Original Article

Development and validity assessment of a diet quality index for Australians

Rasoul Zarrin PhD[1], Torukiri I Ibiebele PhD[2], Geoffrey C Marks PhD[3]

[1]*Food and Beverages Safety Research Center, Department of Nutrition and Biochemistry, Urmia University of Medical Sciences, Urmia, Iran*
[2]*Queensland Institute of Medical Research, Gynaecological Cancers Group, Brisbane, Queensland, Australia*
[3]*The University of Queensland, School of Population Health, Queensland, Australia*

Existing Australian diet quality indices have assumed links to health outcomes but their validity for this has not been reported. We extend the features of existing indices for Australian adults by constructing a new diet quality index (Aussie-DQI) using the national dietary guidelines linked to the Australia National Health Priority Areas. Construct validity was assessed using 24 hour dietary recalls from the 1995 National Nutrition Survey (n=10,851 adults aged 19 years and older). Construct and criterion validity were assessed using food frequency questionnaire data from the Nambour Skin Cancer study (n=1355), a community-based longitudinal study with 16 year follow-up and cause-specific mortality outcomes. Generalised linear regression was used to assess associations between Aussie-DQI scores and socio-economic, demographic, health-behaviour characteristics, and food and nutrient intakes, while Cox proportional-hazards modeling was used to assess associations with cancer and all-cause mortality. A high Aussie-DQI score was associated with being female, being older, non-smoking status, and BMI in the normal range in both study populations; and Aussie-DQI scores were inversely associated with cancer mortality among men in multivariable-adjusted analyses (hazard ratio = 0.30, 95% CI: 0.11, 0.83; *p* for trends = 0.06). In conclusion, Aussie-DQI successfully discriminated diet quality and showed that men, younger adults, current smokers and those overweight/obese were less likely to consume foods that meet dietary recommendations; and that a high diet quality is associated with decreased risk of cancer mortality among men. This study adds further evidence to clarify the role of diet quality in decreasing mortality from chronic diseases.

Key Words: diet quality index, construct validity, criterion validity, cancer mortality, dietary assessment

INTRODUCTION

It is well established that a broad range of dietary components play a role in the development of obesity and a spectrum of chronic diseases.[1-4] There has been a lot of interest in recent years to develop a single index to provide an overall assessment of diet quality for use in epidemiology research and for assessing, monitoring and managing nutritional status. Several indices have been developed in the United States[5-7] and other countries[8-11] including some for the adult population in Australia.[11-13] Most are designed to evaluate intakes against criteria for "healthy diet" such as described by national dietary guidelines, or diversity in food selection. However as pointed out in a recent review by Waijers and coworkers,[14] most appear to have modest validity, particularly in predicting health outcomes (morbidity or mortality). Waijers *et al* point to lack of clarity for many indices in the purpose or what the score intends, and arbitrary choices in the dietary components included, the cut-off values included and scoring systems. This possibly reflects a stage of development in the field where there is not yet consensus on important differences between indices for different purposes and the evidence base for validity appropriate to each purpose.

Diet quality indices recently developed for use with Australian adults[11,12] were specifically designed to assess adherence with the national dietary guidelines for adults, used food-based components, and have been applied to food frequency questionnaires (FFQ) and short dietary questions. While they have assumed a similar link to health outcomes as seen in the literature, their validity for this has not been reported. The current study aimed to design a new index by including both food and nutrients related to health outcomes highlighted in the national dietary guidelines and/or linked to the Australia National Health Priority Areas (ANHPA) and to evaluate both construct and criterion validity by applying the index to cross-sectional and longitudinal datasets.

The most common approach used to assess the validity of a diet quality index has been "construct validity", where the direction of association between diet quality index scores and demographic, socio-economic, health and behavioural characteristics, key foods and nutrients is

Corresponding Author: Dr Geoffrey Marks, The University of Queensland, School of Population Health, Qld 4006, Australia.
Tel: +61 7 3365 5402; Fax: +61 3365 5442
Email: g.marks@sph.uq.edu.au
Manuscript received 24 October 2012. Initial review completed 8 November 2012. Revision accepted 16 February 2013.
doi:10.6133/apjcn.2013.22.2.15

assessed. For example, women are consistently shown to have higher diet quality scores compared to men;[7,12,15] inverse associations have been reported between diet quality scores and tobacco use[12,16,17] and BMI,[15,18,19] while positive associations have been found between diet quality index scores and age[5,7,12] and physical activity.[20] Furthermore, diet quality has been shown to be positively associated with consumption of fruits, vegetables and legumes,[6,7,21] and inversely associated with intake of energy from saturated and discretionary fats.[22-24] However, findings have been inconsistent on the association between diet quality index and blood pressure, income level, or years of schooling.[12,18,22,29] These findings set a benchmark in terms of expectations for new indices.

Another approach to assess validity is "criterion validity" where the ability of a diet quality index to predict morbidity and/or mortality outcomes is examined. For example, the healthy diet indicator, developed according to the WHO guidelines was found to be inversely associated with all-cause mortality in men but not women in studies from three European countries;[17] the Mediterranean diet score was associated with increased survival in some populations,[30] but not others;[30,31] and poorer quality diet as measured by diet quality index in the USA was found to be positively but non-significantly associated with increased mortality in men, and to have significant associations with all-cause mortality and all circulatory disease mortality in women.[32]

In the current study we build on and extend the features of existing diet quality indices developed for Australian adults[11,12] by developing an index that explicitly includes both food and nutritional components highlighted in the national dietary guidelines and/or linked to the ANHPA, and evaluate the association of the developed index with socio economic, demographic and health behavior characteristics using data from a national cross-sectional nutrition survey of Australian adults, as well as its predictive validity with mortality outcomes from a community-based longitudinal study.

MATERIALS AND METHODS

Development of Aussie-DQI

The Aussie-DQI was developed using eleven components that reflect the dietary guidelines for Australian adults,[4,33] and addressed diet-related risk factors associated with the ANHPA[34] (Table 1) which includes cardiovascular health, cancer, injury prevention, musculoskeletal conditions, diabetes mellitus, and obesity.

The components of Aussie-DQI include vegetables, fruits, dairy products, meat and alternatives, cereals, percent of total energy from saturated fats (SFA), percent of total energy from sugar, alcohol, processed meat, added salt/sodium and dietary variety (Table 1). The first ten components were scored between zero (minimum) and ten (maximum) points. The eleventh or "variety" components had four sub-components that were each scored between zero and five points. Participants whose dietary intake complied with the dietary recommendations were awarded maximum points, while those whose diet was not in compliance were awarded minimum points. Proportional scores were computed for dietary intakes situated between the minimum and maximum scoring criteria.

The Aussie-DQI scoring system focused as well on moderation in intake of foods and nutrients shown to be associated with increased risk of some chronic diseases and thus requiring restriction.[15,35,36] For example, to emphasize the importance of moderation in fat intake, consuming more than the recommended serves of dairy products, meats and processed meat incurred minimum scores. Similarly, intake of SFA was assessed using percentage of total energy from SFA, with intakes more than the recommended percentage incurring minimum scores. Furthermore, the percent of total energy from sugar was used to assess the contribution of "low-nutrient density" foods such as sugary foods and drinks to the diet quality index. To discourage unhealthy eating behaviours, the Aussie-DQI scoring system awarded points for choosing a "variety" of vegetables and fruits, and for the inclusion of whole-grains, and fish and fish products in the diet (Table 1). Points were then summed to obtain an overall Aussie-DQI score ranging from 0 to 120 in which a higher score reflects better compliance with the dietary guidelines.

Construct validity using a national cross-sectional nutrition survey

Development of the Aussie-DQI and assessing its construct validity was based on adults (19 years and older) who participated in the 1995 Australian National Nutrition Survey (NNS)[37] and completed a 24 hour dietary recall (n=10,851). We excluded pregnant (n=156) and lactating (n=141) women, and participants with implausible energy intake (n=687) (total energy intake <2093 kJ for women and 3349 kJ for men or ≥14,654 kJ for women and 16,747 kJ for men). Detailed information on the survey including sampling and methodology used has been published previously.[37] In summary, the NNS was conducted on a subset of participants of the National Health Survey and based on a multi-stage area sample of households in urban and rural areas in all states and territories in Australia (n=10,851). Ethics approval for the survey was provided by the Ethics Committee of the Australian Institute of Health and Welfare.

Dietary information

Detailed information on all foods and beverages consumed by participants during the previous day between midnight and midnight was obtained by 24 hour recall. Across the study population, all days of the week and seasons were represented. The multiple-pass method initially developed by the United States Department of Agriculture was adopted. This method comprised a "quick list" of food and beverages consumed, followed by detailed information on each of the items on the quick list; and a 'recall review' phase, to provide an opportunity for participants to report on forgotten items. Food intake in grams and nutrients from foods were calculated by the Australia Bureau of Statistics using a customized food composition database.[37]

Non-dietary information

Information on age, tobacco use, health status, blood pressure, income, BMI, educational status, and physical activity were collected for all participants of the 1995 NNS using a standard questionnaire.[37] Self-perceived health

Table 1. Components of the Aussie-DQI and scoring system

Components	Dietary Guideline for Australians addressed	Score range†	Criteria for maximum score	Criteria for minimum score	Diet related National Health Priority Areas addressed
Vegetables	Eat plenty of vegetables	0-10	≥5 serves/daily (d)	0 serve/d	Cardiovascular health Some cancers Type2 diabetes
Fruits	Eat plenty of fruits	0-10	≥ 2 serves/d	0 serve/d	Cardiovascular health Some cancers Type2 diabetes
Dairy products	Include milks, yoghurts, cheeses and/or alternatives. Reduced-fat varieties should be chosen, where possible	0-10	2-4 serves/d	0 or > 4 serves/d	Some cancers Musculo-skeletal conditions Obesity
Meat and alternatives	Include lean meat, fish, poultry and/or alternatives	0-10	$\frac{1}{2}$ - 1$\frac{1}{2}$ serves/d	0 from meat and alternatives/d or >2 serves from meat/d	Some cancers
Cereals	Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain	0-10	19-60 years: Males: 6-12 serves/d Females: 4-9serves/d >60 years Males: 4-9 serves/d Females:4-7 serves/d	0 or >12 serves/d 0 or >9 serves/d 0 or >9 serves/d 0 or >7 serves/d	Cardiovascular health Some cancers Obesity
Percentage of total energy from SFA‡	Limit SFA and moderate total fat intake	0-10	≤10% of total energy	>10% of total energy	Cardiovascular health Some cancers Obesity
Percentage of total energy from sugar‡	Consume only moderate amounts of sugars and foods containing added sugars	0-10	≤15% of total energy	>15% of total energy	Some cancers Obesity
Alcohol	Limit your alcohol intake if you choose to drink	0-10	Males: 0-20 g/d Females: 0-10 g/d	>40 g/d >20 g/d	Injury prevention and obesity Cancer control Cardiovascular health
Processed meat‡	Eat sausages and processed meats only occasionally	0-10	0-5 serves/month	>5 serves/month	Some cancers
Added salt/sodium	Choose foods low in salt	0-10	≤2300 mg/d sodium or ≤6 g/d salt	> 2300 mg/d sodium or > 6 g/d salt	Cardiovascular health
Variety§					
● Vegetables	Enjoy a wide variety of nutritious foods	0-5	5 points for consuming ≥3 types of vegetables/d	0 serve/d	Cardiovascular health Some cancers Obesity Type2 Diabetes
● Fruits	Eat a wide variety of fruit each week	0-5	5 points for consuming ≥2 types of fruits/d	0 serve/d	
● Wholegrain	Eat more wholegrain bread, high fibre cereal, brown rice and whole meal pasta	0-5	5 points for including wholegrain cereals/d	0 serve/d	
● Fish	Include fish, a very rich source of n-3 PUFA and iodine	0-5	5 points for inclusion of fish in daily or usual diet	0 serve/d	

† Proportional scores are computed for intakes situated between the maximum and minimum criteria.
‡ No clear cut-offs were defined for the intake of processed meat, SFA, sugar intake in the Australian guidelines. For setting cut-offs for these components other relevant dietary guidelines (WHO, UK, USA), national consumption level, and experience from similar studies were consulted.
§ To calculate variety score, vegetables were divided into three subgroups (subgroup A: a score of 2 was awarded for intake of any type of legumes) (subgroup B: score of 1.5 awarded for any consumption of tomato, carrots or fruiting vegetables) (subgroup C: score of 1.5 awarded for consuming any type of dark leafy green vegetables); fruits were divided into three subgroups: (subgroup A: berries; subgroup B: citrus and tropical fruits and subgroup C: dried, stone and other fruits) and 5 points awarded for consuming fruit from any two fruit groups; 5 points awarded for inclusion of any type of wholegrain cereals; and 5 points awarded for inclusion of any fish products.

status was assessed using a standard question from the SF-36: 'In general, would you say your health is', with response categories: excellent/ very good/ good/ fair/ poor. For our analysis we regrouped these into three categories: excellent (excellent and very good), good (good) and poor (fair and poor). An overall measure of physical activity was derived based on the type, duration and the amount of time spent on different forms of exercise including walking for sport, recreation or fitness, moderate exercise (apart from walking), or vigorous exercise in past two weeks. Physical activity was then classified into four categories: vigorous, moderate, low and sedentary. Height and weight of participants were measured according to standardised protocols by trained staff and BMI was calculated (weight/height^2). Blood pressure was measured twice by trained staff using a Tycos Aneroid sphygmomanometer and hypertension status was classified as *normotensives*: systolic blood pressure (SBP) <160 mmHg and a diastolic blood pressure (DBP) <95 mmHg (not on tablets for blood pressure); *controlled hypertensive*: SBP <160 mmHg and DBP <95 mmHg (on tablets for blood pressure); *treated, uncontrolled hypertensive*: SBP ≥160 mmHg and/ or DBP ≥95 mmHg (on tablets for blood pressure); *and untreated hypertensive*: SBP ≥160 mmHg and /or a DBP ≥95 mmHg (not on tablets for blood pressure).[37]

Construct and criterion validity using a community-based longitudinal study

The participants comprised a subset of the Nambour Skin Cancer Study aged 25 years and over, who completed the FFQ at baseline in 1992 (n=1,447). Participants were randomly selected from the electoral roll of Nambour a subtropical community in Queensland, Australia (electoral enrolment is compulsory for all the Australian citizens), and were involved in a 5-year field trial of skin cancer prevention with mortality surveillance continued through 2007. Details of the study have been published elsewhere.[38] Participants were excluded from the analyses if they omitted responses to 10% or more of FFQ items (n=53), had implausible energy intakes (n=34) (as for the NNS above), or died from causes clearly unrelated to dietary intake such as accident, trauma, poisoning and suicide (n=5). All participants provided written informed consent and the study was approved by the Ethics Committee of the Queensland Institute of Medical Research.

Dietary information

Habitual diet during the past 6 months was assessed using a self-administered, semi-quantitative FFQ consisting of 129 food or food group items in 1992. The FFQ was originally developed for the US Nurses'Health Study by Willett *et al*,[39] but adapted for the Australian setting and validated against weighed food records[40,41] and serum biomarkers.[42]

For each food, a commonly used unit or portion size was specified and participants were asked to estimate how often, on average, they ate the given amount of food over the past 6 months. The nine response options ranged from "never" to "4+ times per day". Information on cooking methods, specific types of fats, oils, margarines, breakfast cereals and takeaway foods was also calculated. Average daily intake was calculated by expressing the response to the food as a proportion of daily use, which was then multiplied by the gram amounts of the specified portions and by the nutrient content of the food. Dietary information were analysed for 1,355 participants (574 men and 781 women).

Non dietary information

Methods of assessment of age, tobacco use, blood pressure, BMI, educational status, and physical activity were similar to methods already reported for the NNS.

Information on medical condition was obtained by interviewer-administered questionnaire. Participants were considered to have a history of chronic medical condition if they answered 'yes' to any of the conditions listed separately in the question 'Have you ever been told by a doctor/nurse that you have: diabetes/high blood sugar, high blood pressure/hypertension, angina, heart attack, stroke, cancer?'.

Information on overall and cancer-specific mortality

Information on mortality for participants of the Nambour study was obtained from the National Death Index between February 1992 (baseline) and the end of 2007; however, the cause of death was not available for those who died in 2007. A range of one to seven causes of death was reported on the death certificates. We restricted our analysis to the first cause of death only. The ICD 10[43] classification was used to identify cancer mortality (ICD 10, C00-D48 with the exclusion of C44). All-cause mortality was assessed from the day of interview in 1992 until the end of 2007, and cause-specific (cancer) mortality was assessed up to the end of 2006 as there was no information available regarding the cause of death for 2007.

Statistical analyses

To assess construct validity, differences in mean Aussie-DQI scores (continuous) across categories of age groups, BMI, blood pressure, income, year of schooling, smoking status, self-perceived health status and physical activity were assessed using general linear regression models (GLM) using both NNS and Nambour study data. Reported *p*-values are two-tailed, all analyses were performed using SAS statistical software (version 9.1)[44] and statistical significance was defined as *p*-value <0.05.

Construct validity was also assessed using GLM to examine the associations between Aussie- DQI scores in quartile categories (Q1-Q4) and intakes of selected foods, nutrients and energy intake in both genders using NNS data. Q1 indicated a diet least consistent with the dietary guidelines while Q4 indicated a diet most consistent with the dietary guidelines. Mean scores of the Aussie-DQI for men and women were calculated separately and the t-test was used to compare differences in diet quality scores between genders.

To assess the criterion validity of the Aussie-DQI using the Nambour study data, the association between the Aus sie-DQI score and all-cause and cancer mortality was estimated using Cox proportional hazards model. We calculated hazards ratios (HR) with 95% confidence intervals across tertiles of the index score in age-adjusted and multivariable-adjusted models. Covariates included

Table 2. General characteristics of the 1995 NNS study population and association between mean Aussie-DQI scores by selected personal characteristics, using dietary information from a 24 hour recall

Categories	Men (n=4890)			Women (n=5534)		
	n	Mean score	(95% CI)	n	Mean score	(95% CI)
Age group						
19- 24	414	45.3	(43.2-47.4)	542	49.2	(43.3-51.0)
25-44	1946	49.6	(48.4-50.7)	2118	53.3	(52.1-54.5)
45-64	1603	53.4	(52.3-54.5)	1780	56.6	(55.4-57.7)
65+	927	56.8	(55.6-58.0)	1094	57.2	(56.0-58.4)
*p- trend**		<0.001			<0.001	
Smoking status						
Never smoked	1861	53.3	(52.2-54.5)	3056	56.5	(55.4-57.5)
Ex-smoker	1760	53.1	(52.0-54.3)	1255	54.6	(53.3-55.8)
Current smoker	1178	47.3	(46.0-48.6)	1134	51.1	(49.8-52.4)
*p- trend**		<0.001			<0.001	
Health status *(Self-perceived)*						
Excellent	2589	51.0	(49.9-52.1)	3029	54.2	(53.1-55.3)
Medium	1438	51.7	(50.5-52.9)	1568	53.8	(52.6-55.0)
Poor	863	51.1	(49.8-52.4)	937	53.1	(52.8-55.5)
*p- trend**		0.75			0.53	
Blood pressure status						
Normotensives	3836	51.6	(50.8-52.4)	4417	53.9	(53.0-54.7)
Controlled hypertensive	460	52.2	(49.0-53.4)	584	54.0	(52.7-55.4)
Treated, uncontrolled hypertensives	182	51.2	(48.3-51.8)	209	53.1	(51.0-55.0)
Untreated hypertensives	328	50.1	(50.7-53.7)	220	55.3	(53.2-57.3)
*p- trend**		0.92			0.75	
Income						
≥ 70000	790	52.8	(51.4-54.2)	748	54.1	(52.7-55.5)
20000 ≤ to < 70000	2410	51.0	(50.0-52.1)	2507	53.6	(52.5-54.8)
0 ≤ to < 20000	956	50.0	(48.7-51.2)	1450	54.4	(53.2-55.6)
*p- trend**		0.001			0.95	
BMI						
< 25	1609	52.8	(51.6-54.0)	2696	54.8	(53.6-55.9)
25≤ to < 30	2266	51.7	(50.6-52.8)	1690	54.0	(52.8-55.2)
≥ 30	1006	49.2	(48.0-50.5)	1139	53.4	(52.1-54.7)
*p- trend**		<0.001			0.02	
Educational status						
Bachelor degree or higher	320	51.4	(49.6-53.2)	289	54.6	(52.7-56.4)
Certificate/diploma	824	52.0	(50.7-53.3)	479	53.8	(52.3-55.3)
Basic vocational, Completed high school	2960	51.2	(50.1-52.2)	3763	53.7	(52.7-54.7)
Left high school or never studied	786	50.4	(49.0-51.8)	1003	54.2	(52.9-55.5)
*p- trend**		0.07			0.56	
Physical activity						
Sedentary	1401	49.7	(48.5-50.8)	1526	52.0	(50.9-53.1)
Low exercise level	1387	51.4	(50.2-52.5)	1979	54.3	(53.2-55.4)
Moderate exercise	1229	51.5	(50.3-52.7)	1217	54.9	(53.7-56.2)
Vigorous exercise	347	52.4	(50.7-54.1)	251	55.0	(53.1-56.9)
*p- trend**		<0.001			<0.001	

*General linear regression analysis, each model adjusted for all other characteristics.

in the Cox regression models for all-cause and cancer mortality were those reported in the literature for similar mortality studies including age, smoking status, alcohol consumption, physical activity, BMI, years of schooling and history of major chronic diseases at baseline.[5,45] Analyses were performed using the PROC PHREG procedure in the SAS software package. Trends in the HR over Aussie-DQI scores were tested by Wald chi-square statistic. The models were also tested for interactions.

RESULTS

Mean Aussie-DQI scores are shown for categories of demographic, socio-economic, and health behaviour characteristics using the NNS data in Table 2. Inadequate information on salt or sodium intake was available from the 24 hour recall to assess its intake. Consequently this component was dropped and the total was out of a possible 110 points. The overall Aussie-DQI score was 52.5±13.6 (mean±SD) for men and 55.3±12.8 for women out of a possible 110 points. Stratification showed that mean scores increased significantly with increasing age in men and women. In contrast, Aussie-DQI scores were lowest among current smokers, low income earners (men only), those who were obese (BMI ≥ 30), and the

Table 3. Intakes of selected foods and nutrients by quartiles of the Aussie-DQI scores for adults in the 1995 NNS, using dietary information from a 24 hour recall

	Overall mean (SD)	Mean score (SD)				
		<45	45-54	54-63	≥63	*p*-trend†
		Men (n=4,556)				
		(n= 1318)	(n=1153)	(n=998)	(n=1087)	
Energy (kJ)	10078 (2972)	10506 (3105)	10219 (3042)	9802 (2791)	9662 (2814)	<0.001
Vegetable (g)	282 (231)	198 (211)	282 (239)	289 (207)	379 (225)	<0.001
Fruit (g)	207 (276)	83.2 (193)	179 (250)	240 (268)	355 (315)	<0.001
Dairy (g)	303 (295)	330 (355)	313 (318)	277 (255)	283 (209)	<0.001
Meat (g)	212 (188)	239 (204)	229 (193)	205 (180)	167 (158)	<0.001
Processed meat (g)	27.1 (57.3)	51.4 (74.1)	27.1 (56.4)	15.2 (42.4)	8.6 (30.3)	<0.001
Cereal (g)	359 (254)	333 (247)	355 (255)	365 (254)	391 (259)	<0.001
Alcohol (g)	17.8 (30.5)	26.5 (38.5)	16.3 (27.7)	16.2 (27.5)	10.3 (20.9)	<0.001
Total sugar (g)	123 (66.5)	126 (70.7)	123 (64.7)	117 (64.7)	125 (64.3)	0.291
Total SFA (g)	35.0 (17.4)	40.4 (17.5)	37.8 (17.8)	32.5 (15.9)	27.6 (15.3)	<0.001
Variety score	6.1 (3.7)	3.1 (3.0)	5.0 (3.5)	6.7 (4.0)	9.6 (4.2)	<0.001
Total iron (mg)	15.4 (6.3)	14.1 (6.1)	15.5 (6.5)	15.6 (6.3)	16.7 (6.2)	<0.001
Total folate (mcg)	292 (123)	252 (111)	288 (125)	296 (115)	340 (124)	<0.001
Total calcium (mg)	887 (491)	919 (570)	899 (513)	839 (436)	879 (398)	0.005
Total zinc (mg)	13.3 (8.9)	13.5 (12.1)	13.6 (8.4)	13.0 (6.5)	12.8 (6.3)	0.030
Vitamin C (mg)	131 (114)	86.0 (85.0)	127 (113)	141 (117)	179 (121)	<0.001
		Women (n=5,311)				
		(n=1090)	(n=1345)	(n=1336)	(n=1540)	
Energy (kJ)	7232 (2512)	7465 (2628)	7306 (2578)	7227 (2533)	7005 (2329)	<0.001
Vegetable (g)	239 (193)	156 (166)	208 (197)	239 (177)	326 (187)	<0.001
Fruit (g)	209 (255)	106 (188)	155 (216)	219 (255)	320 (283)	<0.001
Dairy (g)	251 (230)	267 (282)	252 (237)	242 (220)	247 (186)	0.021
Meat (g)	134 (133)	149 (150)	137 (132)	138 (137)	117 (117)	<0.001
Processed meat (g)	15.1 (37.9)	34.6 (53.4)	16.4 (40.1)	8.3 (26.5)	6.0 (23.3)	<0.001
Alcohol (g)	7.2 (17.8)	12.2 (22.6)	7.7 (18.2)	6.1 (17.1)	4.0 (12.6)	<0.001
Cereal (g)	267 (192)	241 (185)	268 (192)	271 (189)	281 (198)	<0.001
Total sugar (g)	94.4 (51.5)	99.2 (55.8)	91.6 (51.7)	91.8 (51.3)	95.6 (48.0)	0.246
Total SFA (g)	25.7 (14.9)	30.1 (15.2)	28.3 (15.0)	25.9 (14.7)	20.0 (12.7)	<0.001
Variety score	5.8 (3.7)	2.9 (2.9)	4.7 (3.6)	6.3 (3.9)	9.4 (4.3)	<0.001
Total iron (mg)	11.7 (4.9)	10.7 (4.0)	11.3 (5.1)	11.9 (4.8)	12.7 (4.6)	<0.001
Total folate (mcg)	229 (108)	187 (89.0)	212 (109)	229 (91.2)	272 (117)	<0.001
Total calcium (mg)	735 (399)	741 (455)	731 (410)	729 (395)	741 (346)	0.916
Total zinc (mg)	9.5 (5.6)	9.2 (6.2)	9.5 (5.8)	9.5 (4.6)	9.8 (5.7)	0.012
Vitamin C (mg)	113 (101)	74.3 (85.6)	93.8 (82.8)	115 (95.6)	157 (112)	<0.001

† General linear regression analysis

sedentary. There were no significant associations between Aussie-DQI scores and self-perceived health status, blood pressure, and years of schooling (Table 2). Using NNS data, higher Aussie-DQI scores (across quartiles) were associated with higher intakes of vegetables, fruits, cereals, iron, folate, vitamin C and "variety"scores, and lower intakes of meat, processed meat, alcohol, total SFA, and energy in men and women (Table 3).

Mean Aussie-DQI scores using the Nambour study data are shown in Table 4, by categories of demographic, socio-economic, and health behaviour variables. The mean Aussie-DQI was higher for females than males (68.5±10.4 versus 63.0±11.1) out of a possible 120 points. Aussie-DQI score increased significantly with increasing age, but was lowest among current smokers, and the obese (BMI ≥ 30) in both genders. No significant association was observed between Aussie-DQI scores and blood pressure, years of schooling, physical activity or history of chronic diseases (Table 4).

Table 5 presents the age-adjusted and multivariable–adjusted risk estimates for all-cause and cancer mortality, stratified by quartile of Aussie-DQI (refer to table 5 for details of variables in models). During the 16 years of follow up, 156 deaths occurred (86 men and 70 women). The Aussie-DQI was inversely associated with the risk of cancer mortality among men in both age-adjusted (HR= 0.25, 95% CI: 0.10, 0.65; p for trends = 0.01) and multivariable-adjusted models (HR= 0.30, 95% CI: 0.11, 0.83; p for trends = 0.06). No significant association was found for all-cause mortality or cancer mortality in females. For these interactions, p-values were not statistically significant and no effect modification was found.

DISCUSSION

We developed a diet quality index (Aussie-DQI) which comprised 11 components to assess adherence to the nutritional guidelines for Australian adults, and considered foods and nutrients that might be related to morbidity outcomes specified in the Australian National Health Priority Areas. The index was applied in two study populations to dietary data collected using a 24 hour dietary recall and FFQ, and showed similar patterns in the means for males versus females in each case (52.5:55.3 out of 110 points for 24 hour recall and 63.0:68.5 out of 120

Table 4. Baseline characteristics of participants of 1992 Nambour study and association between mean Aussie-DQI scores and selected personal characteristics, using FFQ dietary data

	Categories	Men (n=577)			Women (n=783)		
		n	Mean score	(95% CI)	n	Mean score	(95% CI)
Age group *(yrs)*	25-44	208	60.5	(58.0-63.0)	312	65.7	(63.4-68.1)
	45-64	253	64.0	(61.7-66.4)	379	68.2	(66.0-70.4)
	65+	116	66.5	(63.8-69.1)	92	70.4	(67.4-73.3)
P- trend†			< 0.001			0.001	
Smoking status	Never smoked	230	65.7	(63.6-67.9)	486	70.1	(68.0-72.0)
	Ex-smoker	221	65.1	(62.9-67.4)	172	68.9	(66.6-71.3)
	Current smoker	97	60.1	(57.1-63.0)	69	65.4	(61.9-68.7)
P- trend†			< 0.001			0.005	
Blood pressure status	Normal	405	62.9	(61.3-64.6)	500	66.7	(64.8-68.7)
	Treated hypertensive	34	65.9	(61.7-70.0)	62	68.8	(65.6-72.1)
	Untreated hypertensive	75	62.2	(59.3-65.1)	112	68.7	(66.0-71.4)
P- trend†			0.80			0.17	
BMI *(kg/m²)*	<25	161	65.9	(63.3-68.4)	320	68.7	(66.4-70.9)
	25-30	235	62.7	(60.4-65.1)	197	67.9	(64.7-69.5)
	> 30	66	62.8	(59.6-66.1)	101	65.6	(62.9-68.4)
P- trend†			0.058			0.018	
Schooling years	Bachelor degree or higher	42	66.3	(62.6-69.9)	28	67.5	(63.3-71.6)
	Certificate/diploma	123	60.6	(58.3-63.0)	123	68.1	(65.7-70.5)
	Left high school or never studied	341	64.1	(62.2-66.0)	497	68.7	(67.0-70.4)
P- trend†			0.75			0.43	
Physical activity	Sedentary	194	61.7	(60.1-63.2)	222	68.5	(67.1-69.9)
	Low physical activity	120	64.3	(62.3-66.2)	250	68.5	(67.2-69.8)
	Moderate physical activity	76	63.7	(61.2-66.1)	90	68.5	(66.3-70.6)
	High physical activity	112	62.8	(60.7-64.8)	111	68.1	(66.2-70.1)
P- trend†			0.35			0.77	

† General linear regression analysis, each model adjusted for all other characteristics.

points for the FFQ). These moderate overall scores reflect a generally poor adherence to the dietary recommendations in these population groups, a finding that is consistent with previously published work from Australia.[11,12]

Implementation of the index is limited by the data available, even for apparently ‘comprehensive’ methods of dietary assessment. In this study the guideline to “choose foods low in salt” could not be addressed with the data routinely collected for the 24 hour recall. The outcome was that the Aussie-DQI total score was out of 110 for the 24 hour recall, and 120 for the FFQ. This could be addressed by dropping the salt component from the index, but this limits its value in relation to a key recommendation for cardiovascular health and some types of cancers.

Considering construct validity, the pattern of associations between the index and demographic, socio-economic, health and lifestyle characteristics was similar using the different methods of dietary assessment across the two populations. On average, women follow dietary patterns that adhere more closely to the dietary recommendations than men, as do older participants, non-smokers, and those with BMI within the normal range. These findings are consistent with results of previous studies carried out in Australia[11,12] and elsewhere,[15,18,46] and suggest that these are core associations for establishing construct validity. Other associations were less consistent, again reflecting variation in the literature.

The national survey/ 24 hour recall data showed that participants with higher income (only men), and those who engage in vigorous physical activity level had dietary intakes that adhere to the dietary recommendations. And we found no association between diet quality index scores and blood pressure status, educational status and health status. This is consistent with results for other Australian studies.[11,12]

The validity of the index is further demonstrated by findings that show that intakes of fruit, vegetables, cereals, vitamin C, folate, and iron, as well as food choices that incorporate variety of fruits, vegetables, whole grain and fish are associated with higher Aussie-DQI scores and hence high quality diet; while in contrast, high intakes of total energy, meat, processed meat, alcohol, total SFA, were associated with low Aussie-DQI scores and hence poor diet. These findings confirm relatively strong construct validity of the index and are consistent with other studies that have considered these elements.[19,47,48]

In our study, the intake of dairy products, calcium (males only) and zinc (males only) showed a slight decrease in the highest diet quality groups; this pattern is different from other studies.[23,27,25] The difference might be related to the scoring system of the Aussie-DQI, which was deliberately designed to penalise over-consumption of meat, processed meat and dairy products.

The mean Aussie-DQI score was systematically higher in the Nambour/ FFQ analysis than the national survey/ 24 hour recall analysis by 11-13 points across the age and gender strata. This is partially accounted for by the omission of the salt component in the 24 hour recall analysis, but it does not completely explain the differences as the total possible score for the salt component is only 10. The

Table 5. Multivariate adjusted hazard ratios and 95% CIs of all-cause and cancer mortality by tertiles of the Aussie-DQI score, using data from the 1992 FFQ of the Nambour study.

Variables	Tertile 1	Tertile 2	Tertile 3	Chi-Square	*p* for trend
		Men (n=574)			
	n=197	n=186	n=191		
Overall Aussie-DQI score mean(SD)	51.6 (5.2)	62.3 (2.4)	75.4 (6.7)		
All-cause mortality					
Number of deaths	22	30	34		
Age-adjusted HRs (95%CI)	1.00	0.94 (0.54-1.63)	0.65 (0.38-1.12)	3.08	0.21
Multivariable adjusted HRs (95% CI)†	1.00	0.88 (0.48-1.60)	0.70 (0.39-1.26)	1.60	0.45
Cancer mortality					
Number of deaths	12	8	7		
Age-adjusted HRs (95%CI)	1.00	0.46 (0.19-1.14)	0.25 (0.10-0.65)	8.55	0.01
Multivariable adjusted HRs (95% CI)†	1.00	0.48 (0.18-1.26)	0.30 (0.11-0.83)	5.66	0.06
		Women (n=781)			
	n=247	n=261	n=273		
Overall Aussie-DQI score mean(SD)	79.7(6.2)	67.7(2.3)	57.1 (4.9)		
All-cause mortality					
Number of death	18	22	30		
Age adjusted HRs (95%CI)†	1.00	0.86 (0.47-1.59)	0.75 (0.42-1.33)	1.00	0.61
Multivariate adjusted HRs (95% CI)‡	1.00	0.76 (0.40-1.43)	0.69 (0.37-1.28)	1.42	0.49
Cancer mortality					
Number of death	8	9	10		
Age adjusted HRs (95%CI)†	1.00	0.87 (0.34-2.25)	0.69 (0.27-1.75)	0.64	0.73
Multivariate adjusted HRs (95% CI)‡	1.00	0.84 (0.32-2.22)	0.64 (0.24-1.68)	0.87	0.65

†Adjusted for age (continuous).
‡Multivariate adjustment for age and alcohol intake (continuous), smoking status (never smoked, ex-smoker and current smoker), physical activity (sedentary, low, moderate and high), history of major diseases at baseline (present, absent), educational status (bachelor degree or higher, Certificate/diploma, left high school or never studied) and BMI (<25, ≥ 25-30, > 30).

differences may be the outcome of the methods of dietary assessment being used (the FFQ versus the 24 hour recall), or the outcome of differences in dietary patterns for the population groups assessed. The differences may also be related to the selection methods of subjects in cross-sectional and longitudinal studies.[37,38] We are unable to distinguish these with the results available.

Overall the construct validity findings have implications for identifying target groups for nutrition education, such as males, younger age groups, current smokers and the obese. This is a common objective for diet quality assessment.

By considering the criterion validity, we are directly addressing a very common interpretation of diet quality indices: namely its ability to predict health outcomes. The Aussie-DQI was associated with a 70% decreased risk of cancer mortality in men after adjustment for possible confounders, although the decreased association in women was not statistically significant. Our finding of decreased cancer mortality in men is notable as diet quality indices have shown mixed outcomes for criterion validity. For example, index scores were found to be unrelated to cancer mortality in a cohort of U.S. adults aged 50-79 years enrolled in a prospective study with 4 years of follow-up,[32] the Mediterranean diet score was found to be associated with reduced mortality,[30] while the healthy diet indicator was found to be inversely associated with all-cause mortality in men from three European countries, and Dutch elderly men but not women.[17] The comparison of the findings is difficult since these studies are based on different indices with different target populations using a wide variety of methods (sample size, age groups, genders, follow-up period, inclusion or exclusion criteria at baseline, data collection methods, adjustment for potential confounders and so on).

Study limitations include the small sample size of the Nambour study and lack of statistical power that might explain the lack of significant association between the Aussie-DQI scores and all-cause mortality. Additionally, we assumed that the dietary information collected at baseline in 1992 is indicative of diet between 1992 and 2007. Ideally, subjects with a history of major chronic diseases at baseline or in the first few years of the study should have been excluded from analysis but we did not exclude these subjects due to small number of mortality cases. To deal with this issue in our analyses, we adjusted the models for the history of chronic diseases at baseline; however, the adjustment might not be sufficient and there may be residual confounding. Finally, although cut-off values used in developing the Aussie-DQI were mostly derived from the dietary guidelines for Australians, recommendations from the UK, and USA were consulted to obtain suitable cut-off values for processed meat, SFA, and sugar, as there were no clear cut-off values in the Australian dietary guidelines.

To our knowledge, it is the first study in Australia to assess criterion validity for a diet quality index. It is also the first study to report applying an index to both 24 hour recall and FFQ dietary data obtained from cross-sectional and longitudinal studies; therefore, the current study has assessed the validity of the index by two different dietary methods. Furthermore, the scoring system used recommendations from the Australian dietary guidelines and took into consideration foods and nutrients that might be related to morbidity outcomes addressed by the Australia National Health Priority Areas; to this end, the Aussie-DQI scoring system incorporated gender specific cut-offs where available, and penalised over-consumption of certain foods, and foods that contain nutrients known to be associated with chronic non-communicable diseases including obesity, type 2 diabetes, CVD and some cancer.[2,4]

The Aussie-DQI successfully discriminated diet quality using cross-sectional and longitudinal data and two different dietary assessment methods. Thus, current smokers, low income earners (men only), those who are obese (BMI $\geq$ 30), and the sedentary were less likely to follow a dietary pattern that adheres to dietary recommendations. Assessment of criterion validity showed that consumption of a diet that meets dietary recommendations is associated with decreased risk of cancer mortality among men. In conclusion, these findings suggest that a diet consistent with the Australian dietary recommendations may reduce risk of cancer mortality.

ACKNOWLEDGEMENTS
The authors thank Professor Gail Williams for statistical advice.

AUTHOR DISCLOSURES
The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

REFERENCES
1. World Health Organization. Diet, nutrition and the prevention of chronic diseases. World Health Organ Tech Rep Ser No 916, 2003. Geneva: WHO; 2003.
2. World Cancer Research Fund /American Institute for Cancer Research. Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective. Washington DC: AICR; 2007.
3. US Department of Agriculture and Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington DC: U.S. Government Printing Office; 2010.
4. National Health and Medical Research Council. Dietary Guidelines for Australian Adults. Canberra: NHMRC; 2003.
5. Kant AK, Schatzkin A, Graubard BI, Schairer C. A prospective study of diet quality and mortality in women. JAMA. 2000;283:2109-15.
6. Verger EO, Mariotti F, Holmes BA, Paineau D, Huneau JF. Evaluation of a diet quality index based on the probability of adequate nutrient intake (PANDiet) using national French and US dietary surveys. PLoS One. 2012;7(8):e42155.
7. Patterson RE, Haines PS, Popkin BM. Diet quality index: capturing a multidimensional behavior. J Am Diet Assoc. 1994;94:57-64.
8. Kaluza J, Hakansson N, Brzozowska A, Wolk A. Diet quality and mortality: a population-based prospective study of men. Eur J Clin Nutr. 2009;63:451-7.
9. Thiele S, Mensink GB, Beitz R. Determinants of diet quality. Public Health Nutr. 2004;7:29-37.
10. Drake I, Gullberg B, Sonestedt E, Wallstrom P, Persson M, Hlebowicz J, Nilsson J, Hedblad B, Wirfalt E. Scoring models of a diet quality index and the predictive capability of mortality in a population-based cohort of Swedish men and women. Public Health Nutr. 2012:1-11.
11. Australian Institute of Health and Welfare. Australian diet quality index project. Canberra: AIHW; 2007.
12. McNaughton SA, Ball K, Crawford D, Mishra GD. An index of diet and eating patterns is a valid measure of diet quality in an Australian population. J Nutr. 2008;138:86-93.
13. Collins CE, Young AF, Hodge A. Diet quality is associated with higher nutrient intake and self-rated health in mid-aged women. J Am Coll Nutr. 2008;27:146-57.
14. Waijers PM, Feskens EJ, Ocke MC. A critical review of predefined diet quality scores. Br J Nutr. 2007;97:219-31.
15. Fogli-Cawley JJ, Dwyer JT, Saltzman E, McCullough ML, Troy LM, Jacques PF. The 2005 Dietary Guidelines for Americans Adherence Index: development and application. J Nutr. 2006;136:2908-15.
16. Guenther PM, Reedy J, Krebs-Smith SM. Development of the Healthy Eating Index- 2005. J Am Diet Assoc. 2008;108: 1896-901.
17. Huijbregts P, Feskens E, Rasanen L, Fidanza F, Nissinen A, Menotti A, Kromhout D. Dietary pattern and 20 year mortality in elderly men in Finland, Italy, and The Netherlands: longitudinal cohort study. BMJ. 1997;315(7099):13-7.
18. Fisberg RM, Morimoto JM, Slater B, Barros MA, Carandina L, Goldbaum M, Latorre MO, Cesar CG. Dietary quality and associated factors among adults living in the state of Sao Paulo, Brazil. J Am Diet Assoc. 2006;106:2067-72.
19. Fung TT, Rexrode KM, Mantzoros CS, Manson JE, Willett WC, Hu FB. Mediterranean diet and incidence of and mortality from coronary heart disease and stroke in women. Circulation. 2009;119:1093-100.
20. Mai V, Kant AK, Flood A, Lacey JV, Schairer C, Schatzkin A. Diet quality and subsequent cancer incidence and mortality in a prospective cohort of women. Int J Epidemiol. 2005; 34:54-60.
21. Osler M, Heitmann BL, Gerdes LU, Jorgensen LM, Schroll M. Dietary patterns and mortality in Danish men and women: a prospective observational study. Br J Nutr. 20018;5: 219-25.
22. Panagiotakos DB, Pitsavos C, Stefanadis C. Dietary patterns: a Mediterranean diet score and its relation to clinical and biological markers of cardiovascular disease risk. Nutr Metab Cardiovasc Dis. 2006;16:559-68.
23. Harnack L, Nicodemus K, Jacobs DR, Jr., Folsom AR. An evaluation of the Dietary Guidelines for Americans in relation to cancer occurrence. Am J Clin Nutr. 2002;76:889-96.
24. Lee S, Harnack L, Jacobs DR, Jr., Steffen LM, Luepker RV, Arnett DK. Trends in diet quality for coronary heart disease prevention between 1980-1982 and 2000-2002: The Minnesota Heart Survey. J Am Diet Assoc. 2007;107:213-22.
25. Scali J, Richard A, Gerber M. Diet profiles in a population sample from Mediterranean southern France. Public Health Nutr. 2001;4:173-82.
26. Oba S, Nagata C, Nakamura K, Fujii K, Kawachi T, Takatsuka N, Shimizu H. Diet based on the Japanese Food Guide Spinning Top and subsequent mortality among men and women in a general Japanese population. J Am Diet Assoc. 2009;109:1540-7.
27. Bodnar LM, Siega-Riz AM. A Diet Quality Index for Pregnancy detects variation in diet and differences by sociodemographic factors. Public Health Nutr. 2002;5:801-9.
28. Kant AK, Schatzkin A, Harris TB, Ziegler RG, Block G. Dietary diversity and subsequent mortality in the First National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. Am J Clin Nutr. 1993;57:434-40.
29. Lazarou C, Panagiotakos DB, Matalas AL. Foods E-KINDEX: a dietary index associated with reduced blood

pressure levels among young children: the CYKIDS study. J Am Diet Assoc. 2009;109:1070-5.
30. Trichopoulou A, Orfanos P, Norat T, Bueno-de-Mesquita B, Ocké M, Peeters PH, et al. Modified Mediterranean diet and survival: EPIC-elderly prospective cohort study. BMJ. 2005; 330:991.
31. Haveman-Nies A, de Groot LP, Burema J, Cruz JA, Osler M, van Staveren WA, SENECA Investigators. Dietary quality and lifestyle factors in relation to 10-year mortality in older Europeans: the SENECA study. Am J Epidemiol. 2002;156:962-8.
32. Seymour JD, Calle EE, Flagg EW, Coates RJ, Ford ES, Thun MJ. Diet Quality Index as a predictor of short-term mortality in the American Cancer Society Cancer Prevention Study II Nutrition Cohort. Am J Epidemiol. 2003;157: 980-8.
33. Kellett E, Smith A, Schmerlaib Y. Australian Guide to Healthy Eating. Canberra: Commonwealth Department of Health and Family Services; 1998
34. Australian Institute of Health and Welfare. National Health Priority Areas. Canberra: AIHW [cited 20.6.2011]. Available from: http://www.healthconnect.gov.au/internet/wcms/publishing.nsf/Content/Health+Priorities-1.
35. Kim S, Haines PS, Siega-Riz AM, Popkin BM. The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. J Nutr. 2003;33: 3476-84.
36. Mitrou PN, Kipnis V, Thiebaut AC, Reedy J, Subar AF, Wirfa E et al. Mediterranean dietary pattern and prediction of all-cause mortality in a US population: results from the NIH-AARP Diet and Health Study. Arch Intern Med. 2007; 167:2461-8.
37. McLennan W. National Nutrition Survey: Users Guide 1995. Canberra: Australian Bureau of Statistics; 1998.
38. Green A, Battistutta D, Hart V, Leslie D, Marks GC, Williams G, et al. Nambour prevention study group. The Nambour Skin Cancer and Actinic Eye Disease Prevention Trial: design and baseline characteristics of participants. Control Clin Trials. 1994;15:512-22.
39. Willett WC, Sampson L, Stampfer MJ, Rosner B, Bain C, Witschi J, Hennekens CH, Speizer FE. Reproducibility and validity of a semiquantitative food frequency questionnaire. Am J Epidemiol. 1985;122:51-65.
40. Marks GC, Hughes MC, van der Pols JC. Relative validity of food intake estimates using a food frequency questionnaire is associated with sex, age, and other personal characteristics. J Nutr. 2006;136:459-65.
41. Marks GC, Hughes MC, van der Pols JC. The effect of personal characteristics on the validity of nutrient intake estimates using a food-frequency questionnaire. Public Health Nutr. 2006;9:394-402.
42. McNaughton SA, Marks GC, Gaffney P, Williams G, Green A. Validation of a food frequency questionnaire assessment of carotenoid and vitamin E intake using weighed food records and plasma biomarkers: the method of triads model. Eur J Clin Nutr. 2005;59:211-8.
43. World Health Organization. International Statistical Classification of Diseases, Injuries and Causes of Death 10th Revision (ICD10). Geneva: WHO; 2006.
44. SAS software, version 9.1. Cary, NC: SAS Institute Inc, 2000-2004.
45. Michels KB, Wolk A. A prospective study of variety of healthy foods and mortality in women. Int J Epidemiol. 2002;31:847-54.
46. Rafferty AP, Anderson JV, McGee HB, Miller CE. A healthy diet indicator: quantifying compliance with the dietary guidelines using the BRFSS. Prev Med. 2002;35:9-15.
47. Trichopoulou A, Costacou T, Bamia C, Trichopoulos D. Adherence to a Mediterranean diet and survival in a Greek population. N Engl J Med. 2003;348:2599- 608.
48. Gerber MJ, Scali JD, Michaud A, Durand MD, Astre CM, Dallongeville J, Romon MM. Profiles of a healthful diet and its relationship to biomarkers in a population sample from Mediterranean southern France. J Am Diet Assoc. 2000;100: 1164-71.

Original Article

Development and validity assessment of a diet quality index for Australians

Rasoul Zarrin PhD[1], Torukiri I Ibiebele PhD[2], Geoffrey C Marks PhD[3]

[1]*Food and Beverages Safety Research Center, Department of Nutrition and Biochemistry, Urmia University of Medical Sciences, Urmia, Iran*
[2]*Queensland Institute of Medical Research, Gynaecological Cancers Group, Brisbane, Queensland,, Australia*
[3]*The University of Queensland, School of Population Health, Queensland, Australia*

澳洲飲食品質指標之發展及效度評估

現有的澳洲飲食品質指標，被假設與健康相關，然而他們的效度並未被實際評估過。本研究延伸現有澳洲成人飲食指標之特質，利用澳洲國民健康促進重點(NHPAs)相關的飲食指南，建構新的澳洲飲食品質指標(Aussie-DQI)。建構效度，藉由 1995 年澳洲國民營養調查的 24 小時飲食回憶記錄加以評估(計 10,851 位，年齡大於等於 19 歲的澳洲成人)。並以 Nambour 皮膚癌研究之食物頻率問卷資料(樣本數=1355)評估建構與效標效度；Nambour 研究是一社區性縱貫研究，追蹤 16 年的死因別死亡率。以廣義線性迴歸評估 Aussie-DQI 分數與社經、人口學、健康行為特質、食物及營養素攝取量之相關；Aussie-DQI 分數與癌症及全死因死亡率之相關，則以 Cox 比例風險迴歸評估。澳洲國民營養調查與 Nambour 皮膚癌研究中，女性、年紀較長、無抽菸者及身體質量指數正常者，飲食品質指標分數較高；經多變項校正後，飲食品質指標分數與男性癌症死亡率呈負相關(風險比= 0.30，95% CI：0.11-0.83；趨勢 p= 0.06)。總結而言，澳洲飲食品質指標成功地辨別飲食品質，且顯示男性、年輕成人、抽菸者、以及過重/肥胖者，較少攝取飲食建議的食物；此外，高飲食品質與男性較低癌症死亡風險相關。本研究提增進一步的證據，闡明飲食品質於降低慢性疾病死亡率的角色。

關鍵字：飲食品質指標、建構效度、效標效度、癌症死亡率、膳食評估