What's the evidence?

Can bread ever be compatible with a texture modified diet?

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Speech pathologists working in aged care are often asked to consider food items that are not typically included on dysphagia diets to address issues related to weight loss and patient compliance. There has been much debate about bread in this context, given that bread is a staple of the western diet. This edition of "What's the evidence?" investigates the request for bread on a Minced & Moist diet. It uses an evidence-based approach to determine why bread is a choking risk, what factors increase that risk and under what circumstances bread could be included on a texture modified diet. It draws on Speech Pathology Australia's Code of Ethics asking clinicians to balance client safety with autonomy of choice.

Clinician scenario

You are a speech pathologist working in private practice and have received a call from the dietitian at one of the aged-care facilities you visit. Mrs Jones is an 83-year-old lady with dementia, dyslipidaemia, osteoporosis, history of falls, reflux, a recent gastrointestinal bleed and previous history of stroke resulting in dysphagia. She was referred to you when she was first admitted to the centre and your assessment indicated she would be safest on Texture B Minced & Moist Food and Moderately Thick fluids. The dietitian tells you that Mrs Jones has lost more than 10% of her body weight and is at risk of malnutrition. He is looking at all possibilities to increase her intake and would like to include bread and sandwiches in her diet. He is aware that bread and sandwiches are not allowed on a Minced & Moist diet because they pose a choking risk, but the patient is asking for sandwiches and the centre is getting pressure from her family as well.

Reflection/response

Weight loss and malnutrition are problems often noted in aged care with prevalence from Australian studies showing that as many as 41.6% of residents are moderately malnourished, and 8.4% are severely malnourished (Banks, Ash, Bauer, & Gaskill, 2007). Not surprisingly, individuals who rely on texture modified diets have been shown to have reductions in total energy intake and key micronutrients when compared to people who have a normal textured diet (Dunne & Dahl, 2007). Modified diet texture is significantly associated with overall malnutrition (< 0.001), poor dietary intake history (< 0.01), anorexia (p = 0.02) and weight loss history of the previous two weeks (p = 0.007) (Hugo, Cockburn, Ford, March, & Isenring, 2016). When looking at a balanced diet, energy comes predominantly from three macronutrients: protein (15–25%); healthy fats (20–35%) and carbohydrates (45–65%) (NHMRC and New Zealand Ministry of Health Nutrient Reference Values, 2017). Carbohydrates, such as those found in bread, are an essential part of our diet, providing much needed energy and fibre. The Australian Dietary Guidelines (NHMRC, 2013) recommend that women over the age of 70 years should have three serves of cereal fibres per day, giving examples of a single serve as: one slice of bread, one crumpet or English muffin and other examples. The dietitian's concerns for this lady are well founded, with malnourishment in older adults being associated with: increased hospital admissions; reduced quality of life; and increased incidence of pressure ulcers, falls, hip fractures, and mortality (Isenring, Banks, Ferguson, & Bauer, 2012).

As noted above, there are valid reasons to seek changes to dietary intake; however, the question is whether including bread in this lady's diet is the best solution. Death associated with choking on food is also of significant concern. The Australian standardised terminology and definitions for texture modified foods and fluids, endorsed by Speech Pathology Australia and the Dietitians Association of Australia (Atherton, Bellis-Smith, Cichero, & Suter, 2007) recommend only gelled bread on a Texture B Minced & Moist diet. Although the Australian standards for texture modified foods and thickened fluids are currently in place, you are aware that Australia is transitioning to adopt the International Dysphagia Diet Standardisation Initiative (IDDSI) framework on 1 May 2019. On review of the IDDSI framework, you find that Level 5 Minced & Moist similarly excludes regular, dry bread (Cichero, Lam, Steele, Hanson, Chen, Dantas … Stanschus, 2017). Published national guidelines in the field guard also against including regular bread on a Minced & Moist diet.

The Code of Ethics (Speech Pathology Australia, 2010) provides further weight to how we approach this case. Seeking to respect the rights of our clients to self-determination and autonomy must also be balanced with seeking to prevent harm. Although many people are familiar with food choking risks for children, it may be surprising to learn that the rate of death related to choking on food is seven times higher for people over the age of 65 years than it is for children aged 1-4 years (Kramarow, Warner, & Chen, 2014). Further, Kramarow et al. (2014) found that three conditions were most strongly associated with death by choking on food in older individuals. These were a diagnosis of dementia, Parkinson's disease, or pneumonitis.

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A retrospective review of deaths of nursing home residents in Victoria, Australia from 2000 to 2012 found that choking on food was the second highest cause of preventable death (Ibrahim, Murphy, Bugeja, & Ranson, 2015).

Clinical question

While including bread in Mrs Jones's diet might increase much needed nutrition, it also has the potential to result in death by choking. You decide to determine how often bread is associated with choking risk and the factors shown by research to increase or reduce risk for choking on bread.

Searching for evidence/evaluating the evidence

EBSCO Medline, Cinahl, Embase, Scopus, the Cochrane Library, Speech-BITE and Google Scholar were explored using the following search terms: bread AND chok*; "choking on food"; choking AND food; gelled bread AND swallow; gelled bread AND dysphagia. The searches yielded 74 primary articles of which 6 were relevant to the clinical questions (Table 1). References within the retained articles provided further sources of information. The highest level of evidence comes from two studies using autopsy data. The remaining studies are Level IV evidence using case studies, qualitative interviews with people who have chewing and swallowing difficulty, and one study investigating bread chewing in healthy individuals.

How often is bread associated with choking risk?

It might at first seem perplexing that there are no randomised controlled trials looking at choking risks associated with bread or indeed foods in general. However, such trials would require the *possibility of a choking event* as an outcome, which is ethically unacceptable. Consequently, the most robust information comes from autopsy data. The studies by Berzlanovich, Fazeny-Dorner, Waldhoer, and Fasching (2005) and Wick, Gilbert and Byard (2006) show that bread and sandwiches are commonly reported food choking items resulting in fatal consequences. These results are further supported by the case study reported by Aquila et al., (2018) and review by Cichero (2015). Moller, Rasmussen, Hilberg, and Lokke (2015) concluded in their non-fatal case study that foreign body aspiration is common but underdiagnosed. Their patient presented with shortness of breath and cough after a choking episode on a chunk of nut and grain-filled bread. The qualitative interviews of parents of people with CHARGE syndrome provide insight into why bread is problematic (Hudson, Macdonald, & Blake, 2016). When chewing skills are reduced, or there is poor oral sensitivity, individuals may pocket food in their cheeks, allowing saliva to fill and soften the bolus. Pocketing of food in the cheeks, or packing, has led to choking incidents as well as resulted in poor oral hygiene and development of tooth cavities (Hudson et al., 2016). This literature suggests you have every right to be concerned about choking risk for bread, particularly as we again consider our Code of Ethics (SPA, 2010), to take every precaution to ensure client safety (section 3.1.7).

What factors increase or reduce risks for choking on bread?

Although the literature is unequivocal that bread is a food that increases choking risk, it does provide circumstances and conditions that increase or reduce that risk. To thoroughly evaluate all the information before you review the patient and speak with the dietitian, you look to see what guiding principles might assist with your assessment and recommendations.

In the review of 200 autopsies, only 20 had intact dentition (Berzlanovich et al., 2005). Looking at it the other way, 90% of those who choked and died had partial or complete dentures, were edentulous, or had partial or defective dentition. In a recent study of individuals in aged care, oral health assessment revealed that 82% needed dental review, with 64% needing referral to address issues related to chewing and swallowing (Hugo et al., 2016). The medical hypothesis case study found during the literature search also identifies partial or total tooth loss and poor oral hygiene as risk factors that increase food choking risk (Aquila et al. 2018). Aquila et al. specify that when inadequate dentition is accompanied by dry mouth, there will be difficulty in chewing, impaired bolus formation and increased swallowing problems. The authors pinpoint antipsychotic and tricyclic antidepressant medications as problematic, as these have dry mouth as a side effect (Aquila et al., 2018). The authors conclude by recommending routine screening for dental disorders, oral hygiene and salivation problems associated with dry

Table 1. Relevant research articles identified

Articles identified	Purpose	Level of evidence (NHMRC, 2009)
Moller, Rasmusssen, Hilberg, & Lokke, 2015	Case studies demonstrating foreign body aspiration is common but often over-looked	IV
Aquila, Gratteri, Sacco, Nuzzolese, Fineschi, Frati, & Ricci, 2018	Case report predicting factors that increase risk of choking on food	IV
Tourier, Grass, Septier, Bertrand, & Salles, 2014	Effect of mastication, salivation and bolus formation on bread in healthy people	IV
Wick, Gilbert, & Byard, 2006	Autopsy approach – fatal choking on food	III-3
Berzlanovich, Fazeny-Dorner, Waldhoer, & Fasching, 2005	Retrospective review of autopsy data	III-2
Hudson, Macdonald, & Blake, 2016	Qualitative interviews with parents of children, adolescents and adults with CHARGE syndrome regarding packing and problematic feeding behaviours	IV

mouth as a side effect of medications commonly used in aged care. The presence of these risk factors are further supported by studies of indicators of choking risk of adults with learning disabilities (Thacker, Abdelnor, Anderson, White, & Hollins, 2008). When controlling for other variables the authors found that the odds of choking were increased by a factor of 4 if the person needed help with liquids, were 91% greater if the person wore dentures, 75% greater if the person was on sedative medication and 50% greater if unable to read (Thacker et al., 2008). Now we have some new information to look at for our patient. We need to determine the condition of her teeth and what medication is she taking, as these factors increase her risk of choking not just on bread, but also on other food items.

So, what do we know about bread that might be relevant to this new information regarding dentition and saliva? In a study of healthy adult volunteers, individuals took 27 seconds to chew 3g of plain white bread compared to 20s to chew 3g of cooked plain spaghetti pasta (Hoebler et al., 1998). Importantly bread resulted in 5 times more saliva impregnation after chewing than pasta. Chewing the bread also caused a release of starch granules from the protein network making it sticky. The chewed particles were heterogenous in shape and chewing time varied between participants (Hoebler et al., 1998). A more recent study revealed by our literature search provides more detail, explaining that the mechanical properties of bread depend on its density and cellular structure, the amount of dietary fibre it includes, its water binding capacity, inherent moistness and cooking process (Tournier, Grass, Septier, Bertrand, & Salles, 2014). They note that small particle size and an appropriate amount of saliva are critical qualities for the bread bolus to be able to be swallowed. Saliva increases with number of chewing cycles and depends on type of bread, with an average of 28–34 chewing cycles recorded. Unsurprisingly, the bread particles became smaller and a more homogenous bolus forms with longer chewing times. At swallowing, boluses made from bakery baguette had a higher saliva content that those from supermarket-bought baguette and toast bread with saliva uptake varying from 13–66% depending on the type of bread. Further they found that fat in toast aids in in-mouth breakdown and reduces the number of chewing cycles needed. This information suggests that clinically each individual should be their own control, and that patients should be observed biting, and chewing bread. The clinician should look at the chewed bolus before the patient swallows, when the patient thinks it has been chewed well enough, to evaluate its choking risk potential. Furthermore, the Tournier et al. (2014) study demonstrates that 'bread' is a label that describes anything from white bread, to multigrain, baguette, rye bread and more. *Clinical recommendation must be specific to the type of bread assessed and recommended*.

Patient variables such as eating behaviours also need to be considered. Hudson et al. (2016) revealed that a behaviour that accompanied mouth packing was over-stuffing the mouth, which resulted in food packed into the palate as well as the cheeks. Coughing and choking, the need for supervision and the need to spit out or have someone else remove packed food and closely supervise eating were indicators of choking risk. Hyposensitivity such that they did not feel leftover food on the lips or food in the cheeks until the parent physically pressed on it with their hand indicated reduced intra-oral sensitivity. Supervision and the use of consistent terminology, specifically the IDDSI framework, are key recommendations for the reduction of choking risk in residential aged-care facilities (Ibrahim, 2017).

Mrs Jones has dementia. Eating and swallowing problems are noted for people with dementia, with the themes of medication (neuroleptic drugs) and need for supervision again clearly identified (Shinagawa et al., 2009). A carefully constructed choking risk assessment demonstrates that history of choking, medications, mealtime actions such as food stealing, laughing or talking while eating, distraction, lethargy during mealtimes, rapid feeding rate, excessive mouthful sizes, difficulty maintaining upright posture during eating, rapid breathing during eating or seizures can be used to predict low vs. high choking risk (Sheppard et al., 2017). Although normed for adults with intellectual and developmental disability, the factors that informed the assessment tool were drawn from an evidence-based review of the literature on choking risk. Table 2 summarises the factors that increase choking risk associated with bread.

What other solutions exist to provide cereal based carbohydrate food that is safe for texture modified diet?

The dietitian's original reason for the call was due to concerns regarding adequate nutrition and Mrs Jones's weight loss while on a Minced & Moist diet. A systematic review of the literature has found that both oral nutritional

Table 2: Factors that increase choking risk associated with bread

Risk factor	Rationale for risk
Poor or inadequate Dentition	• Reduced number of teeth; partial denture; no teeth/dentures affect the ability to chew food into small enough pieces that they are safe to swallow
Insufficient chewing cycles	• Fewer than 30 chewing cycles for 3–5g of bread reduces the amount of saliva that the bolus takes in and also the reduction of the bread pieces
Poor oral hygiene	• Causes tooth instability affecting ability to chew adequately • Dental caries may also cause pain and affect ability to chew food adequately
Reduced saliva	• Reduction in saliva may come from a side effect of medications such as antidepressants •Insufficient chewing cycles reduces the amount of saliva that is transferred into the bread bolus
Eating in isolation or with reduced supervision	• Supervision or assistance during meals allows for early identification of poorly chewed bolus, or behaviours that increase choking risk such as mouth packing, excessive mouthful sizes, rapid feeding rate, fatigue during eating, difficulty maintaining upright positioning during meals, changes to breathing rate during meals

Source: Adapted from Sheppard et al., 2017

supplements and food-based interventions reduce risks associated with malnutrition (Hugo, Isenring, Miller, & Marshall, 2018). Many oral nutritional supplements come in liquid form, and Mrs Jones has been assessed as needing moderately thick liquids to manage aspiration risk. Consequently, you look at the food-based interventions first. Food-based interventions included offering additional appetisers and snacks, advice to eat high-protein energy foods, and fortifying usual meals with cream and butter. The systematic review concluded that oral nutrition supplements and food-based intervention have a lost cost of implementation and may be cost effective.

Gelled bread has been recommended in many national dysphagia diets as providing a suitable texture for bread on a Minced & Moist diet (Atherton et al., 2007; Cichero et al., 2017). The gelled bread recipe provides moisture by pre-soaking the bread in a liquid (often thickened). This does however change the mouthfeel attributes of the bread so that it tastes 'wet' and may result in large clumps of wet bread. Interprofessional collaboration has come up with an alternative that addresses the key needs identified by the literature review of homogeneity of small particle size and bolus moisture (www.iddsi.org 2018, retrieved from https://www.youtube.com/channel/UC0l9FDjwJR0L5svlGCvlqHA/featured). An innovative solution has been to put fresh bread (minus crusts) through a blender to produce small bread crumbs. The bread crumbs are then sprinkled onto a tray and lightly sprayed with water or other liquid to moisten. A minced and moist filling (e.g., mashed egg that has been moistened with mayonnaise, ensuring that it is not sticky) is then placed over the bread crumbs. A further layer of bread crumbs is sprinkled over the top and moistened with water, milk or stock. The 'sandwich' is refrigerated to give it some stability; however, the sandwich can only be eaten with a fork or spoon. The bread pieces are small and have been pre-moistened. The patient has the ability to have a sandwich that reduces choking risk by modifying key structural properties of the bread. The sandwich can be further fortified by adding milk as the moistening agent, or cream or butter to the filling.

Clinical bottom line

By searching the literature for further information about how often bread is a choking risk and what it is about bread that increases choking risk, you are better prepared to evaluate Mrs Jones and other patients. The literature highlights that the integrity and function of teeth and saliva are critical to your decision-making. Review of Mrs Jones's medications will also be required to see if her risk factors are increased by sedative medication or medication that causes dry mouth. The stage of dementia, as it might affect eating behaviours, also requires consideration. Further, the literature highlights that the ability to chew bread is a very individual phenomenon, and depends on the type of "bread" that is being considered. The ability to provide supervision reduces choking risk and this may be an important factor in your recommendation. National and international dysphagia diet frameworks are conservative and exclude bread from dysphagia diets because of the variabilities highlighted above. Careful clinical assessment on a case-by-case basis is advocated. Tools such as the Sheppard et al. (2017) choking risk assessment provide objective information to share with other health professionals and family members when making decisions about safety for including bread in the person's diet.

Conclusion

This article demonstrates how evidence can be used to respond to a clinical question that has more complexity than appears on the surface. A careful review of risk factors and clinical evaluation means that the clinician can tailor their diet recommendations as specific to the patient. However, this will also require education of staff (nursing, dietetic, personal care attendants, medical practitioners) to alert them that bread may be an appropriate diet inclusion for "this patient, under this specific set of circumstances". The literature demonstrates that case-by-case chewing and swallowing assessment is needed, and that generalisation to all patients on Minced & Moist diets is not possible. Alternatives such as mechanically altering the bread particles and moisture content should be considered. Clinicians continue to balance safety and autonomy of choice in accordance with the Code of Ethics by evaluating on a case-by-case basis.

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