

## Review Article

# A review of consumer awareness, understanding and use of food-based dietary guidelines

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### Abstract

Food-based dietary guidelines (FBDG) have primarily been designed for the consumer to encourage healthy, habitual food choices, decrease chronic disease risk and improve public health. However, minimal research has been conducted to evaluate whether FBDG are utilised by the public. The present review used a framework of three concepts, awareness, understanding and use, to summarise consumer evidence related to national FBDG and food guides. Searches of nine electronic databases, reference lists and Internet grey literature elicited 939 articles. Predetermined exclusion criteria selected twenty-eight studies for review. These consisted of qualitative, quantitative and mixed study designs, non-clinical participants, related to official FBDG for the general public, and involved measures of consumer awareness, understanding or use of FBDG. The three concepts of awareness, understanding and use were often discussed interchangeably. Nevertheless, a greater amount of evidence for consumer awareness and understanding was reported than consumer use of FBDG. The twenty-eight studies varied in terms of aim, design and method. Study quality also varied with raw qualitative data, and quantitative method details were often omitted. Thus, the reliability and validity of these review findings may be limited. Further research is required to evaluate the efficacy of FBDG as a public health promotion tool. If the purpose of FBDG is to evoke consumer behaviour change, then the framework of consumer awareness, understanding and use of FBDG may be useful to categorise consumer behaviour studies and complement the dietary survey and health outcome data in the process of FBDG evaluation and revision.

**Key words:** Food-based dietary guidelines: Consumers: Awareness of dietary guidelines: Understanding of dietary guidelines: Use of dietary guidelines

Food-based dietary guidelines (FBDG) have been described as ‘consistent and easily understandable translations of population nutrient goals to encourage healthy habitual food choices and improve public health’<sup>(1)</sup>. They consist of written messages (e.g. UK 8 tips for eating well<sup>(2)</sup>), which are commonly depicted in the form of visual food guides (e.g. German 3-D food pyramid<sup>(3)</sup>). The purpose of these messages and food guides appears to be various in terms of the audience, application and aim. FBDG have been used to provide information to the consumer, monitor population dietary patterns, check compliance of food industry as well as to

align health policies and nutrition programmes (e.g. food stamps, school meal composition and food labelling)<sup>(4–6)</sup>.

The development and implementation of national/regional FBDG has the potential to bring substantial health and economic benefits. FBDG were originally developed to combat nutrient-deficiency disease, but they may play an important role in discouraging/encouraging the adoption of certain dietary patterns, which have been associated with preventing chronic non-communicable diseases (CNCD; e.g. CVD, certain cancers). Modifiable risk factors such as diet and physical activity have been suggested to account for up to 30% of

**Abbreviations:** CNCD, chronic non-communicable diseases; DGA, Dietary Guidelines for Americans; FBDG, food-based dietary guidelines; FGP, Food Guide Pyramid.

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morbidity and mortality in the USA<sup>(4)</sup>, and ill health from poor diet has been estimated to cost the UK National Health Service billions of Great British Pounds each year<sup>(7)</sup>.

The FAO and the WHO have actively promoted FBDG with the International Conference on Nutrition<sup>(8)</sup>, the expert consultation meeting<sup>(9)</sup> and the Countrywide Integrated Noncommunicable Diseases Intervention programme<sup>(10)</sup>, all pivotal in encouraging the development of FBDG in countries across the world<sup>(4)</sup>. Despite the promotion of FBDG, there has been little evaluation of their effectiveness or monitoring of their impact on population health<sup>(11)</sup>. Attention has arguably been directed away from evaluation and focused on the development of FBDG, such as translating nutrient reference values into FBDG or investigating the mechanisms behind dietary pattern/nutrient compound effects on certain health outcomes<sup>(11)</sup>. For example, the USA have a long history and commitment to government-led consumer dietary guidance, where the Dietary Guidelines for Americans (DGA) have been released every 5 years since 1980, with a legal obligation for their release written into the congressional mandate since 1990<sup>(11,12)</sup>. Yet, there remains no obligation to evaluate the DGA<sup>(6)</sup>.

Limited evaluation of FBDG has led to an uncertainty in the efficacy of FBDG and the role that they may play in (1) changing consumer health behaviours, (2) improving population nutrient/dietary intake/status or (3) decreasing negative health outcomes such as CNCD<sup>(4,13)</sup>. The design of public health initiatives such as FBDG may ultimately contribute towards the achievement of (3) decrease in CNCD. However, measuring CNCD incidence (or intermediary health markers of CNCD) before and after FBDG implementation is insufficient to evaluate the impact of FBDG on CNCD. Chronic diseases by their nature involve small changes over time. Therefore, a plethora of multidimensional factors may have influenced a particular CNCD aetiology and pathogenesis. Repeated national dietary surveys provide data a step between FBDG implementation and CNCD incidence, which yields valuable information on FBDG compliance and monitoring of dietary patterns. However, aside from the practical problems inherent in collecting dietary intake data (e.g. energy levels<sup>(14)</sup>), these sets of data can be similarly influenced by many factors. Thus, a certain dietary intake pattern may have changed irrespective of FBDG implementation<sup>(15)</sup>.

An additional dataset, which can provide evaluative information a step closer to the implementation of FBDG, can come from consumer dietary behaviour studies. These may provide additional information by either directly asking consumers about the influence of FBDG on their dietary behaviours/dietary choices and their subjective understanding and use of FBDG or using tasks to test consumer objective understanding and use of FBDG. The majority of this research is likely to be conducted during FBDG development or following short-term interventions of FBDG implementation. These studies consist of qualitative study designs such as interviews and focus groups or quantitative designs such as questionnaire surveys. Furthermore, they may take the form of mixed designs, e.g. a questionnaire survey with a number of open-ended questions. There are inherent advantages and

disadvantages to the choice of different study methods (e.g. qualitative interviews susceptible to interviewer and interpretation bias, but allow depth to answers and idiosyncratic data *v.* questionnaire forced choices but population-level findings), with each employed depending on the study rationale.

The variety of study rationales and designs of consumer studies to evaluate or revise FBDG limits the possibility of conducting a meta-analysis review. The present study sought to provide a narrative review of this research by categorising studies using the three concepts of awareness (conscious perception), understanding (subjective and objective) and use (single use, extended, indirect and direct) in an adapted theoretical framework developed by Grunert & Wills<sup>(16)</sup>. The framework is based upon classic consumer decision-making research on how information provision (e.g. FBDG) determines choice when there are multiple options available, as well as upon attitude and change research on whether consumers process information, conduct cost–benefit analysis and find meaning, which is a prerequisite for information to affect behaviour (for further details, see Grunert & Wills<sup>(16)</sup>). The categorisation and interpretation of consumer behaviour studies may provide valuable information on how, if at all, FBDG influence consumer dietary choices and the employment of FBDG, and thus complement the dietary survey and health outcome data in the process of FBDG revision and the evaluation of FBDG efficacy.

## Methods

A total of nine electronic databases were searched (PubMed, Web of Science, EconLit, IPSA (International Political Science Abstracts), PsychInfo, EMBASE (Excerpta Medica Database), Cochrane, IBSS (International Bibliography of the Social Sciences) and CINAHL (Cumulative Index to Nursing and Allied Health Literature)), together with manual searches of reference lists and Internet searches of grey literature.

## Search terms

The search strategy consisted of an unlimited date range until August 2009, any language and the following search terms (used in PubMed and modified slightly in other databases): (food based dietary guidelines) or (food-based dietary guidelines).

All references were entered into an endnote library. The initial search in PubMed was entered first, and all additional searches were added to the library only after comparison for duplicates with the PubMed search. The final library contained 939 articles before exclusion (Table 1).

## Exclusion–inclusion criteria

References were excluded using predefined exclusion criteria devised by the research team (Table 1). The majority of studies were excluded, because they were conducted in a clinical setting and involved dietary guidelines for the maintenance of participants who had underlying health problems or diseases (e.g. CVD, alcoholism and HIV). These participants were

excluded from the review, because they may have different motivations and health needs to the general public<sup>(6,13)</sup>. In addition, a large number of quantitative studies were excluded, which analysed food-frequency data and retrospective compliance with FBDG or used FBDG as a benchmark to measure 'healthiness' of diet.

Initially, papers were excluded or included on the basis of their abstracts. Where clarification was needed, full-text papers were obtained and excluded using a data coding form (Table 2 is a condensed version of this form). Strenuous efforts were made to find the original sources of studies by searching online, emailing authors and translating papers into English. When it was not possible to find the original sources of data, primarily due to unpublished, inaccessible or untranslatable data, citations were included in the review. This has limited the available details, thus judgement of quality for certain studies.

### Framework

The three concepts of awareness (conscious perception), understanding (subjective and objective) and use (one time, extended, direct and indirect) taken from the theoretical framework developed by Grunert & Wills<sup>(16)</sup> were used to categorise study findings. Categorisation was decided using the study-reported terminology (i.e. what was described as awareness, understanding or use) as well as interpretation by one research member. The validity of grouping was reviewed and confirmed by the study authors. Only the study details relevant to consumer awareness, understanding or use of FBDG were reviewed and reported in the present review.

### Quality and risk of bias

No studies were excluded on the basis of quality or research design, but the quality of the studies (qualitative, quantitative and mixed designs) and risk of bias were judged using the

guidelines for assessing methodological quality of published papers by Greenhalgh<sup>(17)</sup>. This involved judging the details available on the study aim, purpose, method, design, theoretical framework, analysis, findings, discussion, presentation and references.

## Results and discussion

A total of twenty-eight studies were reviewed, which employed both qualitative methods such as interview and focus groups and quantitative methods such as questionnaire surveys. Of the twenty-eight studies, sixteen referred exclusively to the US DGA, Food Guide Pyramid (FGP<sup>(18)</sup>) or MyPyramid<sup>(19)</sup>. The quality of the twenty-eight studies varied with definition of terms (awareness, knowledge, preference, understanding and use), often unclear and used interchangeably, as well as with study design or method details at times incompletely reported (especially as expected in the cited findings). Analysing and comparing the results from the twenty-eight studies was difficult due to the different rationales and study designs employed. However, we sought to provide an overview of the findings from the studies reviewed. Findings have been reported in relation to the three concepts of awareness, understanding and use, and organised by study design (qualitative, quantitative and mixed).

### Awareness

The FGP has been used throughout the US education system, and focus groups with American elementary schoolchildren reported that the majority had seen the FGP and they were aware of the key elements of the DGA (1990)<sup>(20)</sup>. Similarly, in Chile, more recent focus group data indicated that Chilean schoolchildren were aware of the Chilean food guide (Chile FGP; S Olivares, unpublished results, cited in Albert<sup>(21)</sup>). In contrast, focus groups with US adults in the 1990s reported that some had awareness of a few DGA, but that the majority were unfamiliar with the DGA (1995)<sup>(22)</sup>. Likewise, in New Zealand, focus groups and key informant interviews in 1998 indicated that older people, parents and children-adolescents had limited awareness of the FBDG, and few participants appeared to have seen the official FBDG-related education booklets<sup>(22-24)</sup>. More recent focus groups with US adults indicated that many consumers were aware of the DGA (2000)<sup>(25)</sup>. This was also observed with focus groups of women in Baja California who showed some awareness of two food guides, the Pyramid of Health and the Apple of Health, with the Pyramid believed to be more familiar than the Apple<sup>(26-28)</sup>.

Reported quantitative data indicated that awareness in the USA may have increased over time. American surveys in 1994 (*n* 1945) and 1995 (*n* 1001) reported that one-third of those sampled were aware of the DGA (1990). With respect to the FGP, awareness was also one-third (33%) in 1994 but significantly increased to 43% in 1995<sup>(29)</sup>. In a different survey, two-thirds of the Americans appeared to recognise or be aware of the FGP by 1997<sup>(30,31)</sup>. More recent surveys with grocery shoppers in 2000 showed that 75% were

**Table 1.** Literature review excluded and included papers

Reason for exclusion/inclusion	References
<b>Excluded</b>	
Duplicate missed; non-European language; unpublished data or unavailable paper	16
Clinical/dental participants or animal studies (animal nutrition or related to animal nutrition)	348
Unofficial FBDG or non-general public FBDG (children, elderly and sports)	192
Supplements/fortification; CAM; labelling/health claims or toxicology/food safety	105
Food-frequency data or nutrition intake/status measures to check compliance with FBDG	250
<b>Included</b>	
Search terms: (food based dietary guidelines) or (food-based dietary guidelines)	28
<b>Total</b>	<b>939</b>

FBDG, food-based dietary guidelines; CAM, complementary and alternative medicine.

**Table 2.** Papers and studies reviewed

First author and year	Country – FBDG	Aim	Design and measures	Sample	Analysis	Results
van Dillen (2003) <sup>(15)</sup>	The Netherlands – FBDG	Nutrition awareness and food conversation topics	Mixed study. Qualitative focus groups FBDG relevant Focus groups – card sort task to pick five food topics and ranked importance	<i>n</i> 30 Three mixed sex groups: (1) 18–30 years; (2) 31–50 years; (3) 51–80 years	Coding framework and themes categorised using NUD*IST (QSR Melbourne, Australia) software	Consumers believed that they ate healthily – possibly lacked nutrition awareness (defined as realisation of one's personal risk behaviour regarding nutrition)
Lytle (1997) <sup>(20)</sup>	USA – FGP (1992) and DGA (1990)	Child understanding and interpretation of DGA (1990) and FGP (1992)	Qualitative. Focus groups and interviews with a food identification task (name three foods with high/low fat, high sugar/low sugar, fruit, vegetables or grains). Questions based on Piaget's stages of cognitive development/social cognitive theory. Pilot feedback resulted in DGA 'moderate' phrasing to 'a little'	Convenient sample recruited from after school daycare. <i>n</i> 141, 54% girls, two school districts near Minneapolis and St Paul Minnesota. K–4th and 5–6th grade. Primarily white, middle SES	Video data transcribed verbatim. Coding templates identified concepts, which were sorted, summarised – independently reviewed. FIT – two reviewers evaluated and scored response (inter-rater reliability 98%) No test of prior nutrition knowledge	Differences observed across age groups with a younger/pre-operational/ concrete stage of cognitive development. Difficulties interpreting abstract ideas of variety/healthy weight and identifying foods high in salt/sugar/grains. Difficulties observed in interpreting serving size from the FGP. Vast majority had seen the FGP but unable to articulate learning
Olivares (unpublished results, cited in Albert) <sup>(21)</sup>	Chile – FBDG and pyramid	Evaluation of FBDG and food guide	(1) Qualitative study in schools and (2) quantitative Internet quasi-experimental survey	Asked about FBDG and pyramid, then received information and awareness and willingness to change diet were measured		(1) Schoolchildren had seen pyramid but did not understand portions. 30% knew FBDG and 60% knew the pyramid. (2) Information provision increased awareness and willingness to change diet to 80%
Geiger (2001) <sup>(22)</sup>	USA – DGA 1995	Revision of DGA	Qualitative. Market research company. Focus groups have shown different DGA formats: (1) seven DGA; (2) seven DGA in two tiers; (3) four top tier DGA	<i>n</i> 40 Six single sex (three men and three women) groups with eight persons per group. Recruited by telephone and paid for participation 25–45 years		Somewhat familiar with FGP. Most unfamiliar with DGA but had heard some messages. Confused by 'maintain or improve your weight', 'balance the food you eat with physical activity' and 'balance'. Preferred version (3)
Cameron (1998) <sup>(23)</sup>	New Zealand – FBDG	Evaluation of written health education materials	Qualitative focus groups. Key informant interviews	Children, adolescents, parents and older persons		Few older people, parents, children or adolescents had seen the booklets. Materials were found unappealing/outdated by adolescents, complicated by parents and informative by older people
Trustin (1998) <sup>(24)</sup> IFIC (2005) <sup>(25)</sup>	New Zealand – FBDG USA – DGA (2000)	Perspectives of DGA	Qualitative. Market research company. Focus groups	Four groups, seven to ten people each, two US cities. BMI 22–30 kg/m <sup>2</sup> , age 25–55 years. One session to split into four groups: (1) nutrition savvy women; (2) common sense women; (3) dieters/restricting food/food groups; (4) diet opposed		Consumers know what to do but do not always do it. Many were aware of DGA. Many were confused, can name nutrients but do not understand them. Distinguish between eating for health and eating for weight loss. Quotes provided

**Table 2. Continued**

First author and year	Country – FBDG	Aim	Design and measures	Sample	Analysis	Results
Barcadi-Gascon (2002) <sup>(26)</sup>	Baja California – Apple of Health (1996) and Mexico Pyramid of Health (1998)	Compare and evaluate the two guides for message understanding and ability to apply messages	Qualitative focus groups with a diet plan task to measure objective understanding	Women of 7 or 15 years of schooling		Diet mean plan scores insignificantly different (Apple 76.7%, Pyramid 64.1%). Preference for Apple as more attractive, colourful, clearer to identify food groups and servings
Levy (1995) <sup>(29)</sup>	USA – FGP (1992) and DGA (1990)	Paper prepared for Dietary Guideline Advisory Committee	Quantitative. Survey			Significant increase in FGP awareness (1994–5) 33–43%. In FGP (1995) recognised > DGA or 5/d. In FGP (1994) and (1995), one-third were aware of DGA
ADA (1997) <sup>(30)</sup> Kennedy (1998) <sup>(31)</sup>	USA – FGP (1992) USA – FGP (1992)	Quantitative. Survey Quantitative. Survey				67% Americans were aware More than two-thirds of Americans sampled recognised FGP
Wheat Foods Council (2001) <sup>(32)</sup>	USA – FGP (1992)	Quantitative. Gallup survey (1994), (1996) and (2000)	Primary grocery shoppers			In the 2000 survey, 75% were somewhat or very familiar with FGP (60% in the 1994 and 1996 surveys)
Olivares (2004) <sup>(33)</sup>	Chile – FBDG and pyramid	INTA formal evaluation of FBDG dissemination	Quantitative. Survey	Nutritionists of provisional health services		Educational sessions ( <i>n</i> 36 120). 500 000 leaflets, posters and flyers distributed
Keenan (2002) <sup>(34)</sup>	USA – DGA (1995)	Knowledge and understanding of DGA, sources of health information	Mixed. Telephone open-ended survey questions. Number of DGA recalled (maximum possible thirteen versions of seven guidelines)	Next-birthday method of random respondent selection from 1000 telephone numbers in three zip codes (1 × high- and 2 × low-median income). Response rate: 400/976 contacted. 56% women of 18–49 years. 4.3% did not graduate from high school. Twin cities area, Minnesota	Tallied number of DGA recalled. Stepwise multiple regression to explain variance in knowledge scores	Qualitative: fat guideline knowledge poor. Quantitative: >50% unaware of nutrition federal policy/DGA document. Few named FGP ( <i>n</i> 38) or DGA ( <i>n</i> 1). Average DGA recalled 2.5/13. Diet high in vegetables, fruit and low in fat were the most commonly recalled ( <i>n</i> 208, 191 and 188, respectively). Higher number of media sources predicted higher recall ( $r^2$ 0.08, $P < 0.001$ )
Hunt (1995) <sup>(37)</sup>	UK – BOGH (1994)	Testing ten versions of the food guide for effectiveness in conveying nutrition concepts to consumers; consumer preferences for guide format; preference effects on understanding and recall of food guide messages (also carried out a questionnaire survey asking health professionals' views on the guide, but those results have not been included)	Qualitative interviews and tasks. Awareness measure 'In your opinion what are the main things you need to do to eat healthily?'. Task – random allocation to three groups: (1) control, no guide ( <i>n</i> 298); (2) one out of ten guides seen briefly ( <i>n</i> 883); (3) one out of ten guides seen throughout ( <i>n</i> 893). Four tasks: SUB; COM; SOR; DISH. Asked preference for guide name, most- and least-appealing guide	<i>n</i> 2074 SES groups C (59%) and D (41%) Recruited from town centres using a quota system to ensure representative in sex and age of the general public. 53% female. 14%, 11–18 years; 30%, 19–30 years; 32%, 31–45 years; 24%, 46+ years	Nutritional awareness scored using a predefined list of five statements (e.g. eat more fruit/vegetables). The scores are as follows: 3/5, high awareness (9%); 1 or 2/5, medium (71%); none, low awareness (20%). One-way ANOVA, <i>t</i> tests and $\chi^2$ test. Only significant results have been reported here – see paper for statistics	Sex, age and SES effects seen on the performance of different tasks. Nutrition knowledge effect on all four tasks – higher level of nutritional awareness performed better than lower. COM and SOR task performance better with a guide seen throughout than the control group. Prior exposure affected most- and least-preferred choices with those who had previously seen a guide more likely to say they preferred it v. control group

Table 2. Continued

First author and year	Country – FBDG	Aim	Design and measures	Sample	Analysis	Results
Achterberg (1989) <sup>(38)</sup>	USA – DGA (1985)	Four studies which evaluated DGA (1985) brochures and bulletins	Qualitative. Design common to four studies: (1) pre-interview; (2) intervention of reading brochures/bulletins; (3) post-interview. Random allocation to the treatment/control group	Women ( <i>n</i> 72), 30–40 years, high school diploma or higher, median income		All four studies had difficulties in interpreting DGA, especially the abstract ideas 'desirable weight', 'healthy weight' and 'too much'. Misunderstood brochures and DGA. Most groups learned a significant amount but relatively small amounts compared with what they could have learnt. Those who learned the most consistently had fewer misconceptions. No sex difference once prior knowledge/misconceptions controlled
Achterberg (1990) <sup>(39)</sup>	USA – DGA (1985)			Women ( <i>n</i> 60), 30–45 years and 60+ years, high school diploma or higher, median income		
Achterberg (1991) <sup>(40)</sup>	USA – DGA (1985)			Men ( <i>n</i> 45), 30–45 years, high school diploma or higher, median income		
Auld (1991) <sup>(41)</sup>	USA – DGA (1985)			Men ( <i>n</i> 40), 30–50 years, high school diploma or higher, median income		
Holm (1991) <sup>(42)</sup>	Denmark – FBDG		Interviews at the end of a different 8-month study that served Danish recommendation diets	Men and women in their 20's		Surprised diet consisted of familiar foods, large volumes of vegetables, potatoes and bread, and was palatable
Duenas (unpublished results, cited in Albert <sup>(21)</sup> )	Pre-Thailand – FBDG and Nutrition Flag (1998)	Tested the food guide and messages	Qualitative. Interviews about understanding of portion size and quantities using the flag	Public from department stores, food markets, factories, universities and bus stations		Developed rice serving spoon the as household unit for measuring foods
Britten (2006) <sup>(43)</sup>	USA – FGP (1992)	Consumer understanding and use of FGP messages and possible revisions in terms of understandable terminology, educational messages and actionable messages	Qualitative. Market research company. Twenty-six focus groups, three US cities in two phases: (1) 2002, eighteen groups (eight to twelve people). Individual task for objective understanding/knowledge and discussed by the group. Place food groups and on blank FGP and place composite meals on FGP. (2) 2004, eight groups (eight to eleven people)	(1) Weighted by marital status, age, education, race/ethnicity, employment status and household. Equal number of male and female single sex groups ( <i>n</i> 178). Eighteen groups: 6 × general adults, 4 × 60+ years, 4 × food stamp recipients, 4 × overweight (2) <i>n</i> 75. Eight groups (4 × 25–49 years, 4 × 50–79 years)	Transcribed and verified. Systematic content analysis. Systematic content analysis, organised by group type and location. Themes identified, common recurring themes selected and draft report produced. Draft reviewed by staff who had observed focus groups to validate analysis	(1) FGP familiar. Recognised some messages but misinterpreted food group placement and quantities. Task >80% put one food group in the wrong tier. No problems with composite task. Understood select more foods from the bottom, but not the 'sprinkled' graphic. (2) Lifestyle obstacles to FGP use. Limited understanding of whole grains, fat, vegetable subgroups and physical activity
Albert (2007) <sup>(44)</sup>	Grenada, Dominica, St Lucia and St Vincent, and the Grenadines – FBDG	Process of developing FBDG in four countries	Qualitative. Field tests: (1) pre-interview; (2) follow a DG 1 week; (3) post-interview. Diet variety knowledge = grouping of food items. Focus groups shown: (1) FBDG; (2) food guide; (3) both together	Field tests: heads of households from various parts of the country. Focus groups: women and men from rural and urban parts of the country		Field tests: many barriers to FBDG. Focus groups: corrections and adjustments made to messages and graphics based on results

Table 2. Continued

First author and year	Country – FBDG	Aim	Design and measures	Sample	Analysis	Results
Campbell (1996) <sup>(46)</sup>	USA – FGP (1992)		Quantitative. Survey			58% Americans heard of FGP and 13% say they understand FBDG meaning increased
Zhao (2001) <sup>(47)</sup>	China – FBDG and Food Guide Pagoda (1997)	Trial of effectiveness of the guidelines as a mass education tool	Quantitative. Soon after the publication of FBDG. Understanding and nutrition knowledge pre- and post-repeated promotions of FBDG and pagoda	n 5145 from five cities with different geographic and economic conditions		12–93% in 1 year, more so with children and elderly. Nutrition knowledge increased from 48–59 to 68–91%. Schoolchildren balanced breakfast increased 26–52.5%
Kennedy (1996) <sup>(48)</sup>	USA – DGA (1995)	Consumer perceptions of DGA concepts and perceived barriers to following DGA	Qualitative. Market research company. Focus groups	Twelve focus groups in three US cities; all single sex. Four groups, cross section; eight groups, target groups of African-Americans, elderly, overweight, food stamp recipients		Four themes: (1) difference between recommendations and what is already known as well as what needs to be known to use; (2) most consumers were not motivated by health consequences underpinning DGA; (3) perception of DGA do not explain 'how to do it'; (4) would like DGA in straightforward language – no time, energy or inclination to learn nutritional science
Love (2001) <sup>(49)</sup>	South Africa – FBDG	Assess comprehension, interpretation and implementation of preliminary South African FBDG as a nutrition education tool for women in KZN and the WC	Qualitative. Focus groups. Aided with colour photos of different foods (non-branded, uncooked) discussed previous exposure to FBDG, interpretation of FBDG, constraints to implementation and ability to plan a day's meals using the FBDG	Five magistrate districts in KZN and the WC. Random selection dependent on settlement type (non-urban, urban in/formal), ethnicity (black, mixed, Indian and white). Only women who made purchased food and food preparation decisions. 137 women, 19–63 years	Transcribed and coded, analysed to identify common themes	Fruit/vegetables and fat guidelines familiar to all groups. FBDG well understood. Confused with the terms 'legumes', 'animal foods' and 'healthier snacks'. Barriers to FBDG implementation cost availability, taste preferences, purchase habits, traditional food preparation/cooking, time, accessibility and attitudes to health. Many felt already implemented several FBDG, and all were able to construct a day's meals using FBDG
FMI (1997) <sup>(50)</sup>	USA – FGP (1992)		Quantitative. Survey	Shoppers		27% changed purchases

FBDG, food-based dietary guidelines; FGP, food guide pyramid; DGA, Dietary Guidelines for Americans; SES, socio-economic status; FIT, food identification task; IFIC, International Food Information Council; ADA, American Dietetic Association; INTA, International Institute on Food Technology and Nutrition; BOGH, Balance of Good Health; SUB, substitution; COM, comparison; SOR, sorting; DISH, composite dish; DG, dietary guideline; KZN, KwaZulu-Natal; WC, Western Cape; FMI, Food Marketing Institute.

'somewhat/very familiar' with the FGP<sup>(32)</sup>. All of the aforementioned studies refer to evaluating the outcome of FBDG implementation. During the review of FBDG in Chile, they evaluated the output of FBDG implementation. A survey by the International Institute on Food Technology and Nutrition reported that >36 000 people had participated in FBDG nutrition education programmes and >50 000 leaflets, posters and flyers had been distributed. This provides information on the dissemination of FBDG-related material reported in terms of FBDG evaluation, but it does not provide a measure of outcome in terms of awareness<sup>(33)</sup>.

The definition of awareness differs slightly throughout the studies reviewed but predominantly relates to familiarity or knowledge of a FBDG or food guide. A mixed methods study in The Netherlands defined awareness slightly differently. A high amount of 'knowledge' was reported in response to the question 'what dietary guidelines do you know?'. However, the researchers suggested that participants may have lacked nutrition awareness in terms of 'realisation of one's own personal risk behaviour regarding nutrition', because the focus group participants may have mistakenly believed that they ate healthily or followed the FBDG/food guide<sup>(15)</sup>.

An American telephone interview study supported the 1990s US focus group data indicating that there was some but not widespread awareness of the DGA. Participants reported an average recall of less than 2.5 DGA (1995) out of a possible 13, and only one out of 400 responders correctly identified the DGA as the US nutrition policy document<sup>(34)</sup>.

It is difficult to assess the effect of awareness from the studies reviewed. Awareness has been suggested as a prerequisite to behaviour change<sup>(35)</sup>, and this was indicated by the reporting of a Chilean Internet study intervention, which implied that the provision of information improved awareness both of the 1997 Chile FBDG/food guide and willingness to change diet (S Olivares, unpublished results, cited in Albert<sup>(21)</sup>). However, the reality of the relationship between awareness and behaviour change is complicated by many other factors such as liking and preference, which can be differentially affected by awareness. For example, the previously mentioned Baja Californian focus group study reported that participants consciously stated that they were more familiar with the Pyramid food guide, yet they preferred the Apple food guide, stating that it was more attractive, colourful and clearer to identify foods and food group servings<sup>(28)</sup>. In contrast, a UK study compared ten food guide versions during the development of the UK Balance of Good Health plate (1994)<sup>(36)</sup> and found that those who had previously seen a guide (higher awareness, unconscious/conscious) were more likely to display a preference for the shape they were exposed to compared with the control group who had not seen any guides. It was hypothesised that preference, or familiarity, for a guide may affect an individual's ability to extract the guide's key information either by being more likely to notice and recall information or by familiarity, leading to loss of attention to the information<sup>(37)</sup>. The aforementioned studies indicated that there was a degree of awareness of FBDG and food guides, an apparent greater awareness of food guides compared with FBDG and a possible trend of increased

awareness over time. However, the measurement and definition of the concept awareness was not always clear, and the terms of familiarity, awareness and knowledge were used both interchangeably and differentially across studies. Clarifying what is meant by awareness and how this is measured would be crucial when comparing data across studies to evaluate FBDG and when trying to study the complicated relationship between awareness, understanding and use of FBDG.

### Understanding

Awareness of FBDG or food guides does not appear to automatically translate into understanding of FBDG. Focus groups and interviews with US schoolchildren suggested that they were comfortable using the terms 'low fat' and 'low sugar', but they had difficulties when asked to display objective understanding of these terms by naming three foods in either of these categories, particularly with the younger children<sup>(20)</sup>. Similarly in Chile, schoolchildren, although aware of the FGP, did not understand the portion information portrayed within the pyramid (S Olivares, unpublished results, cited in Albert<sup>(21)</sup>).

Studies that have looked at subjective understanding in terms of asking participants what they understood indicated that misunderstandings were common with abstract ideas. This was observed particularly in relation to weight, physical activity, health, variety or balance, where focus group participants stated confusion with guidelines that included 'desirable weight', 'healthy weight', 'maintain or improve your weight', 'balance the food you eat with physical activity' and 'healthy snacks'<sup>(20,22,38-41)</sup>.

Consumer understanding of food quantities such as portion and serving sizes was often confused. In Denmark, participants were surprised that a Danish nutrient recommendation-compliant diet that they had followed could consist of such large volumes of food, especially vegetables, bread and potatoes<sup>(42)</sup>. Researchers in Thailand and America found that specific examples rather than volumes and weights were useful to explain quantities to consumers. The 'rice serving spoon' was developed as a household measure after consumer testing of the Thai Nutrition Flag (G Duenas, unpublished results, cited in Albert<sup>(21)</sup>). American focus groups reported a preference for quantity size guidance to be depicted in cups for food and minutes for physical activity, rather than ounces or terms such as sedentary. However, confusion remained with fruits and vegetables, where quantities or portion sizes were still considered confusing and difficult to measure even with household units such as cups<sup>(43)</sup>.

A number of studies selected in the present review reported consumer understanding of guidelines but omitted raw data or referred to unpublished results<sup>(44)</sup>. This has been observed in previous FBDG reviews<sup>(45)</sup>. For example, an interesting paper depicted FBDG development in four Eastern Caribbean countries, which involved focus groups, interviews and field tests, where participants were asked to employ one FBDG for a week. However, within the space constraints of the



article, no specific understanding measurement methods or results were reported.

The quantitative results suggested an inconsistent relationship between increased awareness and increased understanding. In an American survey, 58% of those sampled said they had heard of the FGP, but only 13% said they understood it<sup>(46)</sup>. In contrast, a review paper reported a study with a sample of more than 5000 participants, where understanding of the Chinese 1997 FBDG grew on average from 12 to 93% within a year following repeated promotions of the guidelines and Food Guide Pagoda. The largest effect was observed with schoolchildren and the elderly<sup>(47)</sup>. The UK Balance of Good Health study demonstrated that food guides may improve objective understanding of a healthy diet and food groups, yet also highlighted the complicated nature of the relationship between awareness (or exposure) and understanding. Those who had been shown one of the ten Balance of Good Health food guide versions performed significantly better than the control group on comparison and sorting tasks. However, understanding was dependent on sex, age, socioeconomic status and nutrition awareness<sup>(37)</sup>.

A mixed design study with US focus groups suggested that equal awareness of FBDG may not lead to equal understanding, and results demonstrated consumer misinterpretation of guidelines. The 'eat a diet low in sugar' guideline was considered to be ambiguous and difficult to quantify, whereas the dietary fat guideline produced the most confusion with a particular lack of understanding relating to the saturated fat recommendation and those that involved percentages. For example, when participants were told about the DGA of <30% total fat and then asked to quantify the amount of saturated fat that was recommended, answers ranged from 0 to 50%. This study suggested that the new DGA (2000) that incorporated behavioural messages would be better understood than the DGA (1995)<sup>(34)</sup>.

The studies reviewed in this section appeared to show mixed results for consumer understanding. Some studies showed a general understanding of the key concrete concepts of FBDG and food guides, but some difficulties were observed with understanding abstract concepts and specific ideas such as portion sizes and quantities. There is a need for further prospective studies to investigate the long-term effect of FBDG information provision on different aspects of FBDG understanding (subjective and objective) and how this might affect dietary behaviour change or the use of FBDG.

### Use

Few studies explicitly measured consumer-intended or actual use of FBDG/food guides or indicated that use of FBDG could be a measure of FBDG effectiveness. Focus group discussions referred to the barriers of FBDG use, considering time constraints, disinterest in shopping and preparation of food as potential barriers to one's daily food choices<sup>(43)</sup>. A number of studies, which predominantly measured consumer understanding of FBDG and food guides, commented on the need for concrete behavioural examples and messages to enable consumers to use the guidelines. Suggestions

included the consumer behaviours such as remove chicken skin rather than eat less fat<sup>(48)</sup> and visual examples (solid fat *v.* oils) rather than technical terminology (saturated *v.* unsaturated fat)<sup>(43)</sup>. It was stressed that these should be from the consumer's point of view rather than the scientific standpoint and must not require consumers to become nutritional scientists<sup>(20,38–41,43,48,49)</sup>.

A quantitative Food Marketing Institute trends data survey reported that 27% of US shoppers said they used FGP information to make changes in their food purchases<sup>(50)</sup>, and another survey reported that only 13% of those sampled said they used the DGA<sup>(46)</sup>. One quantitative study in China did include behavioural measures following the promotion of the 1997 'Guidelines for Chinese residents' and Food Guide Pagoda. They indicated that the percentage of schoolchildren who had a healthy breakfast increased from 26 to 52% following the intervention<sup>(47)</sup>. It is not clear whether the children (or parents) consciously employed the promoted guideline, if these effects were sustained or if these changes may be explained by other factors, but it is a rare example of a concrete behavioural outcome measured as an indicator of FBDG success. From the limited information available in the papers reviewed in this section, it appears that FBDG and food guides are minimally used by consumers.

### Conclusion

The present review has presented a wide variety of study approaches and applied methods and the possible limitations of these needs to be addressed. External validity may have been limited by unrepresentative samples due to the small sample sizes and the qualitative nature of the focus groups/interviews, as well as the convenient samples used in a number of the quantitative surveys. In addition, there was a possibility of bias during qualitative data analysis interpretation and a lack of controlled confounding variables or over-interpretation during quantitative data analysis. Furthermore, the present review may not have sourced all of the studies relating to FBDG evaluation. For example, studies that used alternative terminology for FBDG, investigated unofficial FBDG, focused on one guideline rather than FBDG in their entirety, or measured concepts other than consumer awareness, understanding or use of FBDG. Nevertheless, we believe that the present review is replicable and exhaustive in terms of the research question, and it has highlighted several issues to consider in future public health initiatives and research surrounding FBDG.

First, a degree of consumer awareness and understanding of FBDG was identified by the literature reviewed. Evidence of FBDG use was limited, but the researchers acknowledged the possibility that consumers may not believe that it is necessary to follow FBDG to eat healthily or they might use FBDG without consciously realising that they are doing so, and that this would not have been apparent from the literature reviewed.

Second, the review indicated that the promotion of FBDG may not have always been accompanied by evaluation of effectiveness, or that research conducted on FBDG successes

and failures has not always been widely published or made available<sup>(4)</sup>. This evaluation is necessary to ensure that the efficacy of FBDG can be judged and that FBDG achieve the purpose for which they are designed. For example, there is a growing trend to move away from nutrient-based targets primarily designed to prevent nutrient-deficiency diseases and to derive FBDG from healthy food-based dietary targets, which may be more appropriate to change lifestyle behaviours associated with lowering chronic disease risk<sup>(51,52)</sup>. Evaluation is required to identify whether these alternatively devised FBDG and the use of dietary pattern goals are more efficacious at changing consumer behaviour or lowering CNCND risk.

Third, to be of most use, future studies that aim to evaluate FBDG would benefit from stating the objectives of the FBDG that are being evaluated, with explicit clarification as to how FBDG effectiveness will be measured and the definition of any concepts such as awareness or understanding. In particular, we would like to highlight the dependence of study findings on the questions asked in relation to both qualitative and quantitative research designs and the need for clarity to allow the replication of studies and the reliable interpretation of results. In addition, the study aim, design, methods and results should be fully reported to allow study comparisons and judgement on the external/interval validity and reliability of the study findings.

Lastly, FBDG have been in existence for a number of years, yet they do not appear to have been as effective as hoped at changing consumer behaviour or helping to reduce the incidence of CNCND. Proposed reasons for this have related to a lack of political support, non-participation of stakeholders and conflict with market forces during FBDG development and implementation. There is also arguably an acknowledged uncertainty in both the nutritional science and social sciences in terms of the complicated relationship between diet and disease, the difficulties of applying theoretical models to dietary pattern behaviour change as well as the recognition that food is only one of the several preventable chronic disease risk factors<sup>(4,11,53)</sup>.

Evaluation of FBDG effectiveness is necessary to measure the contribution of FBDG in safeguarding population health and disentangling the contribution of FBDG from those of the many coexisting public and private health initiatives, as well as to aid FBDG revision and monitor any unanticipated consequences of FBDG implementation<sup>(6,11,54)</sup>. The framework of consumer awareness, understanding and use of FBDG may be a useful way to evaluate FBDG in addition to monitoring health outcome and nutritional intake/status.

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and development of the search strategy. K. A. B. carried out the search strategy, conducted the analysis and wrote the draft of the final manuscript. All authors took part in the revision of the manuscript. The authors have no conflicts of interest to declare. Ethical approval was not required for the present study.

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