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Factors influencing food choice for independently living older people - a systematic literature review

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Factors influencing food choice for independently living older people - a systematic literature review

Abstract

Unyielding, disproportionate growth in the 65 years and older age group has precipitated serious concern about the propensity of health and aged-care services to cope in the very near future. Preservation of health and independence for as long as possible into later life will be necessary to attenuate demand for such services. Maintenance of nutritional status is acknowledged as fundamental for achievement of this aim. Determinants of food choice within this age group need to be identified and better understood to facilitate the development of pertinent strategies for encouraging nutritional intakes supportive of optimal health. A systematic review of the literature consistent with PRISMA guidelines was performed to identify articles investigating influences on food choice among older people. Articles were limited to those published between 1996 and 2014 and to studies conducted within countries where the dominant cultural, political and economic situations were comparable to those in Australia. Twenty-four articles were identified and subjected to qualitative analysis. Several themes were revealed and grouped into three broad domains: (i) changes associated with ageing; (ii) psychosocial aspects; and (iii) personal resources. Food choice among older people is determined by a complex interaction between multiple factors. Findings suggest the need for further investigations involving larger, more demographically diverse samples of participants, with the inclusion of a direct observational component in the study design.

Disciplines

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1 **Factors Influencing Food Choice for Independently Living Older People – A Systematic**
2 **Literature Review**

3
4 **ABSTRACT**

5 Unyielding, disproportionate growth in the sixty-five years and over age group has precipitated
6 serious concern about the propensity of health and aged-care services to cope in the very near
7 future. Preservation of health and independence for as long as possible into later life will
8 therefore be necessary to attenuate demand for such services. Maintenance of nutritional status
9 is acknowledged as fundamental for achievement of this aim. Determinants of food choice
10 within this age group need to be identified and better understood to facilitate the development
11 of pertinent strategies for encouraging nutritional intakes supportive of optimal health.

12 A systematic review of the literature consistent with PRISMA guidelines was performed to
13 identify articles investigating influences upon food choice amongst older people. Articles were
14 limited to those published between 1996 and 2014. Twenty-four articles were identified and
15 subjected to qualitative analysis. Several themes were revealed and grouped into three broad
16 domains: (i) changes associated with ageing; (ii) psychosocial aspects; and (iii) personal
17 resources.

18 Food choice amongst older people is determined by a complex interaction between multiple
19 factors. Findings suggest the need for further investigations involving larger, more
20 demographically diverse samples of participants, with the inclusion of a direct observational
21 component in the study design.

22 **Keywords:** older adults, old age, ageing, aged, independent, community, food choice, eating
23 habits, influences

24

1 BACKGROUND

2 Population aging is a growing concern in many nations around the world (1-10). In Australia,
3 recent statistics reveal that the proportion of people aged 65 years and over has almost doubled
4 - from 8% to 14% - since 1970-71 (11), with 2% now aged more than 85 years (12). These
5 figures have been predicted to escalate to approximately 22% and 5%, respectively, by the year
6 2061 (12).

7 Amplifying concerns amongst Australian economists and healthcare service providers is the
8 concurrent downward shift in the proportion of people of working-age (13), and thus also
9 available taxpayer dollars to fund mounting health care costs. In 2002, more than five persons
10 of working-age contributed to the support of each person aged over 65 years, however, this
11 figure is predicted to drop to less than 2.5 - with growth at almost zero percent - by the year
12 2042 (13). This presents an untenable situation, both economically and from a resource
13 perspective. Consequently, State and Federal governments are seeking to keep older people
14 living as healthily and independently as possible into later life, so as to delay the need for
15 reliance upon public health care services and residential aged-care support (11).

16 Good nutrition during the senior years is important for sustaining health, preventing disease and
17 disability (2,6,8,14-20), and hence, maintaining independence and quality of life (8,14,17,20).
18 Yet the aging process is associated with a number of physiological, pathological, psychosocial
19 and environmental changes which may adversely impact food choice and dietary intake (1-
20 4,14,18-21). For example, declining chemosensory perception (1,3,6,7,10,14,15,18,20,22),
21 poor dentition (3-7,10,15,16,19,21), loss of appetite (1,2,4,6,10,14,19,22,23), onset of chronic
22 illness (1-3,5,6,8-10,14,15,18,20-25), loneliness (2-4,6-10,14,15,20-27), and loss of disposable
23 income (1-3,5,7-10,14-16,18-20,24-27) have been found to contribute to suboptimal dietary
24 intakes in some older adults.

1 A primary goal for health professionals is to devise and deliver programmes that will support
2 sound nutrition and better health outcomes into, and throughout, old age. This requires
3 identification of factors specific to older populations that influence their food choice, and
4 further, an understanding of the way in which these factors operate to either encourage or
5 constrain consumption of nutritious foods (2,3,7,9,14,19,20,26). It is postulated that such
6 factors will be wide ranging, and specific to the particular population under study. A systematic
7 literature review has been undertaken to amalgamate existing knowledge, outline any
8 identifiable gaps, and determine underlying implications for future interventions.

9

10 **METHODS**

11 A systematic review of the literature was performed in line with PRISMA guidelines (28) to
12 answer the following research question: Which factors influence food choice amongst
13 independently-living older people?

14 An electronic search was first implemented through the Web of Science database and then
15 repeated within a further nine databases. Inclusive and exclusive search terms, and Boolean
16 phrases reflective of key words contained within the research question, were employed.

17 Limits were applied to the area and category of research, document type, language, and year of
18 publication (1996 - 2014, inclusive), as well as the study locale. Studies were included if
19 conducted within countries where the dominant cultural, political and economic situations are
20 comparable to those in Australia. All studies utilising population groups where these factors
21 are significantly dissimilar to those from within the broader Australian community - including
22 studies specific to minority populations - were excluded.

1 A participant age range of 50 years or more was applied, both to ensure an adequate number of
2 articles for review, and also due to the variation within the different studies generated from the
3 database search.

4 Specific details of the inclusion and exclusion criteria applied to this review may be found in
5 Table 1.

6 All studies included in the review were rated according to the National Health and Medical
7 Research Council (NHMRC) levels of evidence hierarchy (29) wherever applicable, and graded
8 for quality.

9

10 **RESULTS**

11 The review process generated twenty-four articles for inclusion in the final review (Figure 1).
12 Of these, only one article considered the opinions of ‘experts’, with all others reflecting the
13 perceptions of older people themselves. Findings from the included articles are summarised in
14 Table 2.

15 Qualitative analysis revealed a wide range of themes, which were subsequently collated into
16 three broad domains: (i) changes associated with aging, (ii) psychosocial aspects and (iii)
17 personal resources.

18 Physiological changes associated with the aging process were frequently cited as having a
19 significant impact upon food choice. In particular, poor dentition, taste or chemosensory
20 change, loss of appetite, illness or medical conditions, and mobility/functional limitations were
21 identified as serving to shape decisions regarding foods consumed.

22 The domain of psychosocial aspects was constructed to incorporate thoughts, experiences,
23 values, and beliefs relating to food choice. Seven major themes emerged within this domain,

1 including life course, loneliness (and/or living arrangement), lack of motivation and/or energy,
2 personal interest in health and/or nutrition, self-perception of health status and desire for
3 independence.

4 Personal resources identified as influential for dietary intake included income/food cost, access
5 to quality produce, transportation issues, knowledge and/or skills in food preparation, access to
6 support, and individual dietary resilience in the face of barriers encountered.

7

8 **DISCUSSION**

9 The enormity of the challenge being posed to health and aged care services, the world over, by
10 the magnitude and speed of growth in the proportion of individuals aged 65 years and over
11 cannot be underestimated. Given the relative importance of ensuring sound nutritional intakes
12 for maintaining independence into old age, there appears to be a considerable lack of research
13 into identifying and understanding those factors which might be influential in determining why
14 older people eat the foods they do. Despite this, the present literature has resulted in the
15 identification of a number of common themes surrounding issues that impact upon food choice
16 amongst older people living independently within the community.

17

18 *Synthesis of the existing literature*

19 Three key domains emerged from analysis within this review: physiological changes associated
20 with aging, psychosocial aspects and personal resources.

21

22 *Physiological changes associated with aging*

1 Taste has been widely identified as a key consideration governing food choice in older people;
2 yet, paradoxically, taste acuity often declines with age (1,3,10,14,15,18,22). In addition, older
3 people often take medications which may further compromise flavour sensation (7,22). These
4 factors detract from the enjoyment of eating and have been associated with reduced appetite (7)
5 as well as the selection of foods high in salt and sugar to compensate for flavour loss (10,22).

6 Poor dentition, dentures and difficulty with chewing also limit the range of foods eaten (3-
7 7,10,15,16,19,21); in particular, protein-rich foods (such as meat and nuts) (4,6,15) and fruits
8 and vegetables (4,21). A reduced intake of such foods significantly increases nutritional risk,
9 since they provide a good source of protein, vitamins and minerals - some of which (including
10 protein) are needed in higher amounts during old age (30).

11 Loss of appetite (due to factors such as reduced activity, loneliness or the onset of medical
12 conditions) increases risk for an inadequate intake (1,4), which in turn can both cause and
13 exacerbate health problems (14,15). Compromised health further limits dietary intake, often
14 through avoidance of certain foods, and restriction in both variety and amounts of foods
15 consumed (3,8,15,17,18,20,23,24,26). In contrast, however, Brownie (2013) found that some
16 older people became more interested in their health following the diagnosis of a health problem,
17 and subsequently *improved* their nutritional intake (22).

18 Mobility and functional limitations are often cited as significant barriers to food access and
19 preparation (3,5,6,8,10,15,18,20,23,24,26), particularly for those who lack private transport or
20 support from family and friends, and therefore must rely upon public transport services or walk
21 to and from shops (5,15,26). Of note, studies involving observation of participants functioning
22 in their natural environments (23,26) were better able to detect the nature and extent of problems
23 encountered during shopping expeditions (26), as well as identify modifications required within
24 the home environment to accommodate mobility/functional limitations (23). This suggests of

1 a need for inclusion of a direct observational component in future research endeavours, since
2 some pertinent issues may fail to be unveiled through interview alone.

3

4 *Psychosocial aspects*

5 Life-course (ie. the differing roles and experiences encountered during a lifetime) often serves
6 to shape food choice in old age (3,9,23). Many ideals surrounding food are formed during
7 childhood, and may persist a lifetime; however, food preferences and decisions regarding which
8 and how much food is consumed have also been found to fluctuate in response to changing life
9 circumstances (3,23).

10 Living alone is well-documented as a risk factor for nutritional inadequacy during old age
11 (2,4,5,7-10,14,15,17,19,21,22,24,25,27). Grief and bereavement following the loss of a partner
12 and a higher incidence of depression may also serve to reduce appetite and intake
13 (4,5,7,10,19,23,24). For many, eating is regarded as a social activity, and thus an absence of
14 companionship manifests in loss of pleasure normally associated with both cooking and eating
15 (3,8,10,14,15,23). Increased intakes have been observed when in company, dining within
16 relaxed meal environments (2,3,4,20) and when a television or radio is playing (2,20) to
17 simulate company. Lack of motivation and energy for food shopping, preparation and eating
18 meals, as well as skipping meals, replacement of nutritious meals with snacks and/or
19 processed/convenience foods, and a diminished amount and variety of foods consumed is also
20 more common amongst those living alone (4,8,10,19,20,22,23). Single men are particularly
21 vulnerable (4,7,15,20,22,27), and some have expressed a desire for foods which are tasty, and
22 quick and easy to prepare (9,20). Interestingly, Lane et al (2013) found that some older
23 individuals relished the opportunity to gain new food skills and experiment with different foods

1 and flavours (23); while for others, living alone provides a sense of release from the constraint
2 of cooking³ and eating foods that please the preferences of others (23).

3 Self-perception of health during old age has been indicated as being equally, or *more*, influential
4 for determining food habits than the state of health itself (5,22). Those with a more positive
5 view of their own health were found to consume more nutritious diets than those with a less
6 positive view (5,7,19). Likewise, an interest in health and/or nutrition, and valuing good health,
7 have also been shown to favourably impact upon food choice and dietary intakes
8 (2,7,9,17,20,22,31).

9 The desire (or lack thereof) to maintain independence into old age may also effect food choice
10 (9,14,20,22,23,26). Associated higher levels of physical activity (from independent shopping
11 and cooking) has proven advantageous for some (22), while for others, a strong will to remain
12 independent has created a barrier to sound nutritional intake due to a reluctance to accept help
13 from meal services, government support, or family and friends - compromising the range and
14 amount of foods able to be accessed and eaten (14,24,26).

15

16 *Personal resources*

17 Access to resources such as personal transport, higher levels of disposable income and greater
18 support from family, friends, government and community services have all been shown to exert
19 a positive influence over food choice and nutritional intake in elderly people (2,3,5,8-10,14,18-
20 20,23,24,26,27). Having one's own transport facilitates continued independence and the ability
21 to access shops whenever required, while more income equates to a greater ability to afford
22 foods that are desired or otherwise needed for health/disease management. Support from others
23 may help to overcome obstacles such as lack of transport, mobility and functional limitations,
24 or lack of motivation and energy to cook, through, for example, provision of meals or assistance

1 with shopping. It is of note, however, that one study found *perceived* resources amongst older
2 people to be of equal importance for health and nutritional intake as the *actual* resources
3 possessed (2).

4 Knowledge and skills related to nutrition, selection of appropriate foods and adequate cooking
5 techniques are also essential for ensuring sound nutritional intake (4,9,10,15,17,19,20,27). For
6 many women, the delineation of gender roles from childhood and throughout life have equipped
7 them with such skills (10,17,19,27), however, men often report experiencing deficits in this
8 area and difficulty in coping, especially upon widowhood (4,9,10,15,17). While some men will
9 actively seek to acquire skills in these areas, others are happy to settle for convenience meals
10 or snack-type foods instead (9,15). This suggests a need for programmes specifically targeting
11 the needs of older men, with a desire having been expressed for recipes that are tasty and
12 affordable, yet quick and simple to prepare (15,27). Of concern, however, is the confusion and
13 frustration felt by many older adults, including both men and women, due to what they perceive
14 to be mixed and changing messages provided in public nutrition campaigns (22,31). This
15 further highlights a need for consistent evidence-based messages, and perhaps regulation of
16 health/nutrition information that is promoted to the public.

17 In three of the studies reviewed, limited access to food of acceptable freshness and quality was
18 cited as a significant factor impacting food choice (2,15,26). Munoz-Plaza et al (2013) found
19 that some older people travelled a considerable distance or visited multiple stores in order to
20 access food of an acceptable quality, while those with compromised mobility were forced to
21 accept produce of inferior quality, or else do without. This implies that access to quality
22 produce could be a considerable factor constraining food choice for less mobile older people
23 living within the community.

1 Some researchers propose a concept of dietary resilience, or a 'repertoire' of adaptive strategies
2 developed by individuals to overcome barriers relating to the acquisition and consumption of
3 food (8,15,20,23,31). Such self-imposed behaviour modifications may facilitate the
4 maintenance of adequate food intake, in spite of difficulties encountered. Strategies commonly
5 employed include compromise, substitution, avoidance or restriction/moderation of foods,
6 compensatory behaviours, establishment of routines, seeking out opportunities for
7 companionship during meals (eg. through congregate meal sites) or attending education
8 programmes to develop food knowledge and skills (3,15,20,23,31). Vesnaver et al (2012) have
9 suggested, however, that achievement of dietary resilience may be dependent upon personal
10 motivation, assessment of one's own resources, preparedness to accept available support, and
11 resource availability.

12 In summary, this literature review confirms that food choice during the senior years results from
13 a complex interplay between a number of factors that serve to both constrain and encourage the
14 consumption of a nutritious diet. While there is evidence to suggest some degree of
15 commonality between population subgroups, it has also been shown that different subgroups
16 are subject to specific sets of circumstances that may impact their food choice in variable ways.
17 Consequently, initiatives to enhance nutrition amongst the aged will need to first identify, and
18 then subsequently address, factors relevant to the particular demographic concerned.

19

20 *Limitations and gaps inherent to the literature*

21 Notwithstanding the rigorous, systematic process applied, the outcomes obtained from this
22 review are limited in terms their wider application. Most studies were qualitative in nature,
23 which therefore precludes the generalisability of findings outside of the immediate study
24 populations from which they were derived. Moreover, participation was voluntary in all studies

1 considered, and data largely self-reported. Although the majority of studies included were
2 published in recent years, seven were published between 1996 and 1999. While it is possible
3 that the findings from some of these earlier studies may not accurately reflect the opinions and
4 behaviours of the current older population, similar themes were evident.

5 Despite the use of trained interviewers in many studies, data remains highly subjective and thus
6 open to potential for multiple biases. In addition, many of the studies were limited by sample
7 size, gender and ethnic/racial construct, thus limiting the ability to compare findings between
8 studies. Men, ethnic/racial populations and the infirm or incapacitated have been widely under-
9 represented.

10

11 *Implications for future research and interventions*

12 It is likely that factors influencing both the desire and capacity to make nutritious food choices
13 during the senior years will be specific to particular population subgroups. It is therefore
14 essential that the most pertinent of these factors are identified and addressed by health initiatives
15 so as to maximise the potential for safeguarding nutrition, maintaining independence and
16 improving outcomes for health with advancing age.

17 Further research involving larger, more demographically broad samples and which considers
18 how and why food choices change in the more advanced stages of life (for example, from initial
19 retirement through to 85 years of age and beyond) is warranted. In addition, the inclusion of a
20 direct observational component to facilitate identification of factors potentially missed through
21 interview would be beneficial.

22 Results from this review are suggestive of a widespread need for interventions designed to
23 stimulate poor appetites, encourage adequate consumption of nutritious foods and ensure access

1 to affordable, fresh, quality foods that are easy to prepare. Potential strategies include, for
2 example: educating older populations about the importance of maintaining an adequate protein
3 intake with age; identifying suitable options that are easy to prepare and eat; informing older
4 persons about strategies for increasing the palatability of meals without the need for the addition
5 of high levels of salt and sugar; the development and marketing of convenience high-protein
6 food products that are nutritious and easy to chew; creating opportunities for older people living
7 alone to socialise with others during mealtimes, with provision of transport assistance when
8 required; and providing assisted shopping services for older persons living within the
9 community with compromised mobility or lacking access to personal transport.

10

11 **CONCLUSION**

12 While the findings from this review will provide a basis from which the design of initiatives
13 targeting nutrition in old age may be informed, the qualitative nature of the evidence and
14 limitations inherent to the available research necessitate cautionary application. Health and
15 nutrition professionals will need to develop and implement clear, simple nutrition messages and
16 intervention strategies that remain specific to the expressed needs and priorities of targeted
17 groups. Ongoing evaluation of such initiatives will be imperative to ensure that programmes
18 remain relevant, effectual and viable, and thus that available funding is most efficaciously
19 applied.

20

21 **TAKE-AWAY POINTS**

- 1 • The food choices of older persons living within the community are shaped by a multitude
2 of factors that may serve either to promote, or constrain, both one's desire and capacity to
3 consume a nutritious diet.
- 4 • These factors may be broadly grouped into three categories: physiological changes
5 associated with the ageing process, psychosocial aspects and access to personal resources.
- 6 • Each of these factors may vary in significance to, and the ways in which it impacts upon,
7 the food choices of different population groups.
- 8 • Findings are suggestive of a need for further research involving larger, more
9 demographically broad population samples, with the inclusion of a direct observational
10 component. Population-specific interventions should be designed to stimulate poor
11 appetites, encourage adequate consumption of nutritious foods and ensure access to
12 affordable, fresh, quality foods that are easy to prepare.

13

14

15 REFERENCES

- 16 1. Charlton KE. The nutrient intake of elderly men living alone and their attitudes towards
17 nutrition education. *Journal of Human Nutrition and Dietetics*. 1997; 10:343-352.
- 18 2. Dean M., Raats MM, Grunert KG, Lumbers M. and The Food in later Life Team. Factors
19 influencing eating a varied diet in old age. *Public Health Nutrition*. 2009; 12(12):2421-
20 2427.
- 21 3. Falk LW, Bisogni CA and Sobal J. Food choice processes of older adults: a qualitative
22 investigation. *Journal of Nutrition Education*. 1996;28 (5):257-265.
- 23 4. Holmes BA and Roberts CL. Diet quality and the influence of social and physical factors
24 on food consumption and nutrient intake in materially deprived older people. *European*
25 *Journal of Clinical Nutrition*. 2011; 65:538-545.

- 1 5. Keller HH, Ostbye T, Bright-See E and Campbell MK. Activity limitation and food intake
2 in community-living seniors. *Canadian Journal on Aging*. 1999; 18(1):47-63.
- 3 6. Keller HH, Ostbye T and Bright-See E. Dietary habits of seniors with some activity
4 limitations. *Canadian Journal of Dietetic Practice and Research*. 1999; 60(4):214-221.
- 5 7. Payette H and Shatenstein B. Determinants of healthy eating in community-dwelling
6 elderly people. *Canadian Journal of Public Health-Revue Canadienne De Sante Publique*.
7 2005; 96:S27-S31.
- 8 8. Radermacher H, Feldman S and Bird S. Food Security in Older Australians from Different
9 Cultural Backgrounds. *Journal of Nutrition Education and Behavior*. 2010; 42(5):328-336.
- 10 9. Wham CA and Bowden JA. Eating for health: Perspectives of older men who live alone.
11 *Nutrition & Dietetics*. 2011; 68(3):221-226.
- 12 10. Wylie C, Copeman J and Kirk SFL. Health and social factors affecting the food choice and
13 nutritional intake of elderly people with restricted mobility. *Journal of Human Nutrition
14 and Dietetics*. 1999; 12(5):375-380.
- 15 11. Commonwealth of Australia. 'Caring for the elderly' – an overview of aged care support
16 and services in Australia. 2003 [cited 2014 28 June]. Canberra: Parliament of Australia.
17 Available from:
18 [http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_
19 Library/Publications_Archive/archive/agedcare](http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/archive/agedcare)
- 20 12. Australian Bureau of Statistics (ABS). Population Projections Australia, 2012 (base) to
21 2101: main features. 2013 [cited 2014 28 June]. ABS Publication: 3222.0, Canberra:
22 ABS. Available from:
23 [http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features
24 32012%20\(base\)%20to%202101](http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3222.0main+features)

- 1 13. Commonwealth of Australia. Australia's demographic challenges: appendix – the
2 economic implications of an aging population. 2009 [cited 2014 28 June]. Canberra: The
3 Treasury. Available from:
4 http://demographics.treasury.gov.au/content/_download/australias_
5 [demographic_challenges/html/adc-04.asp](http://demographics.treasury.gov.au/content/_download/australias_demographic_challenges/html/adc-04.asp)
- 6 14. Arcury TA, Quandt SA, Bell RA, McDonald J and Vitolins MZ. Barriers to nutritional
7 well-being for rural elders: community experts' perceptions. *The Gerontologist*. 1998;
8 38(4):490-498.
- 9 15. Best RL and Appleton KM. The consumption of protein-rich foods in older adults: an
10 exploratory focus group study. *Journal of Nutrition Education and Behavior*. 2013;
11 45(6):751-755.
- 12 16. Brennan DS and Singh KA. Grocery purchasing by adults by chewing ability, dietary
13 knowledge and socioeconomic status. *Public Health Nutrition*. 2010; 14(7):1279-1284.
- 14 17. Hughes G, Bennett KM and Hetherington M. M. Old and alone: barriers to healthy eating
15 in older men living on their own. *Appetite*. 2004; 43:269-276.
- 16 18. Locher JL, Ritchie CS, Roth DL, Sen B, Vickers KS and Vailas LI. Food choice among
17 homebound older adults: Motivations and perceived barriers. *Journal of Nutrition Health &*
18 *Aging* 2009; 13(8):659-664.
- 19 19. Shatenstein B, Gauvin L, Keller H, Richard L, Gaudreau P, Giroux F, Gray-Donald K,
20 Jabbour M, Morais JA and Payette H. Baseline determinants of global diet quality in older
21 men and women from the NuAge cohort. *Journal of Nutrition Health & Aging*. 2013;
22 17(5):419-425.
- 23 20. Vesnaver E, Keller HH, Payette H and Shatenstein B. Dietary resilience as described by
24 older community-dwelling adults from the NuAge study "If there is a will - there is a way!".
25 *Appetite*. 2012; 58(2):730-738.

- 1 21. de Morais C, Oliveira B, Afonso C, Lumbers M, Raats M and de Almeida MDV. Nutrition
2 risk of European elderly. *European Journal of Clinical Nutrition*. 2013; 67:1215-1219.
- 3 22. Brownie S. Older Australians' views about the impact of aging on their nutritional
4 practices: findings from a qualitative study. *Australasian Journal on Aging*. 2013; 32(2):86-
5 90.
- 6 23. Lane K, Poland F, Fleming S, Lambert N, Macdonald H, Potter J, Raats M, Skidmore P,
7 Vince C, Wellings A and Hooper L. Older women's reduced contact with food in the
8 changes around food experience (CAFE) study: choices, adaptations and dynamism.
9 *Ageing & Society*. 2014; 34(4):645-669.
- 10 24. Wolfe WS, Frongillo EA and Valois P. Understanding the experience of food insecurity by
11 elders suggests ways to improve its measurement. *Journal of Nutrition*. 2003; 133(9):2762-
12 2769.
- 13 25. Brownie S and Coutts R. Older Australians' perceptions and practices in relation to a healthy
14 diet for old age: a qualitative study. *Journal of Nutrition Health & Aging*. 2013; 17(2):125-
15 129.
- 16 26. Munoz-Plaza CE, Morland KB, Pierre JA, Spark A, Filomena SE and Noyes P. Navigating
17 the urban food environment: challenges and resilience of community-dwelling older adults.
18 *Journal of Nutrition Education and Behavior*. 2013; 45(4):322-331..
- 19 27. Donkin AJM, Johnson AE, Lilley JM, Morgan K, Neale RJ, Page RM and Silburn RL.
20 Gender and living alone as determinants of fruit and vegetable consumption among the
21 elderly living at home in urban Nottingham. *Appetite*. 1998; 30:39-51
- 22 28. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gotzsche PC, Ioannidis JPA, Clarke M,
23 Devereaux PJ, Kleijnen J and Moher D. The PRISMA statement for reporting systematic
24 reviews and meta-analyses of studies that evaluate health care interventions: explanation
25 and elaboration. *Annals of Internal Medicine*. 2009;151, 4:W65-W94.

- 1 29. Williams P, Allman-Farinelli M, Collins C, Gifford J and Byron A. A review of the
2 evidence to address targeted questions to inform the revision of the Australian Dietary
3 Guidelines 2009. Australia: DAA; 2011.
- 4 30. National Health and Medical Research Council and Department of Health and Aging
5 (NHMRC & DOHA). Nutrient Reference Values for Australia and New Zealand:
6 Executive Summary. Canberra: Commonwealth of Australia; 2006
- 7 31. Lundkvist P, Fjellstrom C, Sidenvall B, Lumbers M, Raats M and Food in Later Life team.
8 Management of healthy eating in everyday life among senior Europeans. *Appetite*. 2010;
9 55:616-62.

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Figure 1: Summary of review process.

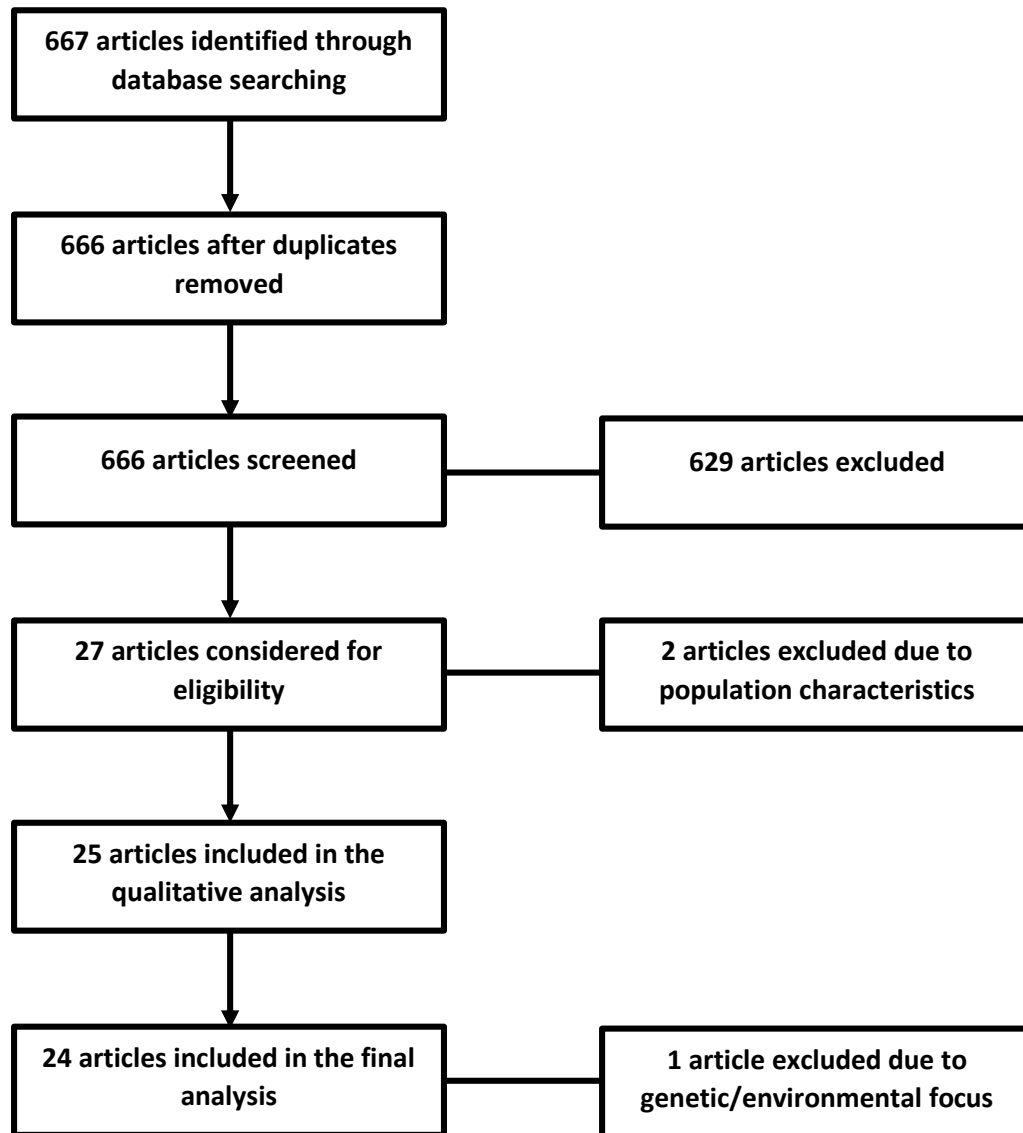


Table 1: Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Population age	≥50 years of age	<50 years of age
Population gender	Male, female or mixed gender studies	N/A
Population health status	Healthy, free from serious chronic disease. Selection of study participants not dependent upon presentation with a specific medical condition, disease, disability or other diagnosis.	Participant inclusion dependent upon presence of pre-existing disease state, disability or medical condition.
Population ability to self-care	Participants free-living in the community, in their own home, and independent for at least most activities of daily living (ADLs). Able to freely select foods consumed.	Study participants dependent upon carers, community services, etc. (eg. inpatients in hospitals or hospices; residents of nursing homes and assisted-living aged-care facilities, etc.); those unable to freely select foods consumed (eg. dependent upon availability from a menu); or else significantly dependent upon others for accomplishing ADLs.
Population biological classification/study focus	Human (non-drug/non-therapeutic interventions). Focus upon factors limiting or influencing food choice amongst elderly populations	Non-human (animal, microbiological or biochemical and nutrient studies) investigations and human interventions involving administration of drug, therapy or dietary intervention, or investigation of particular biochemical phenomena. Focus upon areas of diet other than food choice (eg. nutrient intake, adherence to national dietary guidelines)
Study setting/locale	Countries where the dominant cultural, political and economic situation is comparable to that in Australia (eg. Australia, New Zealand, United States, Canada, United Kingdom,	All countries and populations where the cultural (including diet), political and/or economic situation is significantly dissimilar to that in Australia (eg. Asian nations, African

	England, Ireland, Scotland, Wales, Germany, Austria, Switzerland, Sweden, etc.).	nations, South Africa, Middle Eastern nations, South American nations, Alaska), as well as studies conducted within minority populations (eg. indigenous, Inuit, African-American populations, twins).
Databases	<ul style="list-style-type: none"> • Web of Science • Scopus • Science Direct • PubMed • Medline • Academic Search Complete • ProQuest Central • Informit databases • CINAHL • Health Source: Nursing/Academic Education 	All databases other than those listed under 'Inclusion'
Language	English	All languages other than English
Year of publication	1996-2014 (to ensure an acceptable number of articles could be captured by the search)	Pre-1996 (search initially included 1990-1995, however, later refined due to extensive article numbers)
Limits specific to Web of Science database: <ul style="list-style-type: none"> • Web of Science categories • Research areas 	<ul style="list-style-type: none"> • Nutrition and Dietetics; Public, Environmental and Occupational Health; Psychology (biological or Gerontology) • Nutrition and Dietetics; Public, Environmental and Occupational Health; Geriatric Gerontology; Behavioral Sciences or Biomedical Social Sciences 	All other

Table 2: Summary of articles included in the final review.

Author/s, Date of Pub. [Study Location and Year]	Participants	Key Findings, Conclusions and Recommendations	Strengths, Limitations, Comments	NHMRC Level of Evid.
Arcury et al, 1998 (14) [North Carolina, United States; 1996-1997]	<u>No:</u> 72 (23M/49F) <u>Age:</u> N/A (experts reporting on residents aged ≥70 years)	Nine domains identified (county, programs, transportation, kin, medical, economic, food habits, knowledge and attitudes). Three common themes across domains: geographical (physical distances and cultural barriers), social (family structure, economics, racial and ethnic conflict, reluctance for volunteers) and factors pertinent to the elderly population itself. Collective knowledge of barriers to nutritional health for elderly people is comprehensive, however, individual knowledge is restricted to the area of expertise. Need to educate service providers and promote awareness of multidisciplinary nature of nutrition. Nutrition needs to be made part of the strategic planning process.	Results not generalisable. <u>Strengths:</u> involved experts from a number of specialisations <u>Limitations:</u> sample size; may involve participant bias; subjective data.	VI
Best and Appleton, 2013 (15) [Ireland; date not specified]	<u>No:</u> 28 (1M/27F) <u>Age:</u> ≥65 years (range 65-93 years, mean 81 years) <u>Inclusion:</u> able to provide informed consent and participate fully. <u>Exclusion:</u> not specified, but listed as ‘few’	Nineteen themes categorised into three domains: product-based (taste, texture, odour, biting/chewing/swallowing difficulties, change in tastes, freshness, quality, safety, product origin), environment-based (convenience, effort to cook, restricted mobility, access to shops, living alone, lack of cooking skills, spoilage, waste, cost/multi-buy promotions) or cognitive-based reasons (health information, previous experiences, education, awareness of own frailty and importance of health, medical constraints). Reduction in chemosensory, dental and physical abilities often leads to decreased consumption of high-protein foods. Further research required to understand and address reasons for lack of consumption.	Results not generalisable <u>Strengths:</u> qualitative focus; data saturation point reached. <u>Limitations:</u> small sample size with under-representation of vulnerable groups; voluntary participation	VI
Brennan and Singh, 2010 (16) [Adelaide, South Australia, Australia; 2008]	<u>No:</u> 444 (48%M, 52%F) <u>Age:</u> 60-71 years <u>Inclusion:</u> age; enrolled to vote <u>Exclusion:</u> not stipulated	Results indicate that food choices amongst elderly people are influenced by chewing ability and SES, but not level of dietary knowledge. Those with chewing limitation or of lower SES are less likely to comply with national dietary recommendations. Further research required to determine types of foods that are restricted due to chewing limitations, as well as the extent of tooth loss needed	Sample contained higher % of Australian-born persons than Census; possible under-representation of those in high-care facilities. Findings	IV

		for detrimental impact upon food intake, and the subsequent public health significance for nutrition and health outcomes.	generalisable to community-living older people only. <u>Strengths</u> : sample size; random sampling <u>Limitations</u> : self-reported data; limited age range; reliance on postal return, electoral roll listing, literacy skills, vision, etc.	
Brownie, 2013 (22) [Northern Rivers, NSW, Australia; 2010]	<u>No</u> : 29 (21%M, 79%F) <u>Age</u> : 60-93 years (mean 73 years) <u>Inclusion</u> : age (60 years and over) <u>Exclusion</u> : not stipulated	Participants expressed interest in health and food, and were open to dietary and food behaviour changes. Reduced need and intake of food reported, which may jeopardise adequacy for some nutrients, including protein. Participants felt confused by sometimes conflicting food messages, and unclear about appropriate food choices. Further study required with larger and more ethnically and socially diverse samples. Suggested that older people might benefit from information about nutrient density and quick, simple recipes to meet their nutritional needs.	Results not generalisable to all older Australians. <u>Strengths</u> : data provides insight into reasons for food choice and intake; double-coding of data. <u>Limitations</u> : small sample size; under-representation of men and those with disability/ functional limitation; voluntary participation; supplement intake not assessed	VI
Brownie and Coutts, 2013 (25) [Northern NSW, Australia; 2010]	<u>No</u> : 29 (6M,23F) <u>Age</u> : 60 to 93 years (mean 73.3 years) <u>Inclusion</u> : age (60 years and over) <u>Exclusion</u> : not stipulated; non-dentate individuals excluded from analysis	Four main themes identified: healthy foods, quantity, personal circumstances and good intention. Fresh, seasonal produce and were thought important for health, with conflicting opinions about the importance/benefit of dairy foods; cereal foods rarely discussed. Merit of pre-packaged convenience and frozen foods questioned. Participants believed reducing food intake (especially red meat and fat) was beneficial for health. Price, preferences of others, health conditions and a desire to regain/maintain health also influenced food choice. Participants unaware of special nutritional needs in older age. Older Australians may benefit from a media campaign promoting their increased needs for certain nutrients. Further research required to guide	Results not generalisable to all older Australians. <u>Strengths</u> : data provides insight into reasons for food choice and intake; double-coding of data. <u>Limitations</u> : small sample size; under-representation of men and those with disability/ functional limitation; voluntary	VI

		nutrition education programmes about healthy food choices for older people.	participation; supplement intake not assessed	
Charlton, 1997 (1) [Sunderland, UK; year not specified]	<u>No:</u> 66 (all M) <u>Age:</u> ≥70 years (mean 78.9 years), divided into 70-79 years and 80+ years <u>Inclusion:</u> male; 70 years or more <u>Exclusion:</u> not stipulated	47% with suboptimal energy intakes and 53% underweight. Added sugar accounted for ~1/5 of energy intake, but overall energy intakes low, and mean micronutrient intakes adequate (except vitamin D). Suboptimal mean fibre intake. Subjects appreciated importance of diet for optimising health, with ¾ willing to make dietary changes. Factors most influential in food choice were taste and enjoyment, followed by availability, health and convenience. Main source of nutrition information was the media, followed by family and friends. Most men unwilling to partake in nutrition programmes unless held during regular community luncheons or at their place of residence. Findings suggest elderly men living alone are aware of importance of diet for achieving and maintaining health, and willing to make dietary changes, however, not open to participation in nutrition education programmes. Reaching and engaging elderly men living alone remains a challenge for nutrition educators.	Findings not generalisable to all elderly men living alone. <u>Strengths:</u> use of validated tools; random sample <u>Limitations:</u> small sample size; no housebound subjects included; voluntary participation	IV
de Morais et al, 2013 (21) [Eight European countries (Denmark, Germany, Italy, Poland, Portugal, Spain, Sweden, and UK); based upon data collected from 2003-2005]	<u>No:</u> 644 (quota gender controlled) <u>Age:</u> 65 to 98 years (mean 74.8 years) <u>Inclusion:</u> not specified (data obtained from another study) <u>Exclusion:</u> as per inclusion	Almost half sample reported good health, one quarter moderate nutritional risk and one quarter high nutritional risk - demonstrating poorer risk status amongst this sample compared other elderly living in the community (apply caution to comparisons between studies). Extremes of BMI associated with poorer physical functioning and lower perception of health. Nutritional risk associated with choosing foods easy to chew, difficulty with chewing (for men), lower consumption of F & V per day, lower- health-related QOL, and living alone. Tool employed lacked sensitivity for acute situations. Choice of instrument should reflect objectives of study and specific population. Findings strengthen and add to previous evidence re determinants of nutritional risk. The Nutrition Screening Initiative (NSI) is a useful tool for identification of nutritional risk amongst community-living older people.	As sample was quota controlled for a number of variables, results cannot be generalised to the whole European population. <u>Strengths:</u> sample size; cross-cultural <u>Limitations:</u> self-reported data (although not self-administered); subjective responses	IV
Dean et al, 2009 (2) [Eight European countries (Poland,	<u>No:</u> 3200 (400 from each country; ~50%M, ~50%F) <u>Age:</u> ≥65 years	Actual and perceived resources (financial and other, such as social), physical and mental health, and individual food goals impacted dietary intake and variety, supporting existing evidence.	Findings not generalisable <u>Strengths:</u> sample size; cross-cultural	IV

<p>Portugal, UK, Germany, Sweden, Denmark, Italy and Spain); 2005]</p>	<p><u>Inclusion:</u> quota control for country and region, gender, age and living circumstance <u>Exclusion:</u> not stipulated</p>	<p>Increasing food knowledge of older people and providing quality foods that are familiar may improve intakes and dietary variety. Research required to determine how perceived as well as actual resources influence dietary variety, as well as how food-related goals to increase dietary variety may be evoked.</p>	<p><u>Limitations:</u> sample not representative of population constituencies nor size; non-response not recorded; use of food variety score (applicability across countries); limited objective measures for resources; self-reported resource inventory (halo effect)</p>	
<p>Donkin et al, 1998 (27) [Nottingham, UK; 1994]</p>	<p><u>No:</u> 369 (443 weighted sample); 177M, 192F <u>Age:</u> ≥65 years <u>Inclusion:</u> people aged 65 or over; over-representation of 75+ years <u>Exclusion:</u> not stipulated; analysis excluded composite foods</p>	<p>Single men ate vegetables less often and with less variety than women or married men. Women ate more fruit, with single men eating the least. Vegetables eaten more frequently and in greater quantities in summer. Gender was the most influential variable, followed by living status. Increasing age and lower education associated with decreased vegetable (but not fruit) intake. Income significant for fruit, but not vegetables. Single men prefer meals that are easy to prepare, cook and open. Money more important for those living alone. Consumption of all foods decreased in those aged 75+ years. Interventions should focus upon basic cooking skills (especially for single men) and preparation of appetising, non- bulky vegetable dishes. Single elderly men may benefit from encouragement to increase social activities involving food to improve F & V intake. Research needed to determine whether the oldest age group requires 5 serves of vegetables per day (a lesser amount may be adequate). Easy-to-open, prepare and cook foods, in an appropriate portion size and at an affordable price, recommended.</p>	<p><u>Strengths:</u> sample size <u>Limitations:</u> Based upon frequency of consumption without weighted portions, limiting accuracy; results may have been partially affected by exclusion of composite products</p>	<p>IV</p>
<p>Falk, Bosgni and Sobal, 1996 (3) [Upstate New York, USA (3 counties);year not specified]</p>	<p><u>No:</u> 16 (gender ratio not specified) <u>Age:</u> ≥65 years <u>Inclusion:</u> 65+ years; controlled for gender, age, educational and income level, living situation.</p>	<p>Three food choice components identified: life course (experiences, especially during childhood, changing roles and environments), influences (ideals including meal constitution, social and family rules and expectations surrounding meals, the cultural significance of food and the food-health relationship; social framework, including socialisation and companionship; personal factors, including physical conditions, limitations, knowledge and skills) and personal system</p>	<p>Findings not generalisable. <u>Strengths:</u> develops a model to help coalesce knowledge from a number of disciplines to explain the process of food choice amongst the elderly.</p>	<p>VI</p>

	<p><u>Exclusion:</u> less than 65 years; those dependent for ADL's; existing acute-stage disease</p>	<p>(value negotiations, especially sensory perceptions, financial considerations, convenience, managing social contexts and physical well-being). Personal system also includes strategies and repertoires to simplify the process of food choice; four main strategies: elimination/avoidance, substitution, limitation and routinisation. Food choice is multidimensional. Further research utilising different population groups required to deepen understanding of food choice amongst the elderly.</p>	<p><u>Limitations:</u> small sample size; all participants Caucasian, from upstate New York, attend congregate meals, were free-living and relatively healthy; most participants female; reliant upon self-report.</p>	
<p>Holmes and Roberts, 2011 (4) [UK; Data collected from 2003-2005]</p>	<p><u>No:</u> 725 (234M, 491F) <u>Age:</u> ≥65 years (separated into 65-74 and ≥75 years) <u>Inclusion:</u> from parent study and aged 65+ years; one person per eligible household <u>Exclusion:</u> <65 years; parent study excluded those not free-living or not within lowest 15% of population for material deprivation</p>	<p>Better diet quality associated with eating meals at the table, good appetite (women) and being a non-smoker (women). Although not significant, poorer diet quality tended to be associated with age greater than 75 years, eating alone and poorer cooking skills. Men more likely to report limited cooking skills, most of these living alone. Those with poorer dietary intakes more likely to be at risk for consuming suboptimal amounts of many nutrients. For men, chewing difficulties resulted in poorer quality intake. Research that includes a focus upon the eating environment (ie. where and with whom meals are consumed) required.</p>	<p>Comparisons between populations limited due to lack of standard for measuring dietary quality. <u>Strengths:</u> sample size; division into young old and older old categories <u>Limitations:</u> reliant upon self-report; no allowance for misreporting made in analyses; limited to materially deprived people; possible under-representation of men</p>	IV
<p>Hughes, Bennett and Hetherington, 2004 (17) [Merseyside, England; Year not specified]</p>	<p><u>No:</u> 39 <u>M:</u> 39 <u>F:</u> 0 <u>Age:</u> 62-94 years <u>Inclusion:</u> male, older age (limits not specified), living alone <u>Exclusion:</u> nil (all interested people accepted into study)</p>	<p>Four main themes: health and well-being, energy and nutrient intakes, cooking skills, and fruit and vegetable intake. No significant differences for health based upon age or smoking status. Better perceived health associated with higher levels of physical health and greater life satisfaction. Life satisfaction also associated with social engagement. Only 4 participants met or exceeded energy requirements for at least one of two days assessed. Higher energy intakes associated with alcohol consumption. Lowest F & V intake linked to more alcohol and less energy from protein. Most acknowledged the importance of nutrition, but exhibited incongruence between understanding and actual consumption.</p>	<p>Results not generalisable to whole population <u>Strengths:</u> qualitative component <u>Limitations:</u> small sample size; voluntary participation; possible under-representation of those with physical or other limitations</p>	IV

		<p>Study confirms lower energy and F & V intakes in elderly people. Older men living alone had the least adequate intakes for energy and F & V, less variety and poorer cooking skills. Most did not meet requirements for energy, therefore advice to increase F & V intake alone insufficient. Interventions should seek to clarify understanding of what constitutes a healthy diet in old age, and further encourage cooking and consumption of more vegetables by men. Must consider needs and wishes of the target group during intervention design.</p>		
<p>Keller et al, 1999 (5) [London, Ontario, Canada; Year not specified]</p>	<p><u>No</u>: 145 (32M, 113F) <u>Age</u>: 53-98 years (mean 78 years, S.D. 8) <u>Inclusion</u>: degree of functional limitation; adequate memory and mental status <u>Exclusion</u>: inadequate memory or mental status as determined by SPMSQ</p>	<p>Those with greater dependency for meal preparation and eating were associated with better dietary intakes. Transportation was found to be the single greatest barrier to food intake. Higher income and education level, as well as older age, better hearing and participation in grocery shopping, were associated with better food intakes. Results suggest that the perception of health is more influential than actual morbidity. More medications were associated with better intake, while smoking was associated with poorer intake.</p> <p>Further research needed to examine relationship between quality of life and food intake or nutritional status, and to determine whether decreased dietary intakes in a large cohort of seniors followed over time are preceded by activity limitations.</p>	<p>Sample not representative or generalisable to whole population <u>Strengths</u>: use of validated tools and trained interviewers <u>Limitations</u>: relatively small sample size; no comparison for seniors without functional limitation; under-representation of those with considerable health or other problems; subjective measures; measures based upon self-report and recall</p>	IV
<p>Keller, Ostbye & Bright-See, 1999 (6) [London, Canada]</p>	<p><u>No</u>: 145 (32M, 113F) <u>Age</u>: 53-98 years (mean 78 years, S.D. 8) <u>Inclusion</u>: degree of functional limitation; adequate memory and mental status <u>Exclusion</u>: inadequate memory or mental status as determined by SPMSQ</p>	<p>25% of women and 31% of men had poor dietary intake. Two-thirds of participants consumed less than recommended number of F & V serves daily, and only 6% met recommendations for grain products. Many reported a decreased intake of foods from one or more of four food groups considered. Chewing difficulties were associated with decreased intake of meat and alternatives, and in turn, with weight loss. Concerns over fat and cholesterol possibly placed at risk for low intake of protein rich foods. Convenience an important factor in determining food choice, and in part explained a reduction in intake of F & V. Seniors with a higher BMI consumed a more balanced diet overall.</p>	<p>Sample not representative or generalisable to whole population <u>Strengths</u>: use of dietary supplements ascertained; validated tools and trained interviewers <u>Limitations</u>: relatively small sample size; no comparison for seniors without functional limitation; under-</p>	IV

		<p>Many participants reported recent weight loss, citing a recent health crisis or decreased activity as the primary reason.</p> <p>Results suggest those with mild to moderate limitation, who likely receive less formal support, are at increased risk for poor dietary intake and should be targeted by intervention programmes. Further study needed to ascertain whether change in nutritional status is preceded by deterioration in independence for ADLs.</p>	<p>representation of those with considerable health or other problems; subjective measures; supplement formulation/strength not verified; measures based upon self-report and recall</p>	
<p>Lane et al, 2014 (23) [Norfolk, UK; 2007-2008]</p>	<p><u>No</u>: 40 (all F) <u>Age</u>: 65-95 years (mean age 82 years) <u>Inclusion</u>: female, age 65+ years, living independently, reduced preparation from scratch for main meals to ≤ 2 weekly, English fluency <u>Exclusion</u>: not stipulated</p>	<p>Many changes around food related to life course; in particular, health, energy levels, loss of a partner, missing family/friends, changes in life role and socialisation, and contemplation of alternative options available. Older women actively changed their relationship with food by responding to changes in circumstance. Time-release from food preparation and cooking was diverted to other enjoyable activities, such as socialising and pastimes, rather than withdrawing from public and social engagements.</p> <p>Reduced contact with food was either voluntary or in response to changes in health, energy, or loss of significant others, with intentional adaptations made. Developing a repertoire of strategies to compensate or adapt to changes in physical, mental and social conditions was viewed as reflective of successful aging. Flexibility enabled women to exercise a degree of choice in their responses to changing circumstances, suggesting a strong degree of resilience that may be overlooked by the literature and public perceptions. Satisfaction derived from the ability to shape responses to changing circumstance should be acknowledged when developing policies and initiatives.</p>	<p>Findings not generalisable to all populations <u>Strengths</u>: broad sample in terms of method of deriving meals, urban vs rural setting, degree of dependency and SES <u>Limitations</u>: mostly widows and lack of ethnic diversity</p>	VI
<p>Locher et al, 2009 (18) [USA; Year not specified]</p>	<p><u>No</u>: 185 (20%M, 80%F) <u>Age</u>: range not specified; mean 78.9 years <u>Inclusion</u>: meet Medicare's definition for homebound status, reside in the community, able to communicate unaided</p>	<p>Important motivators included sensory appeal, convenience and price, with ethical concerns, mood and natural content of foods of less importance. Frequent barriers to consuming desired foods were health, adherence to a special diet, and inability to shop. Lack of appropriate cooking equipment/facilities, being unable to self-feed and companions during a meal were least frequently reported. Older people were more likely to be motivated by health and mood, but not weight, and those with lower educational attainment by price (with money problems posing a barrier). African Americans reported money problems and</p>	<p>Not clear whether findings may be generalisable to other population groups; further investigations required. <u>Strengths</u>: questionnaires administered by second party, although</p>	IV

	<p><u>Exclusion:</u> cognitive impairment, terminal illness, reliance upon enteral tube-feeding or ventilator-dependant</p>	<p>adherence to a special diet as barriers. Most participants had suboptimal intakes for energy and vitamin D.</p> <p>Participants viewed health as a barrier, rather than a motivation, for eating foods they desired, suggesting a possible need for liberalisation of the diet for this age group to ensure adequate food and energy intake and to afford QOL. Neither motivations nor barriers differed significantly by gender, ethnicity, marital status or living arrangement.</p> <p>Interventions to alter dietary intake in the aged need to consider motivations beyond those relating to health and acknowledge individual preferences and concerns so as to encourage participation and desired changes. Effort and cost on behalf of the participants must be minimised.</p>	<p>skills/qualifications not stated</p> <p><u>Limitations:</u> study reliant upon subjective data and self-report; relatively small sample size</p>	
<p>Lundkvist et al, 2010 (31) [8 countries (Sweden, UK, Denmark, Italy, Germany, Poland, Portugal, and Spain); 2003-2005]</p>	<p><u>No:</u> 564 (gender ratio not stated)</p> <p><u>Age:</u> ≥65 years</p> <p><u>Inclusion:</u> men or women aged 65+ years; speak native language of their country of residence; living independently; free from severe visual or hearing impairment</p> <p><u>Exclusion:</u> not stipulated</p>	<p>Participants expressed an awareness of nutrition, its implications for health, and their own responsibility for eating well. Many were motivated to eat healthily, but some viewed this as an ‘ideal’. Foods were often categorised as ‘good’ or ‘bad’, with some foods avoided and others included to benefit health. Dietary variety, regular meals, and food preparation methods were considered important, with home-cooked meals viewed as more nutritious, and processed and takeaway foods distrusted. Concerns were held about sources of nutrition information and food safety. Participants reported a range of strategies for making food choices, however, much decision-making was routine and uncomplicated.</p> <p>This study highlights the need to view food choice as a multidimensional phenomenon that incorporates behavioural, psychological, social, cultural, biological, economic, political, historical, environmental, geographic and other elements, both consciously and subconsciously. Acknowledging that people are not always aware of the decisions they make and may not interpret or utilise information in the manner intended is important when communicating food and health messages</p>	<p>Findings not generalisable.</p> <p><u>Strengths:</u> sample size; cross-cultural sample</p> <p><u>Limitations:</u> inconsistent recruitment between countries may have biased some of the sample; equal numbers of people from each country may not provide a culturally representative of Europe as a whole; demographic variables not considered.</p>	VI
<p>Munoz-Plaza et al, 2013 (26)</p>	<p><u>No:</u> 30 (6M, 24F)</p> <p><u>Age:</u> 60 to 88 years (Mean 73 years)</p>	<p>Factors influencing shopping, cooking and eating were categorised into intrapersonal, social and environmental factors, and specific strategies employed to overcome barriers faced discussed.</p>	<p>Findings not generalisable.</p> <p><u>Strengths:</u> includes observational data collected</p>	VI

<p>[New York, USA ; 2010-2011]</p>	<p><u>Inclusion:</u> black, white or Latino ethnicity; speak English or Spanish; able to understand purpose of study and participant burden. For qualitative component: English fluency, have completed baseline measurements for parent study, reported being the primary household food purchaser <u>Exclusion:</u> not stipulated</p>	<p>Independence was viewed as an important part of personal identity. Participants valued shopping and cooking for themselves, although few drove and many were reluctant to pay cab fares or delivery fees to overcome difficulty. Health conditions and environmental hazards served as barriers to food access, as did price, quality and variety. Quality of fresh produce was perceived to vary by neighbourhood and racial make-up, and concerns over food safety and deceptive practices raised. Few participants ate restaurant meals (price, lack of control over nutritional composition). Use of food pantries, community meal centres and/or support from family and neighbours were reported by two-thirds of the sample. Data supports findings from previous research, and could be used to guide future health behaviour interventions and clinical practice. Price and access are important aspects which need to be considered. Researchers acknowledge that more nutritious diets are likely when food is more conveniently accessed.</p>	<p>in the home and in the community while shopping <u>Limitations:</u> sample size; under-representation of males, married people, white people and the food insecure</p>	
<p>Radermacher, Feldman and Bird, 2010 (8) [Melbourne, Australia; 2007]</p>	<p><u>No:</u> 37 (13M, 24F) <u>Age:</u> 58 to 85 years (mean 70 years) <u>Inclusion:</u> of Anglo-Celtic, Macedonian, Serbian or Maltese background <u>Exclusion:</u> those dependent upon a community bus excluded from analysis (older)</p>	<p>One quarter of participants reported cost (but not money), health, mobility and intrapersonal factors as barriers to food choice. In addition, foods regarded as nutritious or for addressing particular health needs were perceived to be more expensive, and ability to access preferred foods (eg. culturally specific foods/ingredients) was problematic for some groups. Many participants preferred simple foods, selected within their financial means. Health and physical capacity to shop, prepare and eat meals were identified as significant barriers to food choice, leading many to resort to creative strategies to overcome them. Public transport was perceived inadequate and unreliable, and concerns expressed over the suitability and cultural applicability of Meals on Wheels and similar services. Authors suggest: (1) local governments should play a greater role in the provision of community health, social support and transport services, with integration of these policies (2) consideration be given to the changing nature of the modern family and its ability to support older family and community members (3) the views and</p>	<p>Not representative of all older Australians from different cultural backgrounds. <u>Strengths:</u> cross-cultural sample <u>Limitations:</u> voluntary participation; limited ethnic diversity; small sample size; subjective data and self-report; males and those most at-risk for food insecurity under-represented</p>	<p>IV</p>

		resourcefulness of older people should be acknowledge and valued (4) experts should recognise the dynamic, ever-evolving nature of the elderly population and their needs.		
Shatenstein et al, 2013 (19) [Canada; 2003-2005]	<p><u>No:</u> 1793 (853M, 940F)</p> <p><u>Age:</u> 67 to 84 years</p> <p><u>Inclusion:</u> aged 67 to 84 years, community-dwelling, in good general health, cognitively and functionally intact at recruitment</p> <p><u>Exclusion:</u> not stipulated</p>	Further research is required to clarify factors shaping food choice with aging, and how this impacts upon dietary quality. Longitudinal studies are further recommended to ascertain whether dietary quality is maintained or changes with time. Interventions specific to ensuring good dietary quality with age will be needed, since dietary knowledge was an important determinant of dietary quality for both men and women in this age group.	Findings not generalisable <u>Strengths:</u> sample size <u>Limitations:</u> variability in income, health status and functional capacity limited within sample; many factors which could have better informed the analyses were not ascertained	IV
Vesnaver et al, 2012 (20) [Canada; 2009]	<p><u>No:</u> 30 (6M, 24F)</p> <p><u>Age:</u> 68 to 86 years (mean 74.87 years)</p> <p>For NuAge:</p> <p><u>Inclusion:</u> age 7-84 years, speak English or French, community-dwelling, free from cognitive impairment and disabilities which limit ADLs</p> <p><u>Exclusion:</u> \geq class II heart failure, COPD requiring O₂ therapy or oral steroids, inflammatory digestive diseases, cancer treated by chemotherapy, radiation or surgery within past 5 years.</p> <p>For this study:</p> <p><u>Inclusion:</u> Exhibit 2+ nutritional risk factors at baseline; maintenance or improvement of diet quality</p>	<p>Several challenges in relation to shopping for and preparing food were identified, and apathy toward eating was common. Adoption of strategies to overcome problems faced was reported, demonstrating different degrees of resiliency amongst individuals, however these did not always result in a high quality diet. Four key themes of resiliency emerged: <i>prioritising eating well</i> (decisions relating to money, time and energy), <i>doing whatever it takes to keep eating well</i> (relating to understanding of eating well), <i>being able to do it yourself</i> (importance of independence) and <i>getting help when you need it</i> (formal and informal support networks).</p> <p>Results indicate that elderly people are able to successfully manage their diet in response to age-related obstacles encountered, even at advanced ages, however, resilience was dependent upon having food-related motivation as well as access to personal and collective resources. Practitioners and health professionals may need to help older people to appreciate the importance of food for health, to build strategies to maintain pleasure in eating, counsel in ways to improve self-efficacy and encourage an acceptance of support measures.</p>	Results not generalisable to the whole population. <u>Strengths:</u> qualitative focus <u>Limitations:</u> under-representation of males, people living as a couple or in facilitated care, and those with chronic disease or mobility limitations, and possibly cultural and ethnic diversity; voluntary participation and sustained participation over 4 years may be due to a high interest in nutrition (bias)	VI

	over previous 3 years (n=20), diet vulnerability (n=10)			
Wham and Bowden, 2011 (9) [New Zealand; 2006-2007]	<p><u>No</u>: 12 (all M)</p> <p><u>Age</u>: 79 to 87 years</p> <p><u>Inclusion</u>: aged 75+ years, living alone for at least 3 months, residing in the community and involved in food shopping and preparation.</p> <p><u>Exclusion</u>:</p>	<p>The most common risk factors identified were eating alone, low intake of meat or alternatives, not enjoying meal preparation and belief that weight was either too high or too low. General knowledge about nutrition and an awareness of the diet-disease relationship was lacking. Three main themes were evident from the interviews: individual circumstances (finances, mobility, transport, support networks), knowledge and skills (largely shaped by life-course and current health; cooking skills) and food-related values (four: whether importance of healthy eating was valued; structure, including routines, forward planning, timetables and familiarity; convenience (time-saving, effort-saving or both, impacting upon selection of foods, shopping location, and cooking appliances and methods) and activities related to shopping, including enthusiasm for, enjoyment of, reluctance and resistance.</p> <p>Barriers to healthy eating included lack of nutrition knowledge and cooking skills, absence of routines for food-related activities, skills required for managing on a low income, need for supportive networks and access to transport for shopping. Suggestions for overcoming these include lunch clubs, community evenings, cooking and nutrition education groups, and group/bulk purchasing. It is further suggested that interventions with this age group need to be specific to men and address their wishes and needs, with greater emphasis upon quick and easy meal preparation.</p>	<p>Results not generalisable to whole population</p> <p><u>Strengths</u>: qualitative component</p> <p><u>Limitations</u>: small sample size; indigenous and ethnically diverse groups not represented; participants derived from one region; voluntary recruitment with food/healthy eating focus (bias); recruitment only through clubs; literacy skills dependent; questionnaire not validated for this population</p>	IV
Wolfe, Frongillo and Valois, 2003 (24) [New York, USA ; 1999-2000]	<p><u>No</u>: 53 (M:F not stated)</p> <p><u>Age</u>: 53 to 88 years, mean 71 years</p> <p><u>Inclusion</u>: recruitment through subsidised housing, churches, congregate and home-delivered meal services and a community worker</p> <p><u>Exclusion</u>: not specified</p>	<p>Findings reveal four components of food insecurity for older people: quantitative (having enough), qualitative (the right foods for health), psychological (self-awareness of food situation and feelings about this) and social (accessing food in socially acceptable ways and patterns of eating incongruent with commonly accepted social norms). Commonly identified causes of food insecurity included lack of income, inability to access food (due to lack of transport, physical mobility limitations, and functional or health limitations hampering preparation), lack of motivation or energy, lack of appetite, loneliness</p>	<p>Participants paid \$10 for interviews; results not representative of whole population</p> <p><u>Strengths</u>: qualitative focus, with in-depth interviews repeated after 6 months</p> <p><u>Limitations</u>: limited to those living in Upstate New York</p>	IV

		and depression. Authors suggest that the accepted definition of food security insufficiently broad for the aged population. A new tool incorporating 14 new measures was developed which takes into account issues pertinent to an elderly population, however, this requires more rigorous testing with larger and more diverse samples. Authors contend that food assistance programmes for the elderly need to find ways to deliver the right types of food (including culturally and socially appropriate foods) in an efficient and socially acceptable manner.	and those with low income; does not include an ethnically and racially diverse population	
Wylie, Copeman and Kirk, 1999 (10) [Leeds, UK; Year not specified]	<u>No</u> : 15 (3M, 12F) <u>Age</u> : 67 to 91 years (mean 80.6 years) <u>Inclusion</u> : community living, restricted mobility <u>Exclusion</u> : not specified	This study highlighted three areas affecting nutritional intake in older people: social (loneliness and bereavement), economic (budget, access to Social Services) and physical (difficulties with shopping for, preparing and cooking food). It is proposed by the authors that public policy should consider the adequacy of resources made available to elderly people to help them to remain independently living in the community for longer. Public transport is one area of concern, since current forms are not always suited to the needs of elderly people. In addition, some elderly people are unaware about access to home delivery services or else avoid them due to loss of opportunity for socialisation. In addition, those with physical limitations (eg. arthritis) need to be identified and provided with access to aids.	Results not generalisable to whole population <u>Strengths</u> : qualitative data <u>Limitations</u> : small sample size; males and people living as couples under-represented; voluntary participation; limited to people with restricted mobility	VI