Contribution of thickened drinks, food and enteral and parenteral fluids to fluid intake in hospitalised patients with dysphagia

Vivanti, Angela P.; Campbell, K. L.; Suter, M. S.; Hannan-Jones, M. T.; Hulcombe, J. A.

Published in:
Journal of Human Nutrition and Dietetics

DOI:
10.1111/j.1365-277X.2009.00944.x

Published: 01/01/2009

Document Version:
Peer reviewed version

TITLE: Contribution of thickened drinks, food and enteral and parenteral fluids to fluid intake in hospitalised patients with dysphagia

RUNNING TITLE: Fluid intake in dysphagia

ABSTRACT

Background Studies amongst older people with acute dysphagic stroke requiring thickened fluids have assessed fluid intakes from combinations of beverage, food, enteral and parenteral sources, but not all sources simultaneously. The study aimed to comprehensively assess total water intake from food, beverages, enteral and parenteral sources amongst dysphagic adult in-patients receiving thickened fluids.

Methods Patients requiring thickened fluid following dysphagia diagnosis were recruited consecutively from a tertiary teaching hospital's medical and neurosurgical wards. Fluid intake from food and beverages was assessed by wastage, direct observation and quantified from enteral and parenteral sources through clinical medical records.

Results No patients achieved their calculated fluid requirements unless enteral or parenteral fluids were received. The mean daily fluid intake from food was greater than from beverages whether receiving diet alone (food 807±363mL, food and beverages 370±179mL, $p<0.001$) or diet with enteral or parenteral fluid support (food 455±408mL, food and beverages 263±232mL, $p<0.001$). Greater daily fluid intakes occurred when receiving enteral and parenteral fluid in addition to oral dietary intake, irrespective of age group, whether assistance was required, diagnosis and whether stage 3 or stage 2 thickened fluids were required ($p<0.05$). After enteral and parenteral sources, food provided the most important contribution to daily fluid intakes.

Conclusions The greatest contribution to oral fluid intake was from food, not beverages. Designing menus and food services which promote and encourage the enjoyment of fluid dense foods, in contrast to thickened beverages, may present an important way to improve fluid intakes of those with dysphagia. Supplemental enteral or parenteral fluid may be necessary to achieve minimum calculated fluid requirements.

Keywords

dysphagia, swallowing disorder, thickened fluids, fluid intake, dehydration prevention, enteral and parenteral fluid.

Introduction

Dysphagia is an abnormality of swallowing food or fluid that is a frequent consequence of neuromuscular or obstructive disease states (Duncan et al., 2005; Perry, 2001). Dysphagia can occur due to a range of conditions affecting structure or function, including cancer, neurologic diseases or stroke (Palmer et al., 2000). The incidence of dysphagia after conditions such as stroke has been reported from 33% to as high as 81% (Hamdy et al., 1997; Martino et al., 2005; Meng et al., 2000; Parker et al., 2004).

If not well managed, swallowing difficulties can result in increased risk of aspiration (Low et al., 2001; Martino et al., 2005), pneumonia (Chouinard et al., 1998; Low et al., 2001; Martino et al., 2005; Perry, 2001) weight loss and malnutrition (Finestone et al., 1995; Smithard et al., 1996) dehydration (Chouinard *et al.*, 1998), increased length of stay (Smithard *et al.*, 1996) and mortality (Low et al., 2001; Smithard et al., 1996). Management of dysphagia aims to prevent aspiration, through prescription of texture-modified diets and thickened fluids (Duncan et al., 2005; Perry & Love, 2001). However, increased viscosity and oropharyngeal transit times are essential for dysphagia management and makes eating and drinking a slower process (Sopade et al., 2007).

Inadequate fluid intake is documented as a common consequence of dysphagia, and has been demonstrated in the acute care setting (Finestone et al., 2001; Whelan, 2001). In the long term care setting, markers of dehydration were present in 75% of dysphagic residents

receiving oral intake alone compared with only 18% receiving enteral feeding ($p<0.001$) (Leibovitz et al., 2007).

Research on the sources of fluid intake for patients requiring thickened fluids has been limited. Fluid intake studies of those with acute dysphagic stroke requiring thickened fluids have assessed beverage, enteral and parenteral fluid intake but have not included fluid from food (Finestone *et al.*, 2001; Whelan, 2001). Others studies amongst older people in long term care assessed fluid intake from both food and beverages, but excluded enteral and parenteral sources and did not assess those requiring thickened fluids (Holben et al., 1999). Additionally, the intakes of younger and older people with dysphagia has not been investigated.

This study aimed to comprehensively assess the contribution of total water intake from food, beverages, enteral and parenteral sources amongst dysphagic in-patients receiving thickened fluids and compare mean intakes with calculated fluid requirements.

Methods

Study population

Patients were included in this study from commencement on texture modified foods and thickened fluids following dysphagia diagnosis from bedside assessment and/or barium swallow by a speech and language therapist. All patients from general medical, neurology and neurosurgical wards at a tertiary teaching hospital for five days or more were eligible for inclusion. Eligible patients provided verbal consent to participate in this study. This study was determined by the hospital quality unit to be within the scope of a routine clinical practice and no ethics approval was required.

Collection of fluid intake data

Two dietetic assistants were trained to collect quantitative food and fluid intake data from tray and bedside wastage, and observational data concerning patients feeding ability. Direct observation and/or plate wastage assessment occurred for all meals, snacks and between meal beverages. All food and fluid provided was quantified from collection of tray wastage, stored for each patient throughout the study and quantified by the dietetic assistants. Weighed food and fluid intakes were not performed due to operational limitations. Food and fluid intake data was recorded on a categorical scale of none, quarter, half, three-quarters, all for each meal, snack and additional fluids administered with medication and swallow assessments (de Graafa et al., 2005; Jukkloa & MacLennen, 2005). Data was collected by the two dietetic assistants over both week and weekend days, providing a seven day coverage. Dietitians collected patient diagnosis, age and weight (recorded to one decimal place on ward scales) and quantified additional daily fluid intake from intravenous (IV) and enteral sources, using standard fluid balance charts. Additional sources of fluid intake such as fluid with medication, fluids required for flushing tube feeding and intravenous fluids were verified by dietitians daily with medical and nursing staff.

Patients were identified by diagnostic type based on the primary aetiology of dysphagia reported by speech and language therapists as documented in the clinical medical records: mechanical (e.g. trauma); deterioration (e.g. weakening musculature, dementia); or stroke. The older age group was categorised as those aged 60 years or more (World Health Organisation, 2002). The need for, or upgrade from, thickened fluids was determined by the speech and language therapists clinical assessment. “Assistance with meals” was defined as those requiring assistance with activities such as sitting up, removing lids, opening cutlery and assistance with feeding. Only full days when prescribed thickened fluids was collected.

Where a patient was nil-by-mouth during a 24 hour period, that individual total day's intake was omitted from analysis on the basis that it was not the prescription of thickened fluids that impacted on the lack of fluid intake.

In this study, 'thickened beverage' refers to drinks thickened to the appropriate consistency following standardised recipes. The thickening agent used was guar gum (Super-Col U, Chipmonk Pty Ltd, Nambour, Australia). The consistencies were as follows stage 1 (quarter thick, nectar thick & level 150 mildly thick), stage 2 (half thick, honey thick & level 400 moderately thick), and stage 3 (full thick, pudding thick & level 900 extremely thick) (Joint Working Party - British Dietetic Association and Royal College of Speech and Language Therapists, 2002) . Fluid contribution from food was defined as any non-beverage oral intake, including fluid from milk-based puddings, vegetables, fruits, protein, fats and cereal portions provided by the meal service. Available fluid from foods and beverages was determined by computerised nutritional analysis (FoodWorksTM Professional Edition 3.02 Xyris Software, Brisbane, Australia). Enteral/parenteral fluids in this study include fluids provided by intravenous solutions and available fluids from enteral feeds and water flushes. Total fluid intake refers to a sum of fluids from thickened beverages, food and enteral/parenteral sources. Each patients estimated minimum calculated fluid requirement, as established by the Parenteral and Enteral Nutrition Group (Todorovic & Micklewright, 2004), was completed and compared directly to their own fluid consumption on a daily basis throughout the study period.

Data analysis

Each day a patient was included in this study was considered as a separate 'case', thereby enabling the distinction between days with additional fluids and days with oral food and beverage intake only. Mean total fluid intake for each case was assessed as total intake (mL) and adjusted for body weight (mL/kg).

Total fluid intake from oral food and beverage sources only was assessed for statistically significant differences based on age, diagnostic type, level of assistance required and level of thickened fluid provided by independent sample t-test and analysis of variance (where appropriate). Significance was determined at $p<0.05$ level. All analysis was undertaken using Statistical Package for the Social Sciences (Release 11, SPSS Inc, Chicago, IL, 2003).

Results

All 25 patients included in the study were on thickened fluids for five days or more with data recorded for a maximum of 10 days (mean 7.3, sd 1.7 days, Range 5-10 days). Data collection ceased when patients had been discharged on thickened fluids (n=10), were no longer on thickened fluids (upgraded, n=8) or had died (n=1).

For the whole group (Table 1)., the mean (sd) total fluid intake daily from all sources was 1371 mL (sd 685mL) with 351mL (sd 179mL) from beverages, 739 mL (sd 396 mL) from food and 299 ml (sd728) from additional enteral or parenteral fluids. The mean daily fluid intake from food was greater than from beverages whether receiving diet alone or diet with enteral or parenteral fluid support ($p<0.001$) (Table 1). When no additional enteral or

parenteral fluid was provided, approximately two thirds of fluid was derived from the foods consumed (Table 1).

Influence of enteral and parenteral fluid on total fluid intakes

Investigation of the overall group showed significantly greater total fluid intake was attained when enteral and parenteral fluid was provided in addition to food and beverage, compared with food and beverage intake alone ($p<0.05$).

When explored further, a significantly greater fluid intake when receiving enteral and parenteral fluid remained evident irrespective of age group, whether assistance was required, diagnosis (excluding "other" due to low numbers) and whether stage 3 or 2 thickened fluids were required ($p<0.05$). The only exception was patients requiring stage 1 thickened fluids, where the increased fluid intake from enteral and parenteral fluid in addition to food and beverage, compared with food and beverage alone did not reach statistically significant differences (Table 1, 2).

Fluid from food and beverage consumption

Compared to those receiving enteral or parenteral fluids, significantly lower fluid intake from food and beverage consumption alone was evident amongst patients who were older, required assistance, or with diagnoses including deterioration or dementia. Caution is needed in interpreting results indicating higher fluid intakes amongst those receiving stage 2 thickened fluids (compared with the other consistencies) as only two patients were involved and individual variation may have played a role.

Once enteral and parenteral fluids were ceased, significantly more fluid was consumed from food in contrast to beverages, regardless of age, assistance required, diagnosis or fluid thickness recommended ($p<0.05$). Even when enteral or parenteral fluids were required, in general, a greater proportion of the fluid consumed was consumed from food rather than beverages (Table 2) although statistical significance was not reached if older (compared with younger, $p=0.62$), a stroke or neurological diagnosis (compared with other diagnoses, $p=0.40$), stage 2 or 3 fluid thickness (compared with stage 1, $p=0.44$, 0.13 respectively) and when assistance was required (compared with self reliant, $p=0.08$).

Comparison with fluid requirements

No patients achieved their calculated fluid requirements (Todorovic & Micklewright, 2004) unless enteral or parenteral fluids were received. However, adequate fluid intake was still not generally achieved. Of the 13 patients receiving enteral or parenteral fluids (days: median 2, range 1-7), the calculated minimum fluid requirements were met each day by only two patients (5 and 7 days respectively), met on half the days by three patients (who received 2, 2 and 4 days of enteral or parenteral fluids), on one day by two patients (who received 3 and 5 days of enteral or parenteral fluids) and were never met for six patients (1 receiving 4 days, 5 receiving 1 day enteral or parenteral fluids).

Discussion

This study's findings demonstrate that individuals with dysphagia requiring thickened fluids, are unlikely to meet any published estimated minimum fluid requirements (Austin, 1986; Chernoff, 1994; Chidester & Spangler, 1997; Holben et al., 1999; Zeman, 1991). Poor total daily oral fluid intake was apparent across all categories regardless of age group, diagnosis,

fluid thickness and whether assistance was required. Indeed, with diet alone, mean intakes did not achieve the minimum daily fluid intake target for adults of 30ml/kg/day if over 60 years, or 35 ml/kg for other adults recommended by the Parenteral and Enteral Nutrition group of the British Dietetic Association (Todorovic & Micklewright, 2004).

However, when enteral or parenteral fluid was provided, minimum total fluid intake were achieved regardless of age group, diagnosis, fluid thickness or assistance required. The only exception were patients requiring stage 1 (quarter thick, nectar thick, or level 150 mildly thick) fluids who barely achieved minimum water requirements, due to receiving far less enteral and parenteral fluids than patients requiring fluid of greater thickness. It is speculated as to whether requiring the lowest grade of fluid thickness is taken as an indication of lower acuity and a lesser need for additional support.

The mean fluid intake from thickened beverages in our study is equivalent to consumption of less than two of the six 200ml thickened fluid beverages provided through the food services each day. Previous studies have shown that poor satisfaction with thickened fluids contribute to poor compliance and consumption (Macqueen et al., 2003). Consequently, providing additional thickened beverages to individuals with a poor fluid intake is unlikely to greatly improve fluid intake. One study found a change in food service meal provision from three to five meals a day successfully increased fluid intake by over 10% in those with dysphagia (Taylor & Barr, 2006). Consequently, alternative means to improve fluid intakes through offering nutrient rich food choices with high fluid contents offered between meals as an alternative to thickened beverages appears desirable, while remaining cognisant of the importance of staff support and assistance to optimise consumption.

The contribution of food as a fluid source is emphasised by our study. In fact, food provided our patients with over two thirds of the total daily oral fluid intake. Philip and Green (Philip & Greenwood, 2000) also identified that around 70% of fluid was provided from pureed foods amongst aged care residents receiving a pureed diet plus thickened fluid. It is important that these fluid dense foods are not overlooked when assessing fluid intake in this population.

Nutrient rich, fluid dense foods can easily be encouraged and promoted to improve fluid intakes in dysphagic populations. Thick nourishing soups, pureed fruit, yoghurts and milk based puddings are practical alternatives to thickened fluids, could be offered at midmeals and allow for the inclusion of a variety of flavours and contain 70 - 80% fluid (FoodWorksTM Professional Edition 3.02 Xyris Software, Brisbane, Australia). Many of these items are also commercially available, including as single serves. These fluid dense foods are familiar fare, are consumed as 'every day' foods by people without dysphagia and may well be more acceptable to those who require texture modified foods and beverages. Offering fluid dense foods first could be a positive and practical strategy to improving fluid intakes of dysphagic patients. This approach also avoids diluting micronutrients through the addition of fluid when making meals a suitably smooth texture. Such initiatives could also result in cost savings for some facilities given these products are less expensive than most commercially available thickened fluids.

Patients in our study who were able to self feed consumed more fluid orally, through food and beverage, than those requiring assistance with eating. In our setting, assistance to eat is generally provided at main meals, but is less consistent with snacks due to time constraints of

the acute environment. Others have found an inverse association between level of disability and oral fluid intakes suggested that the level of assistance required to eat and drink is important and may contribute to poor oral fluid intakes (Whelan, 2001).

Environmental factors and functional disability add to the difficulty of fluid consumption. Even amongst older people who could swallow fluids safely, many were unable to drink mainly due to the inability to reach a drink (Blower, 1997; Spencer et al., 2000). The bed-bound were less likely to be able to take a drink compared with those able to be seated in a chair (Spencer et al., 2000). Other environmental barriers, such as the use of restraints, were observed to markedly reduced fluid intake (Morley & Silver, 1995).

The risk of dehydration is a consequence of both the degree and duration of inadequate fluid intake. Individuals receiving fluid from oral intake only (foods and thickened beverages) fell short of reaching minimum calculated fluid requirements. Mortality of between 12% and 71%, as well as increased 2-year mortality, has been identified amongst dehydrated older people receiving care (Faunt et al., 1995; Long et al., 1991; Molaschi et al., 1997). Mortality rates are high during both acute hospital care (Long *et al.*, 1991) and subsequently in ongoing care units (O'Neill et al., 1990). The clinical impact of dehydration and suboptimal fluid intake amongst dysphagia individuals requires further investigation as does to most effective use of alternative hydration options.

Limitations exist with this study, which was undertaken within the available resources of a real clinical setting. It is acknowledged that fluid intake assessments may be inaccurate

through omission error, estimation error or recording bias. It was attempted to minimise errors of omission through the use of dedicated dietetic assistants during both meal and midmeal times, by incorporating tray wastage into food and fluid quantifications and by the dietitian verifying additional sources of fluid intake (such as with medication, flushing tube feeds, intravenous fluids) daily with medical and nursing staff. A study of estimation errors reported volumes of a cup of tea (180 ml) and jelly (150 ml) being underestimated by 13.8% and 6.0% respectively (Daffurn et al., 1992). If our mean fluid intake from food and beverage only (1174ml) was underestimated by the greater level of 13.8%, the adjusted mean intake (1336ml), remains below estimated requirements. However, food and fluid intakes were estimated on a categorical scale rather than weighed or measured. This approach has been validated against weighted food records (de Graafa et al., 2005) and provides a practical means of assessing intake when food serve sizes are standardised.

Recording bias may have occurred through enhanced health practitioner vigilance, once aware that intakes were being recorded. However, documented fluid intakes remained below calculated requirements. Additionally, the effect of this potential bias was minimised due to much of the documentation being completed by the studies dietetic assistants.

Each day of observational data is not independent as each patient provided several days of data. Their use as separate cases may inflate statistical significance. However, regardless of any statistical significance, whether differences are clinically significant also needs to be considered.

Additionally, fluid consumption may be influenced by many factors including severity of illness, cause of dysphagia, age, the degree of meal texture modification required, the modality of fluid provision (enteral/parenteral, oral), displacement of oral intake through receiving enteral/parenteral fluids and the previous days fluid intake, to name a few. Future studies may further investigate issues of potential confounding or effect modification upon the association of fluid intake amongst acute patients with dysphagia. However, this descriptive study provides preliminary data indicating inadequacy of fluid intakes and offers insights as to the most important fluid sources in an at risk population group.

In conclusion, enteral and parenteral fluids were a significant source of fluid for individuals with dysphagia, although calculated fluid requirements were still not achieved in the majority of patients. In the absence of enteral and parenteral fluids, mean fluid intakes from food and beverages alone fell below the calculated minimum fluid requirements each day for every patient. Fluid dense foods contributed statistically more to total daily fluid intake than thickened beverages. Encouraging the intake of nourishing fluid dense foods should be considered to be an important strategy to improving fluid intakes of those requiring thickened fluids.

References

Austin, C. (1986). Water: Guidelines for nutritional support. *Nutritional Support Services.* **6**, 27-29.

Blower, A.C. (1997). Is thirst associated with disability in hospital inpatients? *Journal of Human Nutrition and Dietetics.* **10**, 289-293

Chernoff, R. (1994). Meeting the nutritional needs of the elderly in the institutional setting. *Nutr. Rev.* **52**, 132-136.

Chidester, J.C., & Spangler, A.A. (1997). Fluid intake in the institutionalized elderly. *J. Am. Diet. Assoc.* **97**, 23-28.

Chouinard, J., Lavigne, E., & Villeneuve, C. (1998). Weight loss, dysphagia, and outcome in advanced dementia. *Dysphagia.* **13**, 151-155.

Daffurn, K., Hillman, K.M., Bauman, A., Lum, M., Crispin, C., & Ince, L. (1992). Fluid balance charts: Do they measure up? *Br. J. Nurs.* **3**, 816-820.

de Graafa, C., Kramerb, F.M., Meiselmanb, H.L., Lesherc, L.L., Baker-Fulcod, C., Hirschb, E.S., & Warbere, J. (2005). Food acceptability in field studies with us army men and women: Relationship with food intake and food choice after repeated exposures *Appetite.* **44**, 23-31.

Duncan, P.W., Zorowitz, R., Bates, B., Choi, J., Glasberg, J., Graham, G., Katz, R., Lamberty, K., & Reker, D. (2005). Management of adult stroke rehabilitation care: A clinical practice guideline. *Stroke.* **36**, e100-143.

Faunt, J.D., Wilkinson, T.J., Aplin, P., Henschke, P., Webb, M., & Penhall, R.K. (1995). The effect in the heat: Heat-related hospital presentations during a ten day heat wave. *Aust. N. Z. J. Med.* **25**, 117-121.

Finestone, H., Foley, N., Woodbury, M., & Greene-Finestone, L. (2001). Quantifying fluid intake in dysphagic stroke patients: A preliminary comparison of oral and nonoral strategies. *Arch. Phys. Med. Rehabil.* **82**, 1744-1746.

Finestone, H., Greene-Finestone, L., Wilson, E., & Teasell, R. (1995). Malnutrition in stroke patients on the rehabilitation service and at follow-up: Prevalence and predictors. *Arch. Phys. Med. Rehabil.* **76**, 310-316.

Hamdy, S., Aziz, Q., Rothwell, J., Crone, R., Hughes, D., Tallis, R., & Thompson, D. (1997). Explaining oropharyngeal dysphagia after unilateral hemispheric stroke. *Lancet.* **350**, 686-692.

Holben, D.H., Hassell, J.T., Williams, J.L., & Helle, B. (1999). Research and professional briefs. Fluid intake compared with established standards and symptoms of dehydration among elderly residents of a long-term-care facility. *J. Am. Diet. Assoc.* **99**, 1447-1450.

Joint Working Party - British Dietetic Association and Royal College of Speech and Language Therapists. (2002). *National descriptors for texture modification in adults.* Birmingham: British Dietetic Association.

Jukkloa, K., & MacLennen, P. (2005). Innovations in aged care - improving the efficacy of nutritional supplementation in the hospitalised elderly *Australasian Journal on Ageing.* **24**, 119-224.

Leibovitz, A., Baumoehl, Y., Lubart, E., Yaina, A., Platinovitz, N., & Segal, R. (2007). Dehydration among long-term care elderly patients with oropharyngeal dysphagia. *Gerontology.* **53**, 179 - 183.

Long, C.A., Marin, P., Bayer, A.J., Shetty, H., & Pathy, M.S.J. (1991). Hypernatraemia in an adult in-patient population. *Postgrad. Med. J.* **67**, 643-645.

Low, J., Wyles, C., Wilkinson, T., & Sainsbury, R. (2001). The effect of compliance on clinical outcomes for patients with dysphagia on videofluoroscopy. *Dysphagia.* **16**, 123-127.

Macqueen, C., Taubert, S., Cotter, D., Stevens, S., & Frost, G.S. (2003). Which commercial thickening agent do patients prefer? *Dysphagia.* **18**, 46-52.

Martino, R., Foley, N., Bhogal, S., Diamant, N., Speechley, M., & Teasell, R. (2005). Dysphagia after stroke: Incidence, diagnosis, and pulmonary complications. *Stroke.* **36**, 2756-2763.

Meng, N., Wang, T., & Lien, I. (2000). Dysphagia in patients with brainstem stroke: Incidence and outcome. *Am. J. Phys. Med. Rehabil.* **79**, 170-175.

Molaschi, M., Ponzetto, M., Massaia, M., Villa, L., Scarafiotti, C., & Ferrario, E. (1997). Hypernatremic dehydration in the elderly on admission to hospital. *J. Nutr. Health Aging.* **1**, 156-160.

Morley, J.E., & Silver, A.J. (1995). Nutritional issues in nursing home care. *Ann. Intern. Med.* **123**, 850-859.

O'Neill, P.A., Faragher, E.B., Davies, I., Wears, R., McLean, K.A., & Fairweather, D.S. (1990). Reduced survival with increasing plasma osmolality in elderly continuiung-care patients. *Age Ageing.* **19**, 68-71.

Palmer, J., Drennan, J., & Baba, M. (2000). Evaluation and treatment of swallowing impairments. *Am. Fam. Physician.* **61**, 2453.

Parker, C., Power, M., Hamdy, S., Bowen, A., Tyrrell, P., & Thompson, D. (2004). Awareness of dysphagia by patients following stroke predicts swallowing performance. *Dysphagia.* **19**, 28–35.

Perry, L. (2001). Dysphagia: The management and detection of a disabling problem. *Br. J. Nurs.* **10**, 837-844.

Perry, L., & Love, C. (2001). Screening for dysphagia and aspiration in acute stroke: A systematic review. *Dysphagia.* **16**, 7-18.

Philip, K.E., & Greenwood, C.E. (2000). Nutrient contribution of infant cereals used as fluid thickening agents in diets fed to the elderly. *J. Am. Diet. Assoc.* **100**, 549-554.

Smithard, D., O'Neill, P., Park, C., Morris, J., Wyatt, R., England, R., & Martin, D. (1996). Complications and outcome after acute stroke: Does dysphagia matter? *Stroke.* **27**, 1200-1204.

Sopade, P.A., Halley, P.J., Cichero, J.A.Y., & Ward, L.C. (2007). Rheological characterisation of food thickeners marketed in australia in various media for the management of dysphagia. I: Water and cordial. *Journal of Food Engineering.* **79**, 69-82.

Spencer, B., Pritchard Howarth, M., Lee, T., & Jack, C. (2000). Won't drink? Can't drink. *Age Ageing.* **29**, 185.

Taylor, K.A., & Barr, S.I. (2006). Provision of small, frequent meals does not improve energy intake of elderly residents with dysphagia who live in an extended-care facility. *J. Am. Diet. Assoc.* **106**, 1115-1118.

Todorovic, V.E., & Micklewright, A. (2004). *A pocket guide to clinical nutrition, third edition, the parenteral and enteral nutrition group of the british dietetic association.* Birmingham: British Dietetic Association,.

Whelan, K. (2001). Inadequate fluid intakes in dysphagic acute stroke. *Clin. Nutr.* **20**, 423-428.

World Health Organisation. (2002). Health and ageing - a discussion paper. *vol. accessed 24 July 2008*: http://whqlibdoc.who.int/hq/2001/WHO_NMH_HPS_01.1.pdf.

Zeman, F.J. (1991). *Clinical nutrition and dietetics.* NewYork: Macmillan Publishing Company.

Table 1 Fluid intake (mL and %) from all fluid sources (individual days of consumption assessed) in relation to fluid source,

					Millilitres of fluid from				**mL/Kg/d**	**Percentage (%) of fluid from**		
Category (number of patients)	**Age** (years) Mean (sd)	**Weight** (kg) Mean (sd)	**Receiving**	**Number of days analysed**	**Extra fluid** (enteral/ parenteral) Mean (sd)	**Beverages** Mean (sd)	**Food** Mean (sd)	**Total intake (mL)** Mean (sd)		Extra	**Beverages**	**Food**
All patients [a]												
(n=25)	74 .0 (16.2)	62 (12.2)	Whole population	182	299 (728)	351 (179)	739 (396)	1371 (685)	22.0 (11.0)			
			Diet only	146		370 (159)	806 (363)	**1174 (455)**	**18.9 (7.0)**		32	68
			Diet with ent/ parenteral fluid	36	1501 (931)	263 (232)	455 (408)	**2165 (867)**	**34.6 (14.7)**	69	12	21
			P Value					**< 0.001**	**< 0.001**			

* “diet only” includes food and beverages

Table 2 Fluid intake (individual days of consumption assessed) in relation to fluid source, age, assistance, diagnosis and fluid thickness categories.

Category (number of patients)	**Age** (years) Mean (sd)	**Weight** (kg) Mean (sd)	**Receiving**	**Number of days analysed**	**Millilitres of fluid from**			
					Extra fluid (enteral/ parenteral) Mean (sd)	**Beverages** Mean (sd)	**Food** Mean (sd)	**Total intake (mL)** Mean (sd)
Age Group [a b]								
Older	79.8 (7.1)	60.1 (12.4)	Diet only	121		352 (159)	716 (341)	**1064 (428)**
(n=21)			Diet with ent/ parenteral fluid	32	1528 (906)	184 (169)	365 (347)	**2076 (854)**
Younger	45.5 (17.5)	71.8 (3.3)	Diet only	25		424(149)	1198 (239)	**1622 (519)**
(n=4)			Diet with ent/ parenteral fluid	4	1025 (868)	639 (348)	851 (715)	**2515 (863)**
Assistance required [a b]								
Nursing and/or	71.7 (19.8)	59.4 (12)	Diet only	75		320 (150)	710 (402)	**1031 (482)**
family assist (n=15)			Diet with ent/ parenteral fluid	29	1538 (840)	211 (277)	297 (432)	**2047 (1112)**
Self reliant	77.4 (8.4)	65.8 (12.0)	Diet only	71		414 (157)	884 (298)	**1298 (377)**
(n=10)			Diet with ent/ parenteral fluid	7	1148 (1235)	351 (193)	803 (523)	**2303 (707)**
Diagnosis [a c]								

Stroke,	70.1 (18.4)	61.5 (10.1)	Diet only	49		398 (154)	865 (355)	**1263 (446)**	
Neurological (n=16)			Diet with ent/ parenteral fluid	19	1684 (798)	313 (262)	411 (433)	**2408 (695)**	
Deterioration,	80.9 (6.9)	61.0 (12.5)	Diet only	74		355 (168)	707 (364)	**1066 (466)**	
Dementia (n=12)			Diet with ent/ parenteral fluid	20	1380 (949)	137 (134)	420 (328)	**1937 (940)**	
Other eg	64.3 (20.2)	71.7 (12.6)	Diet only	16		325 (155)	931 (308)	**1256 (351)**	
Mechanical (n=3)			Diet with ent/ parenteral fluid	1	2000	300	170	**2470**	
Fluid Thickness**	**a c, d**								
Stage 3 (n=11)	72.9 (15.1)	62.6 (13.4)	Diet only	62		329 (139)	688 (386)	**1017 (458)**	
			Diet with ent/ parenteral fluid	8	2151 (620)	177 (157)	221 (154)	**2548 (675)**	
Stage 2 (n=2)	82.3 (2.5)	67.3 (10)	Diet only	16		505 (129)	995 (350)	**1500 (403)**	
			Diet with ent/ parenteral fluid	6	1292 (784)	260 (156)	610 (495)	**2161 (551)**	
Stage 1 Quarter thick (n=10)	78.1 (9.0)	58.3 (11.5)	Diet only	64		355 (167)	835 (311)	**1190 (398)**	
			Diet with ent/ parenteral fluid	12	832 (897)	186 (204)	531 (406)	**1549 (905)** **ns**	

* “diet only” includes food and beverages

** Stage 3 : other terms include full thick, pudding thick & level 900 extremely thick

Stage 2 : other terms include half thick, honey thick & level 400 moderately thick

Stage 1: other terms include quarter thick, nectar thick & level 150 mildly thick

a p<.05 **independent t-test.** Comparing **“Diet with enteral/parenteral fluid” with “Diet only”**

b p<.05 independent t-test. Two group comparison of “**Diet only”** within a category (eg young and old)

c p<.05 **ANOVA** Three group comparison of “**Diet only**” within a category (eg fluid thickness)

d p<.05 ANOVA Three group comparison of “**Diet with enteral/parenteral fluid”** within a category (eg fluid thickness)

ns **independent t-test.** Comparing **“Diet with enteral/parenteral fluid” with “Diet only”** was not statistically significant.