

Grocery purchasing among older adults by chewing ability, dietary knowledge and socio-economic status

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Abstract

Objectives: Nutrition plays a central role in health, with poor dietary habits and nutritional intake being associated with a range of chronic diseases. The aim was to examine grocery purchasing behaviour in relation to chewing ability, dietary knowledge and socio-economic status (SES) among older adults.

Design: Data were collected by mailed survey in 2008. Grocery purchasing was measured using a sixteen-item index of compliance of food purchasing with dietary guidelines. Self-reported number of teeth was classified as an inadequate dentition if less than twenty-one teeth were present. Chewing ability was based on a five-item chewing index. Dietary knowledge was collected using twenty true/false items. SES was assessed using a subjective social status rating representing where people stand in society.

Setting: Population survey in Adelaide, South Australia.

Subjects: Adults aged 60–71 years.

Results: Responses were collected from 444 persons (response rate = 68.8%). Among dentate persons, 24.4% had an inadequate dentition with 10.3% defined as 'chewing deficient'. Multivariate regression coefficients adjusted for age, sex and income showed chewing deficiency (−5.8) and low SES (−3.6) was associated ($P < 0.05$) with lower grocery purchasing scores, but dietary knowledge was not statistically significant.

Conclusions: For older adults, chewing deficiency and lower social status were associated with lower compliance with dietary guidelines, independent of dietary knowledge.

Keywords
Food choice
Tooth loss
Dietary knowledge
Socio-economic status
Older adults

Nutrition plays a central role in health, with poor dietary habits and nutritional intake being associated with a range of chronic diseases⁽¹⁾. Intake of specific nutrients into the body reflects the diet that a person eats, which involves the food choices made by an individual usually as part of food purchasing behaviour.

Poor dietary habits have been linked to a number of factors, including socio-economic status (SES). SES may influence nutrition directly as a resource limitation associated with price as a barrier to food choice. SES may also influence nutrition through the impact of dietary knowledge on food choice⁽²⁾. Another pathway that SES may influence nutrition through limiting food choice is by the impact of tooth loss on chewing ability. Lower intakes of specific nutrients (e.g. β -carotene, vitamin C, folate and dietary fibre) have been found for the edentulous and people with few natural teeth⁽³⁾. The relationship between dentition status and nutritional intake is important because of the well-known health sequelae of poor dietary habits⁽⁴⁾.

The literature on tooth loss and nutrition has identified a plausible link between chewing disability and restricted diets^(3,4), possibly reflecting a general restriction in diet or selective avoidance of some healthy foods on the basis of their being difficult to chew. However, the observed links between tooth loss and SES, and dietary knowledge and SES⁽²⁾, could mean that the association between tooth loss and diet may be confounded. Hence, it is necessary to demonstrate that tooth loss and related chewing disability is an independent predictor of diet.

The generally higher levels of tooth loss among the elderly places them at risk of nutrition-related problems compared with younger persons. These diet-related health problems may be further exacerbated by lower SES, and may be influenced by variation in dietary knowledge. The aim of the present study was to examine grocery purchasing behaviour in relation to chewing ability, dietary knowledge and SES among elderly persons.

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Methods

A random sample of adults aged 60–70 years living in Adelaide, South Australia, was drawn from the Electoral Roll. Data were collected by mailed self-completed questionnaires in 2008, with multiple follow-up mailings to non-respondents.

Outcome variable

Grocery purchasing was assessed by sixteen grocery items (see Table 1) using multiple responses for each item in relation to what type of grocery item they usually buy, based on previous reports using the Grocery Purchasing Index⁽²⁾. For example, the food-type item of 'bread' had response options such as 'white', 'wholemeal', 'multi-grain', etc. Participants were advised to report on themselves (i.e. 'your usual food shopping') or 'the person who shops for you' to cover such cases as a person shopping on behalf of their spouse. The responses to the grocery items were classified into 'recommended' and 'regular' categories, with items in the recommended category being those suggested by health authorities as preferable to minimise the risk of diet-related disease. These were based on national guidelines produced by the Australian National Health and Medical Research Council⁽⁵⁾. For example, a response of 'white' to the 'bread' item would be classed as 'regular', while a response such as 'wholemeal' would be classed as 'recommended'. Responses to each food-type item were coded as 0 if never purchased, 1 if the regular option was purchased exclusively, 2 if both the regular and recommended options were purchased and 3 if the recommended option was purchased exclusively. These coded responses were summed to form the purchasing index. Following the reported method for the index⁽²⁾, the index scores were adjusted for the number of food-type items usually purchased and re-scored on a range from 0 to 100, with high scores indicating greater compliance with dietary guideline recommendations.

Explanatory variables

Self-reported number of teeth was classified as inadequate dentition if less than twenty-one teeth were present, consistent with the case definition used elsewhere, such as in the UK adult dental health survey⁽⁶⁾ and the National Survey of Adult Oral Health, Australia 2004–2006⁽⁷⁾. Chewing ability was assessed using five items based on previous reports of chewing index scores (see Table 2)⁽⁸⁾. Responses of 'yes' to each chewing item were coded as 1 and summed to produce a chewing index score. Scores of 0–4 were classed as 'chewing deficient', whereas a score of 5 was classed as 'chewing competence'⁽⁸⁾.

Dietary knowledge was collected using twenty true/false items (see Table 3)⁽²⁾. Correct answers were coded as 1, and summed to produce a dietary knowledge score where higher scores indicated better dietary knowledge.

Scores were dichotomised into high dietary knowledge if fifteen or more items were correct.

SES was assessed using the measure of subjective social status whereby persons rate themselves on a ladder ranging from 0 to 10 representing where they stand in society with higher scores representing those best off in terms of education, money and jobs⁽⁹⁾. This measure was dichotomised with scores less than 5 coded as lower SES.

In addition, annual income (up to \$AU20 000 and >\$AU20 001), age (60–64 and 65–70 years) and sex (male and female) were included as explanatory variables to control for their potential effects.

Analysis

The analysis was restricted to dentate persons (with some of their own natural teeth). Associations of chewing ability with dentition status, dietary knowledge, SES, income, age and sex were tested using the χ^2 statistics. Differences in mean grocery purchasing scores were tested using Mann–Whitney *U* tests⁽¹⁰⁾. The multivariate model was fitted using linear regression for all main effects and two-way interactions were tested, but the interactions were only retained if statistically significant at the $P < 0.05$ level.

The research was approved by the Human Research Ethics Committee of the University of Adelaide.

Results

Response

Responses were collected from 444 persons (response rate = 68.8%). The majority of the respondents were dentate (88.6%). Among the dentate respondents, 48% were men and 67% were born in Australia.

Distributions

For the grocery purchasing items (Table 1), generally a small percentage of persons reported purchasing the regular option only, except for rice (67.2%) and pasta (73.3%). In addition, small percentages reported that they 'do not buy' each food-type item except for cooking fat (83.0%). The grocery purchasing index score ranged from 33 to 100, with a median of 78 and a mean of 76 (SD 13).

For the chewing index, a high percentage of persons reported being able to chew the items in the index, ranging between 91.1% for 'bite off and chew whole fresh apple', 96.1% for 'chew fresh carrot', 96.3% for 'chew firm foods such as steak or dried apricots' and 98.7% for 'chew fresh lettuce salad' and 'chew boiled vegetables'. The summed chewing index score ranged from 0 to 5, with a median of 5.00 and a mean of 4.82 (SD 0.67). When classified by chewing ability, 10.3% were defined as chewing deficient.

The majority of persons gave correct answers to the dietary knowledge items, ranging between 81.9% and 98.9% (Table 2). The summed dietary knowledge score ranged from 9 to 20, with a median of 19.0 and a mean of 18.3 (SD 1.9). When dichotomised into dietary knowledge

Table 1 Median responses to grocery purchasing items and responses grouped into categories of purchasing

Food type	Response categories (row %)				Median response
	Do not purchase	Regular only	Mixed (regular and recommended)	Recommended only†	
Bread	1.6	7.7	18.8	71.9	3.0
Rice	7.5	67.2	11.6	13.7	1.0
Pasta	8.6	73.3	9.1	9.1	1.0
Baked beans	19.4	46.3	2.1	32.3	1.0
Fruit juice	24.3	11.2	2.6	61.9	3.0
Tinned fruit	24.9	6.5	3.4	65.2	3.0
Milk	2.6	20.5	12.2	64.8	3.0
Cheese	3.6	37.9	11.4	47.0	2.0
Yoghurt	18.4	11.7	4.4	65.5	3.0
Beef mince	9.6	18.4	6.0	66.0	3.0
Chicken	5.8	31.4	8.9	53.9	3.0
Tinned fish	9.1	32.9	14.5	43.5	2.0
Vegetable oil	2.3	0.5	16.5	80.7	3.0
Margarine	22.8	12.9	3.2	61.2	3.0
Butter	45.7	24.9	3.1	26.2	1.0
Cooking fat	83.0	3.1	0.5	13.4	0.0

†Recommended included⁽²⁾: bread (wholemeal, multi-grain, white high in fibre, rye, soy and linseed), rice (wholemeal or brown), pasta (wholemeal or brown), baked beans (salt-reduced or unsalted), fruit juice (unsweetened), tinned fruit (in natural juice), milk (reduced-fat, low-fat, high-calcium, high-iron, high-protein, reduced-lactose, no cholesterol, soy or soy and linseed), cheese (reduced-fat, low-salt), yoghurt (low-fat), beef mince (lean), chicken (without skin), tinned fish (in spring water), vegetable oil (salt-reduced, fat-reduced), butter (salt-reduced, unsalted), solid cooking fat (margarine, solidified oil).

Table 2 Percentage of correct responses to dietary knowledge items

Dietary knowledge items	Percentage of correct responses
It is better for health to choose lean meat (with little visible fat)	98.7
It is better for health to limit those foods which contain high levels of sugar such as soft drinks, cordial and biscuits	95.8
Adequate calcium intake may reduce the risk of osteoporosis	98.9
It is recommended that adults have some milk, cheese or yoghurt every day	97.6
Fruit is a poor source of vitamin C	93.4
Whole-grain breads are good sources of fibre	99.2
It is recommended that we eat fat and oil in limited amounts	91.8
Bread, cereal, fruit and vegetables should make up the smallest part of our diet	90.6
Dietary fibre from wholemeal foods combined with an adequate intake of drinking water prevents constipation	96.0
Low sugar intake may decrease the risk of dental cavities	97.1
Saturated fats are found in large quantities in butter, lard and dripping	96.3
A high intake of saturated fat can protect against heart disease	96.6
Choosing wholemeal bread provides no health benefits	95.5
Choosing salt-reduced food provides no health benefits	93.0
Adults should choose full-cream milk instead of skimmed or trimmed milk	84.1
Meat, fish, chicken and eggs should make up the largest part of our diet	74.3
A high intake of plant food combined with a low salt intake may protect against high blood pressure	97.9
Milk and milk products such as cheese and yoghurt are the best sources of iron	91.1
Meat, poultry and fish are the best sources of calcium	88.3
Dark green and orange vegetables like spinach, broccoli, carrots and pumpkin are low in vitamin A	81.9

categories, 90.8% were classified as having high dietary knowledge.

The responses to the subjective social status item ranged between 0 and 10, with a median of 6.0 and a mean score of 5.9 (SD 1.9). When classified into SES groups, 21.3% of persons were in the lower SES group.

Associations

Chewing ability was related to dentition status and SES, but not to dietary knowledge (Table 3). Chewing deficiency was more prevalent among persons with inadequate

dentition (26.4%) compared with those with adequate dentition (4.9%), among the lower SES group (18.2%) compared with the higher SES group (8.6%) and in the lower income group (20.9%) compared with the higher income group (7.4%).

Unadjusted mean grocery purchasing scores were lower for persons with chewing deficiency, lower dietary knowledge, lower SES, lower income and for men (Table 4). Multivariate regression coefficients showing chewing deficiency (−5.0) and low SES (−4.0) were both associated ($P < 0.05$) with lower grocery purchasing scores, as

Table 3 Distributions of explanatory variables and associations of explanatory variables with chewing ability

	Distribution	Chewing deficient	
	Column (%)	Row (%)	<i>P</i>
Number of teeth			
Inadequate dentition	24.4	26.4	**
Adequate dentition	75.6	4.9	
Dietary knowledge			
Higher	90.8	10.0	NS
Lower	9.2	15.2	
Social status			
Higher	78.7	8.6	**
Lower	21.3	18.2	
Income (\$AU)			
Up to 20 000	24.9	20.9	**
≥20 001	75.1	7.4	
Age group (years)			
60–64	60.8	9.0	NS
65–70	39.2	12.4	
Sex			
Male	47.7	10.4	NS
Female	52.3	10.2	

***P* < 0.01, χ^2 test.

Table 4 Grocery purchasing scores: unadjusted means by chewing ability, dietary knowledge, social status, income, age and sex and coefficients from multivariate regression analysis

	Unadjusted			Multivariate		
	Mean	SE	<i>P</i>	Coefficients	SE	<i>P</i>
Chewing ability						
Deficient	69.8	2.7	*	−5.0	2.3	*
Competent	75.8	0.7		Ref.	–	
Dietary knowledge						
Higher	76.4	0.7	NS	3.6	2.6	NS
Lower	71.2	3.4		Ref.	–	
Social status						
Higher	76.9	0.7		Ref.	–	
Lower	72.4	1.6	*	−4.0	1.9	*
Income (\$AU)						
Up to 20 000	73.3	1.6	*	−1.3	1.9	NS
≥20 001	76.7	0.8		Ref.	–	
Age group (years)						
60–64	76.1	0.8	NS	−1.0	1.4	NS
65–70	75.9	1.2		Ref.	–	
Sex						
Male	74.1	1.0	**	−3.7	1.4	**
Female	77.9	0.8		Ref.	–	

Ref., reference category.

P* < 0.05; *P* < 0.01.

were men (−3.7) compared with women. However, dietary knowledge, income and age were not statistically significant. No interactions were statistically significant.

Discussion

The findings show that grocery purchasing behaviour among older adults in Australia varied by chewing ability and SES, but not by the level of dietary knowledge. This indicates that persons with chewing deficiencies and lower social status are less likely to comply with the recommended dietary guidelines. The link between food choice

and dietary quality means that attention is needed to understand factors that influence food purchasing behaviour⁽¹¹⁾. The findings of the present study are important because of their relevance to the issues of tooth loss, chewing and diet in the elderly. The accumulation of tooth loss over the life course places older adults at potential risk of nutrition-related problems due to their generally higher levels of tooth loss compared with younger persons⁽¹²⁾. There is also evidence of socio-economic disparities in dietary patterns and nutrition^(13,14). The impact of dietary knowledge on food choice has been linked as one pathway through which SES may influence nutrition⁽²⁾. However, in this group of older adults, dietary knowledge was not related to food choice.

Chewing ability

People with a compromised dentition have been found to have significantly impaired masticatory function compared with those with an intact dentition⁽¹⁵⁾. Among the elderly dentate adults in the present study, while only a minority were classified as having a chewing deficiency, chewing deficiency was associated with inadequate dentition and lower compliance with dietary guidelines. Edentulous and people with few natural teeth have been reported to have lower intakes of specific nutrients (e.g. β -carotene, vitamin C, folate and dietary fibre)^(3–4,16–17). The present study shows that the link between tooth loss and chewing ability with diet persists after controlling for the effects of both dietary knowledge and SES.

Dietary knowledge

Previous studies have shown links between dietary knowledge and eating behaviour^(18,19), with variation in nutrition knowledge being associated with characteristics such as education, age, sex and work status^(20,21). However, dietary knowledge was not associated with food purchasing behaviour in the present study of older adults when adjusted for SES and chewing ability. One consideration was that the levels of dietary knowledge were quite high among the respondents, perhaps indicating the success of health promotion campaigns in improving nutrition knowledge. It should also be considered that knowledge does not necessarily translate into behaviour. However, socio-economic variation in dietary knowledge could provide a link between socio-economic position and food purchasing behaviour⁽²⁾, and diet-related health promotion may be more effective if tailored to the needs of disadvantaged groups⁽¹¹⁾.

Socio-economic status

Subjective social status was used as a measure of SES for older adults in the present study as the age range included a cross-section where some may still be employed, others may not be working in formal employment, and yet others may be retired from work. Subjective social status has been related to a range of health-related factors such as self-rated

health, heart rate and body fat distribution⁽⁹⁾, and reflects the cognitive averaging of standard markers of socio-economic position rather than psychological biases⁽²²⁾. Previous studies have established a link between SES and diet. For example, SES has been related to fruit and vegetable intake among Australian adults⁽²³⁾, while data on US adults found that better SES improved the likelihood of adequate fruit and vegetable intake as well as overall diet quality⁽²⁴⁾. The present study confirms the link between SES and food purchasing, and further shows the independent effects of both SES and chewing ability.

Strengths and limitations

The sampling is likely to generate a representative sample of the general population of adults in the age range since it was based on the Electoral Roll and voting is compulsory. Comparison with census data for similarly aged Adelaide residents from 2006⁽²⁵⁾ showed a similar percentage by sex (48% men in the sample compared to 46% in the census), but there was a higher percentage of Australian-born persons in the sample (67%) compared to the census (58%). It is also possible that despite the adequate response rate, elderly persons in high care facilities may be under-represented, and the findings may be generalised to community-dwelling older adults. While the findings are based on self-reports of usual purchasing behaviour, it is considered important to understand dietary behaviour, which is distinct from the downstream consequences of behaviour (i.e. food and nutrient intake)⁽¹¹⁾. The cross-sectional nature of the study limits the ability to comment on the observed associations in terms of causal relationships.

Implications and conclusions

The non-significant result for dietary knowledge is consistent with findings that suggest that extended nutrition education would have only limited effects on food intake⁽²⁶⁾. The persistence of chewing ability and SES as predictors of food purchasing does not support the hypothesis of confounding by dietary knowledge. While chewing ability was related to food purchasing behaviour, further research is required to document the types of foods that are restricted and to establish the public health significance of such differences in terms of nutrition and health outcomes. In addition, further research may also shed more light on the extent and pattern of tooth loss associated with restricted dietary intakes. For example, studies have shown that tooth loss may need to be severe in order to influence diet⁽²⁷⁾. Another consideration for future research could be the investigation of whether factors such as both chewing disability related to tooth loss and dietary patterns cluster together along with other common health behaviours. There are suggestions that while tooth loss is related to diet, other psycho-social factors may be more influential⁽²⁸⁾. In summary, the present study showed that among older adults, chewing deficiency and lower social status were

associated with lower compliance with dietary guidelines, independent of dietary knowledge.

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