weeks. Indeed, the intensity of the contrast between the two layers of the finger foods differed across the weeks. In the first week, hoki (white) and spinach (dark green vegetable) were used and the intensity of contrast was greater than in subsequent weeks when hoki or salmon was associated with a less visually contrasted vegetable (mixed vegetables, leek or carrot).

4. Discussion

The aim of this study was to investigate the influence of three formulation parameters: shape, the presence of sauce and contrast, on the attractiveness of finger foods to people with AD. Four paired comparison tests per parameter were performed in real-life meal-time situations in 114 subjects with AD living in institutions. This study did not permit any conclusions regarding the potentially positive effect of finger foods when compared with the meals.
normally served in nursing homes. However, the average finger food consumption rate, and the low rates of refusal seen among participants, demonstrated that the finger foods formulated for this study were not rejected.

Different first choices and consumption levels were observed for the three formulation parameters. Considering all the weeks of the experiment together, the results showed:

- A positive effect of the presence of sauce (vs. absence).
- No effect of shape (squared vs. moulded).
- A positive effect of a presentation in two layers (vs. one).

Finger foods cut into squares were no more and no less frequently chosen first and consumed than finger foods moulded in a cylindrical form. Thus shape was not shown to exert an influence on food attractiveness during this study. The findings suggested that the shapes investigated were certainly relatively easy to pick up, appealing and attractive for the subjects who participated in this study. Although the shape parameter did not generate a significant effect during this study, it cannot be excluded that different shapes (other than moulded in a cylindrical form or cut into squares) might have an impact on the food consumption and first choices made by the participants. For instance, moulding pureed food into a shape which reconstitutes that of non-pureed food might be a means of enhancing food attractiveness. Indeed, some authors have identified this strategy as an opportunity to improve food liking and consumption among patients with dysphagia, although they were not able to clearly demonstrate its efficacy (Cassens, Johnson, & Keelan, 1996; Stahlman, Garcia, Hakel, & Chambers, 2000; Stahlman et al., 2001). But to our knowledge, no study as yet has investigated the influence of reconstituting the shape of pureed food on food attractiveness in AD patients, even though this might be a good solution to trigger cognitive stimulation in those with memory losses. Nevertheless, it is important to bear in mind that finger foods must be easy to eat with the fingers, which means that any complex shapes should be avoided. Further research is therefore necessary to study the effects of new finger food shapes on food attractiveness among AD patients.

Even though the finger foods with sauce and in two layers were generally chosen first and consumed more frequently than finger foods without sauce and in two layers, respectively, the results were not significant when each week was taken separately. This heterogeneity could be explained by the fact that the ingredients transformed into finger foods were different each week. Therefore, the contrast between sauce and finger foods or between the two layers for the contrast parameter also differed each week. It has generally been assumed that people with AD suffer from an inability to distinguish colour contrasts (Gilmore, Cronin-Golomb, Neargarder, & Morrison, 2005; Rizzo, Anderson, Dawson, & Nawrot, 2000) which, during mealtimes, may lead to a reduction in food accessibility. In their study, Dunne, Neargarder, Cipolloni, and Cronin-Golomb (2004) investigated the influence of colour contrast manipulations on the food consumption of AD patients. They noted that offering glasses and plates in strongly contrasting colours led to an increase in food consumption by their subjects. During our study, colour contrasts probably played an important role in food attractiveness. A brown sauce with a pale-coloured finger food

Fig. 3. Shape parameter: □ moulded finger foods, ■ squared finger foods. Percentage of first choices (a) and finger food consumption (b) with a probability p (t-test) for each week with N participants.

Fig. 4. Homogeneity parameter: □ finger foods with one layer, ■ finger foods with two layers. Percentage of first choices (a) and finger food consumption (b) with a probability p (t-test) for each week with N participants.
such as chicken, and a hake and spinach combination were markedly contrasting, while a dark-coloured food such as a beef-based one with a brown sauce, or a hake and carrot combination, were less contrasted and so less visible.

Considering all the weeks together, our findings underlined the importance of the presence of sauce and a presentation in two layers of separate ingredients to the attractiveness of finger foods to elderly AD patients, which could be explained by some low level factors (sensory factors and accessibility) and a high level of perception (cognitive factors).

First, a sauce constituted a factor for sensory attractiveness because it participated in the taste and visual appeal of the food (Laureati, Pagliarini, Calcioni, & Bidoglio, 2006), especially among elderly AD patients suffering from sensory losses. The presentation in two layers was also more attractive than just one layer because of the sensory contrasts involved (colour and taste). These results could also be interpreted in terms of accessibility. Because the elderly suffer from a reduction in salivary flow (xerostomia), sauce is also a means to moisten finger foods and facilitate chewing and swallowing (Appleton, 2009; Best & Appleton, 2011). And because the finger foods in two layers were more contrasted than those in one layer, they were also more accessible because more visible than the single-layer finger foods to AD patients suffering from contrast perception disabilities (Gilmore et al., 2005).

Secondly, wiping up sauce with food or a piece of bread is very common among the older generation in France. The participants in our study suffered from AD but nevertheless retained this habit and wiped up the sauce with the finger foods. These observations suggest that the sauce could trigger cognitive stimulation. Not mixing ingredients together in the two-layered finger foods might also provide an opportunity for AD patients to identify foods from their colour.

It is well known that low level factors (sensory factors and accessibility) and high level factors (cognitive factors) both participate in food attractiveness in the elderly (Winter Falk, Bisogni, & Sobal, 1996) but the importance of these factors has not been widely investigated amongst those with cognitive impairment. Our study thus confirmed that these factors play a role in food attractiveness. Nevertheless, further research is necessary in order to better understand the relative importance of low and high level factors to food attractiveness among AD patients.

It is generally accepted that AD is a progressive disease. Patients will move through different stages from moderate to severe dementia, displaying a gradual loss of cognitive abilities (Braak & Braak, 1997). AD patients do not generally have same sensory acuities because of their own history (individual idiosyncrasy) or their medications. Indeed, drugs are frequently prescribed in elderly AD patients and can modify flavour perceptions (Schiffman & Gatlin, 1993). We therefore cannot exclude that the attractiveness of food to people with AD may differ according to the sensory and cognitive specificities of each subject. No account was taken of any differences between the participants during our study. Nevertheless, in order to investigate the relative importance of low and high level factors for attractiveness, it would have been interesting to evaluate the participants in terms of their cognitive abilities and sensory acuities. This study will therefore be supplemented by further research on the attractiveness of food to people with AD by considering their individual specificities.

In operational terms, this study highlighted the fact that elderly AD patients are still able to make food choices. Healthcare professionals should therefore pay greater attention to food attractiveness when developing the foods offered to these patients. As for finger foods, our findings suggest that the addition of sauce and visual contrasts might increase their attractiveness, and indeed, some practical culinary suggestions have already been implemented by our partner geriatric institutions.

5. Conclusion

The finger foods formulated for this study were well accepted and consumed by elderly patients with AD. This research showed that AD patients tended to choose first, and then consume, finger foods with a sauce and in two layers rather than those without sauce and in one layer, where all the ingredients were mixed. By contrast, their shape (moulded or squared) had no influence on the food choices and consumption of AD patients during our study. In light of these findings, it is possible to conclude that people with AD are still able to make food choices. The development of finger foods needs to take account of key drivers for their attractiveness, such as sauce and contrast. The importance of these factors can be explained by cognitive and sensory cues related to accessibility, and further research is now necessary in order to better understand food attractiveness among people with AD as a function of their disease-related sensory and cognitive status. These findings open the way towards the development of new foods for use in geriatric institutions that will enhance the attractiveness of foods to people with AD and improve their nutritional status.

Acknowledgements

The authors would like to thank Philippe Zawieja and the eight nursing homes (Groupe ORPEA) and their staff who contributed to this study: Marly-le-Roi, Saint-Rémy-lès-Chevreuse, Valenton, Courbevoie, Rocquencourt, Le Pré-Saint-Gervais, Les Musiciens (Paris) and Edith Piaf (Paris).

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