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Review Article

Nutrition knowledge and food consumption: can nutrition knowledge change food behaviour?

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The status and explanatory role of nutrition knowledge is uncertain in public health nutrition. Much of the uncertainty about this area has been generated by conceptual confusion about the nature of knowledge and behaviours, and, nutrition knowledge and food behaviours in particular. So the paper describes several key concepts in some detail. The main argument is that 'nutrition knowledge' is a necessary but not sufficient factor for changes in consumers' food behaviours. Several classes of food behaviours and their causation are discussed. They are influenced by a number of environmental and intra-individual factors, including motivations. The interplay between motivational factors and information processing is important for nutrition promoters as is the distinction between declarative and procedural knowledge. Consideration of the domains of nutrition knowledge shows that their utility is likely to be related to consumers' and nutritionists' particular goals and viewpoints. A brief survey of the recent literature shows that the evidence for the influence of nutrition knowledge on food behaviours is mixed. Nevertheless, recent work suggests that nutrition knowledge may play a small but pivotal role in the adoption of healthier food habits. The implications of this overview for public health nutrition are: (i) We need to pay greater attention to the development of children's and adults' knowledge frameworks (schema building); (ii) There is a need for a renewed proactive role for the education sector; (iii) We need to take account of consumers' personal food goals and their acquisition of procedural knowledge which will enable them to attain their goals; (iv) Finally, much more research into the ways people learn and use food-related knowledge is required in the form of experimental interventions and longitudinal studies.

Key words: Behaviour change, food behaviour, nutrition knowledge.

Introduction

We live in a knowledge society – knowledge is power – isn't it? But the status and role of nutrition knowledge is decidedly uncertain. Does nutrition knowledge influence food behaviours? We usually assume that the answer must be in the affirmative. Indeed, most of us implicitly accept the simple knowledge–attitude–practice model. If people know what is good for them then they are likely to behave in their best interests. Like so many lay views, this model was abandoned years ago as a complete explanation. However, as we shall see it may have some currency and may be a good short hand explanation for complex phenomena. Before coming to answer the key question of this paper we need to consider some basic concepts and definitions.

Knowledge

What kinds of knowledge are there?

Psychologists have distinguished two key types of knowledge:

1. Declarative knowledge, knowledge of 'what is', awareness of things and processes. For example, that lemons are a good source of Vitamin C, that the Earth is round, that high intakes of fruit and vegetables can prevent hypertension, that milk contains psychotropic peptides,

that skin wrinkling is linked to the type of fats you consume. Declarative knowledge is very important for individuals' survival, (e.g. it can be important to know that railway lines are not a good place to sleep, or, that 'real men drink beer'!). Obviously declarative knowledge can be divided into many domains, some of which include various types of nutritional knowledge.

2. Procedural knowledge, this is knowledge about how to do things. For example, how to choose a red wine for a meal, how to choose a low salt packet of soup, how to lay out the cutlery for a dinner party, or how to make spotted dick. We require a lot of procedural knowledge even to perform the most basic tasks, such, as using an ATM or programming a video recorder.

What is knowledge as distinct from beliefs?

You may believe that iodine deficiency can cause intellectual disability. This is a belief – a perception of a link between two concepts – 'iodine deficiency' and 'intellectual

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disability'. You may see a strong or a weak relation between the two, and you may hold the belief with a particular degree of strength. Scientists 'make' new beliefs (facts or factoids; Bryce Courtney in the *Power of One* reckons fathers make something called 'dadfacts' – beliefs that are made up on the spur of the moment with little evidence but which turn out later in life to be surprisingly correct!)

We can test the validity of beliefs (or perceptions), in fact all humans do by asking questions, such as: 'Is that pink elephant I see at the bottom of the garden real?' Psychologists have often examined such questioning and identified the ways that we check out perceptions and beliefs (attribution theory). But knowledge is more than just a collection of 'true facts', it is a system of beliefs – what psychologists refer to as schema and meta schema that are skeletal frameworks on which beliefs or facts are based.

What is knowledge for?

Knowledge helps us explain important aspects of the world and gives predictability to events, thus meeting the human need for cognitive consistency or predictability.¹ We all know when to go home from work; we know how to work during an examination (as fast as possible) while people who are unused to our ways do not.

Whose knowledge?

Groups of people have different experiences so they have different beliefs and knowledge. Nutritionists have their own meta schema (e.g. energy balance, water soluble vs fat soluble vitamins, antioxidants). Powerful social groups have their own knowledge that they use to explain the world [e.g. business parlance, scientists and their jargon (exact terminology)] and weak groups of people have their own beliefs and explanations of why things are as they are – what Foucault calls 'subjugated knowledge' – imprecise, unofficial explanations (e.g. 'He caught pneumonia because he sat in a draught.'). Different groups of people have their own systems of beliefs, (e.g. vegetarians and their quite distinct views of most things in the world ranging from different views of health and illness to different political opinions and different dress sense). Note that belief systems help to create solidarity and exclude non-believers. (e.g. religious vs secular views of faith and reason).¹

How logical is knowledge?

As recorded in scientific textbooks knowledge appears to be firmly grounded on empirical evidence, but as Thomas Kuhn showed many years ago, some knowledge is ignored while other knowledge is highlighted in scientific consciousness.² Two people watching the same football match may come away with quite different views of the game depending on their team allegiances. Events in the world are interpreted and coloured by prior beliefs. Some beliefs (true and false) are held to be more important by us than others. Thus to vegetarians, say, eating meat is akin to killing animals and since animals are part of Creation, as we are, so killing an animal requires far more justification (if it ever can be

justified) than it does for a meat eater who may be less aware of 'crucial facts' about animals (e.g. their sentient nature, their ability to feel pain). Various balance theories and the theory of cognitive dissonance, which emerged in the 1930s, show quite clearly that beliefs or 'messages' are often accepted or rejected according to their consonance with prior beliefs. Many people acquire cognitive consistency only by manipulating (quite unconsciously) the 'facts'. Beliefs, then, are not static but are held in a dynamic manner being subjugated to deeper more ego related beliefs. Marketers are well aware of this as a look at current consumer behaviour texts will show. In contrast, I doubt if I have heard more than one or two mentions of 'cognitive consistency' or the 'theory of cognitive dissonance' in public health during the past 20 years – yet here we are trying to influence people's food behaviours.

What influences our beliefs and knowledge?

There are many influences. They include: our experiences, and what influences our experiences, the people we mix with – our social groups, the people we aspire to be like (reference groups) and our beliefs about what they want for us (e.g. most women think men want them to be about two sizes smaller than what men want them to be). In addition, our physical and biological environments certainly influence our beliefs. If you have ever had 'Montezuma's Revenge' you will have learned a lot about yourself and the world – like the value of health insurance!

Our prior or established beliefs influence our acceptance of new information. For example, if you believe the world is flat, when you see the curved horizon from an aeroplane you'll have a bit of struggle and may 'explain' your new perception as 'something to do with the curved windscreen in the cockpit'. That we see the world through rose tinted or other tinted spectacles has long been understood. The symbolic interactionists of the early 20th century drew attention to the inherent symbolism of perceptions (created by culture or prior experiences) and especially of language. Thus to a food microbiologist a black pudding is a risky food with interesting flora, to a Lancastrian it is likely to be a healthy and delicious food. Different people often interpret the same identical object or event in quite different ways according to their origins, training and experiences.

Humans then are prime information processors. We sort it all out but we can't process everything (we have very limited short-term memories) so we adopt all sorts of 'clumping devices' or 'heuristics'. For example, rather than considering all the nutrients listed on a packet of breakfast cereal we may 'measure' the nutritiousness of the cereal by the length in centimetres of the list, the longer the list the more nutritious the cereal! This may be illogical but is very handy when the shopping has to be done in a hurry.

What is nutrition knowledge?

Somewhat cynically, but accurately, we can define knowledge as that which distinguishes experts from ignoramuses. In fact this is how we decide which items to include in test

banks. We expect experts to be able to answer items that people unversed in the discipline cannot, with novices occupying some middle position.³ Not many so-called nutrition knowledge tests have been validated in this way.

What nutritionists think it is versus what consumers think it is

Nutrition knowledge is knowledge of nutrients and nutrition. Immediately one can ask 'so what'? As Gussow and Contento⁴ observed two decades ago, nutritionists have scientific needs and interests, so do 'learners' (consumers) and so does society. What the various groups understand by nutrition and nutrients requires careful examination. For now let us assume that all there is to understand is what nutritionists understand. What are the domains of nutrition knowledge? What are the most important things about nutrition that we need to know? I asked a similar question about a decade ago of nutritionists and shoppers when I asked them which nutrition information should be printed on food product labels.⁵ Figure 1 shows the differences between shoppers' and nutritionists' answers; the longer the line to the right, the greater was the difference between shoppers' and nutritionists' opinions (the longer the lines to the left, the more nutritionists wanted the information). Do you agree with these views?

How do we conceptualize the domains of nutrition knowledge? Do we look at the functions that nutrients undertake in the body, such as, energy turnover, or growth and repair, or do we think about antioxidants and the various defence mechanisms they operate. Or do we classify groups of nutrients in some other way(s)? What sort of relevance do such classifications have for the 'consumer in the shop'? Probably very little, except perhaps to confirm the misbelief that fat is bad? Of course it's not even this simple because not only can we group nutrients (according to their functions say, or to the disease processes they may be involved in) but

nutrition is a quantitative science so we know how much of a nutrient is 'too much' or too little. So when we say 'too much saturated fat is not healthy' what do we mean? How does this relate to buying cheese? When we say we should eat a varied diet do we mean at every meal, or everyday or weekly? Such questions do raise the possibility that although we may have a lot of facts in nutrition they may not be very relevant to every day eating and they may not represent much knowledge or certainty. They also cast doubt about the validity of 'nutrition knowledge' tests that seem to be frequently reported in publications and that are often unrelated to food choice? It's all very vague.

When it comes to consumers' knowledge of nutrition – this has been described as 'a mile wide and a centimetre deep'! Few investigators have asked consumers about what they want to know about nutrition (and food).⁶ Consumers seem to view nutrition as including much more than mere nutrients; it includes ways to lose weight, ways to prevent cancer, the effects of vitamins on skin condition, food safety, 'additives' and their effects, and much more. Why do the differences shown in Fig. 1 exist? Perhaps because lay people are unconstrained by 'disciplines' and have a much greater number of interests, motivations and goals than nutritionists – who frequently limit their domain of interest to traditional nutrients (thus excluding alcohol, water, non-traditional nutrients and physical activity – all of which have rather widespread effects on body processes). The point is that people have knowledge about what they are interested in. Indeed recent studies show that interest and knowledge are interrelated.

Which areas of nutrition are worth consumers knowing about? Here are some suggestions:

1. The energy content of food.
2. The roles of fats.
3. The sources of vitamins and minerals.
4. The sources of phytochemicals.
5. The links between food production and ecology and sustainability.
6. What else? It depends on what you consider is important.

Are the things nutritionists are interested in the same as those various groups of consumers are interested in?

How do you measure nutrition knowledge?

Most of us think that knowledge enables us to distinguish true from false beliefs, facts from falsehood. So we often pose questions and count the number of correct answers. This can be well done (using validated methods)³ or badly done. However, knowledge is not one-dimensional as tests scores suggest, it is somewhat structured. We might measure someone's knowledge of various areas of nutrition and find that they know about some areas but less about others. We could derive profiles of their knowledge. Inside someone's mind, however, knowledge (and beliefs) may be more highly structured or differentiated. Figure 2 shows 10-year-olds' 'knowledge' of some of the perceived nutrition properties of some foods before and after a nutrition education program. You can see that they associated various properties more

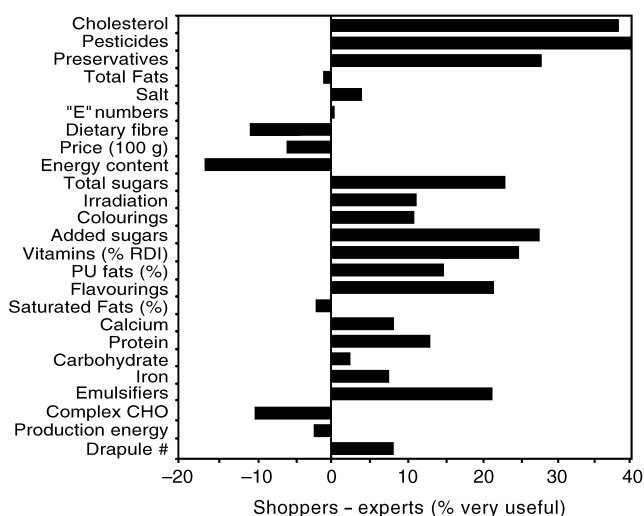


Figure 1. Differences between shoppers' and nutritionists' views about information that should be on the food product label.⁵

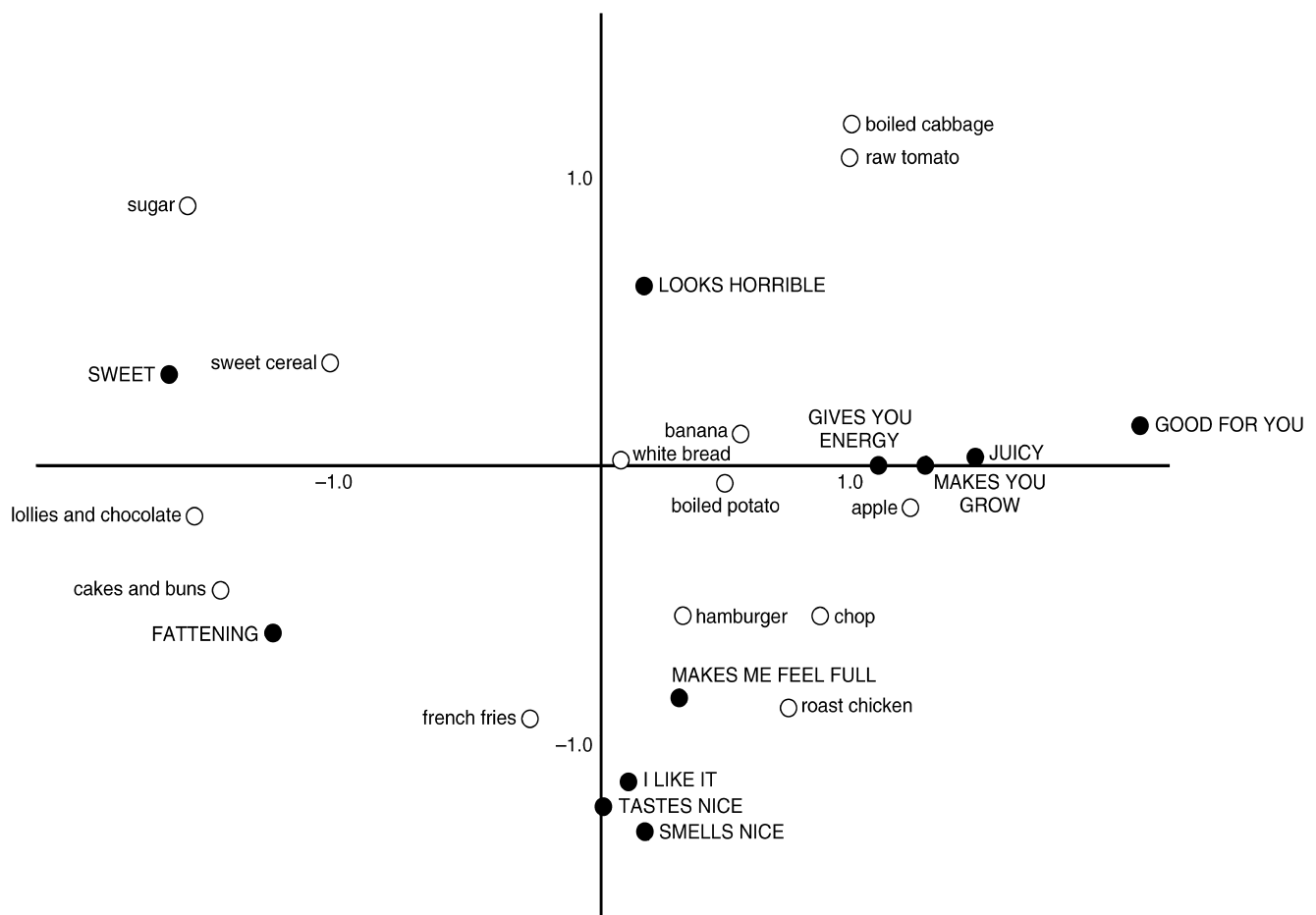


Figure 2. Ten-year-old's views of foods, nutrients and health.⁷ In this figure the closer a food is to a food characteristic the more that food was perceived to have that characteristic (e.g. cakes and buns were seen to be more fattening than sweet cereal).

with some foods than others. Therefore, measurement of nutrition knowledge is a little more complex than simple summation of 'true/false' scores.

Food behaviours

What do we mean by food behaviours? The term can cover a multiplicity of distinct behaviours from 'simple' chewing of food to food shopping, food preparation, etiquette, and food policy decision-making. It can be general (e.g. doing the weekly grocery shopping) or quite specific (e.g. choosing brand A over brand B according to their saturated fat contents). Much knowledge is required for these behaviours, only a little of which is related to nutrition. For example, imagine the steps required in making a pavlova, including knowing where to buy the best ingredients, how to combine and cook them. Where exactly in this chain of events does nutrition knowledge play a part? Behaviours are dynamic processes most of which involve 'decision points' (e.g. knowing when it is safe to swallow that bolus of tough meat). Simple linear measures of association between knowledge indices and the final behavioural outcomes (as in correlation-based statistics) are unlikely to reflect the key influence of nutrition knowledge on decision-making.

Influences on food behaviours

There are many models of human behaviours in relation to 'dietary' behaviours, several of which have been reviewed by Baranowski *et al.*⁷ They found that most of these models yielded similar predictiveness (about 30% of variance) but having any model was better than having no explicit model. Some of the key components of these models are described briefly to demonstrate that nutrition knowledge is only one among many likely influential factors:

1. The perceived consequences of the behaviour. These can be favourable or unfavourable, likely or less likely. Expectancy value models like the health belief model, theory of planned behaviour stress this aspect.⁸
2. Attitudes and beliefs about the behaviour and the object of the behaviour (e.g. perceptions about 'value for money') are important.
3. Skills like knowing how to shop and how to cook are important.
4. Confidence in being able to perform the behaviour is stressed as self efficacy in models like Social Learning Theory.
5. The social and physical, internal and external environment. The situations in which foods are purchased and

used are extremely important as they often include both social constraints (e.g. 'It is not "cool" to drink with a straw.') and highly attractive or aversive physical stimuli (e.g. the sight of a chocolate bar, the smell of freshly baked bread).

6. Motivators are extremely important. These include social influences (e.g. doing as your peer group does), environmental rewards (reinforcers), biological needs (e.g. hunger) psychogenic needs (e.g. need for ego recognition) and personal and cultural values – which define what are 'good' and 'bad' consequences of behaviours. Motivators are often subtle, for example, food may signify desired states (e.g. eating caviar may signify one's wealth and influence) hence the importance of hermeneutics. People make and use knowledge to meet their own goals and purposes – do consumers and nutritionists share the same goals? A relatively simple concrete example of a behavioural model is given in Grunert's Food Lifestyle Model (Fig. 3).⁹

Beyond the mainstream of food choice theory, consumer behaviourists have invented models that attempt to simulate the steps taken by humans in food purchasing decision-making.¹⁰ They also show that many factors impinge on the behavioural eventual outcome. A currently popular process model is the transtheoretical theory. This assumes that people go through a series of stages when changing their behaviours.¹¹ It has been successfully applied to fruit and vegetable consumption by Ling and Horwath.¹² This is an important model if only because it emphasizes that individuals may be affected by almost unique combinations of factors. This has led to tailoring methods of nutrition promotion,¹³ which are about twice as effective in bringing about dietary behaviour change as other approaches. Recent work on personal food value systems also provides similar, indeed greater richness, which is perhaps best provided by qualitative or experimental studies.¹⁴

So where does nutrition knowledge fit? Somewhere among the set of perceptions a person may hold about a food and the behaviours they might perform in relation to that

food. In the pool of food behaviour variance it would not be surprising if nutrition knowledge (however, well defined) were drowned out. We need more studies which follow the paths taken in real time (as distinct from timeless multiple regression analyses) by consumers during their behaviours. Such path analyses are rare.

Is nutrition knowledge related to food behaviours? Can it change food behaviours?

Yes, a little! This is not a 'systematic review' in the Cochrane Collaboration sense. Many studies show no relationship but there are some that do, albeit mainly at 'low' levels of evidence.

A major, influential study was performed by Wardle *et al.*¹⁵ This was a postal survey of 1040 18–75-year-old participants selected from General Practitioners' lists in England. Nutrition knowledge was significantly associated with 'healthy eating' (e.g., fruit and vegetable intakes) indeed knowledgeable individuals were 25 times more likely to consume adequate amounts of fruit and vegetables daily. Through analyses of covariance the authors were able to show that nutrition knowledge was a partial mediator of the socio-demographic variation in food intake (especially fruit and vegetable intakes). This work is part of the bigger thrust at University College London to explain the ways in which social class differences influence health. Social economic, cultural and psychological variables such as 'powerlessness' appear to be important predictors of health and disease states.¹⁶ Similar deconstruction of socio-economic influences such as education has been achieved in other related domains. For example, Davies at the University of Adelaide showed that education background differences in children's dental status were explained through different sets of parental beliefs (i.e., subcultures) about the value of dental hygiene and the prevention of dental caries.¹⁷ This suggests that 'education' encourages a different set of beliefs and values (or interests) among its participants. In a similar vein, a study by the USDA's Economic Research Service¹⁸ shows that the more mothers know about food and nutrition the better the quality of their children's diets, especially younger children's diets.

In another population study Harnack *et al.* in a national US sample of adults, showed that fat, fibre, fruit and vegetable intakes were closer to dietary recommendations among respondents who had more cancer-prevention knowledge, after social economic and nutritional confounders were taken into consideration.¹⁹

The possible role of interest in nutrition in Wardle *et al.*'s findings is suggested by a study by Chew and Palmer.²⁰ In a three wave national survey they showed that differences in nutrition interest, not education differences, were associated with differences in nutrition knowledge. They also showed that TV viewing was associated with greater interest in nutrition and thus greater nutrition knowledge. We have also shown that nutrition interest is a key mediator of the link between personal values and dietary choices.²¹

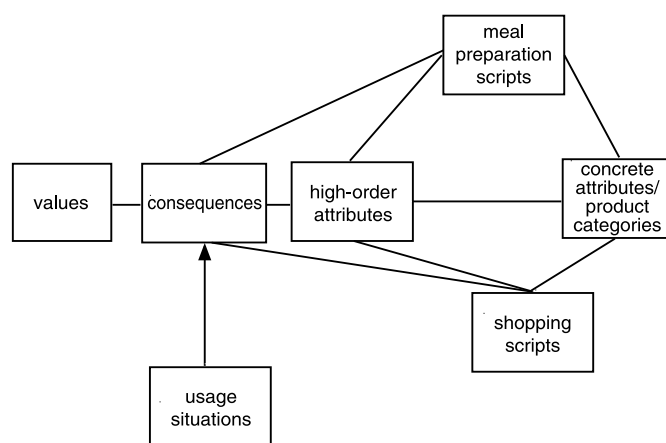


Figure 3. The Food Lifestyle Model.¹⁰

Kristal *et al.* found that among 97 middle aged women knowledge of fat nutrition and social norms about fat were positively related to the consumption of low fat diets.²²

In a study of a random sample of 475 elderly Americans, Elbon *et al.* found that high nutrition knowledge was strongly associated with the reading of nutrition information panels on food products (along with being female, and positive nutrition-related health seeking behaviours, i.e. interest).²³

The possible wide scope of influence of nutrition knowledge is further suggested by two studies. Elbon *et al.* found that elders' nutrition knowledge of dairy products did not predict the amount of milk that they drank but instead it predicted the type of milk consumed.²⁴ In a structural equation modelling study of primary teachers willingness to teach nutrition. Finally, Britten found that knowledge was a predictor of their *confidence* to teach.²⁵

Finally, our systematic review of children's healthy eating literature clearly shows that the nutrition education of school children can bring about change in their dietary behaviour, which sometimes last for over 2 years.²⁶

Why the scarcity of evidence?

There are several reasons for the scarcity of evidence, among them are:

1. Poor conceptualization of nutrition knowledge.
2. Lack of relevance (e.g. knowledge of cholesterol may be more relevant to 60 years olds than to 16 years olds – so why teach it to children?).
3. Poor measurement – there is a lack of well validate nutrition knowledge instruments, which measure knowledge that is of relevance both to consumers and to nutritionists.
4. Poor matching of knowledge and outcome variables – Fishbein and Ajzen drew attention to the law of specificity – dependent and independent variables must be measured at the same levels of specificity (e.g. we cannot correlate a person's knowledge of world malnutrition with their use of vitamin supplements).²⁷ Even more glaringly, general nutrition knowledge indices are unlikely to predict specific domains of food consumption, such as, vegetable or biscuit consumption.
5. Many studies have been small and did not have the statistical power to detect the influence of nutrition knowledge on food behaviours.

Implications for public health nutrition

We need to pay greater attention to the development of children's and adults' knowledge frameworks (schema building) via group and experiential learning. There should be more studies of children's nutrition knowledge and food beliefs and how they develop their dietary patterns. There is concern among community nutritionists and others that many children have poor experiential knowledge of food and have few buying and preparation skills.²⁶

There is a need for a renewed proactive role for the education sector. Much more documentation of the effects

of education is required. We have anecdotal evidence to suggest that the effects may be widespread and far reaching. We need to take education more seriously in order to work out what it does. There is a need for new student-centred life skills curricula in secondary schools that will prepare students for adult life, and for the evaluation of the effects of such curricula.

We need to take account of consumers' personal food goals and their acquisition of procedural knowledge that will enable them to attain their goals. Which sets of knowledge are required for people to get the best out of the current food system and to satisfy their aspirations about their bodies, their health and their aspirations about society and the planet? That is, we should attend more to people's food-related goals.

Knowledge is part of an open system not a closed system. You may teach nutrition knowledge but consumers will translate that knowledge and do what they like with it – often years later. For example, our daily physical education intervention study of 1978 (SHAPE²⁸) appears to have resulted in greater participation in vigorous activity and lower than average smoking rates 20 years later.²⁹ So, it is important in evaluation to anticipate likely lateral and sleeper effects.

Greater attention to experiential and procedural knowledge – it is the 'how to' that is difficult, for example, how to reduce energy intake. Perhaps different kinds of nutrition knowledge are required, such as, an understanding of strategies to influence metabolic regulation, energy intake and expenditure.

Finally, we need much more research into the ways people learn and use food-related knowledge in the form of systematic reviews, experimental interventions, path modelling studies, decision process studies and longitudinal studies

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