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# Food as therapy

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## Legitimacy of the concept

Depending on the cultural and historical perspective, food may or may not be regarded in a therapeutic sense[1]. There are several phases in the history of medical practice where the therapeutic role of food has assumed great importance. These include early Chinese medicine[2], medicine in ancient Egypt[3], and in medieval times[4].

Items, once perceived as therapeutic, may no longer be regarded as food; the concept of herbal remedies has often assumed these dimensions. In Chinese culture there has been a blurring of concepts of foods and health and of medicinals and health, with herbals being seen sometimes as one and sometimes as the other.

It is a common human view that the ways of food consumption, or the lack of them, contribute to or deny health maintenance. The concept of preferred eating patterns to minimize the expression of chronic disease is one which has been championed in the context of industrial societies in recent times as 'dietary guidelines'[5].

A contemporary consideration is that, whatever the therapeutic value of food, it is undesirable for the health care professional to use it in a prescriptive fashion. The reason for this is that this implies that determination of a patient's behaviour is possible, and that negotiation and education about the therapeutic strategy are relatively unimportant. Yet it is in relatively recent times that dietary prescriptions for peptic ulcer, diabetes, obesity, coeliac disease and other conditions were the order of the day. Perhaps this is one of the reasons why food as therapy has had low standing amongst patients and doctors alike.

The validity of the concept of food as therapy depends on another important consideration. It is that food usage and social activity are inextricably linked. The issue is no more impressively raised than in a classical study by Welin *et al.*[6], in which two cohorts of Swedish born men in 1913 and 1923 were followed

prospectively in relation to social activity scores (Fig. 1). There were clear inverse relationships between mortality rates and social activity scores, so that the greater the level of activity the less the mortality. Age was interactive, with the effects being more marked in the older age group. To what extent the effects of social activity are mediated by food is not revealed by this study. And, of course, what is presently attributed to food, insofar as its use is favourable or unfavourable to mortality and morbidity rates, may be explained by aspects of social activity. This constitutes a fertile area for future research. It must be acknowledged that the pathways by which food intake may influence health may include the social, psychological and physiological.

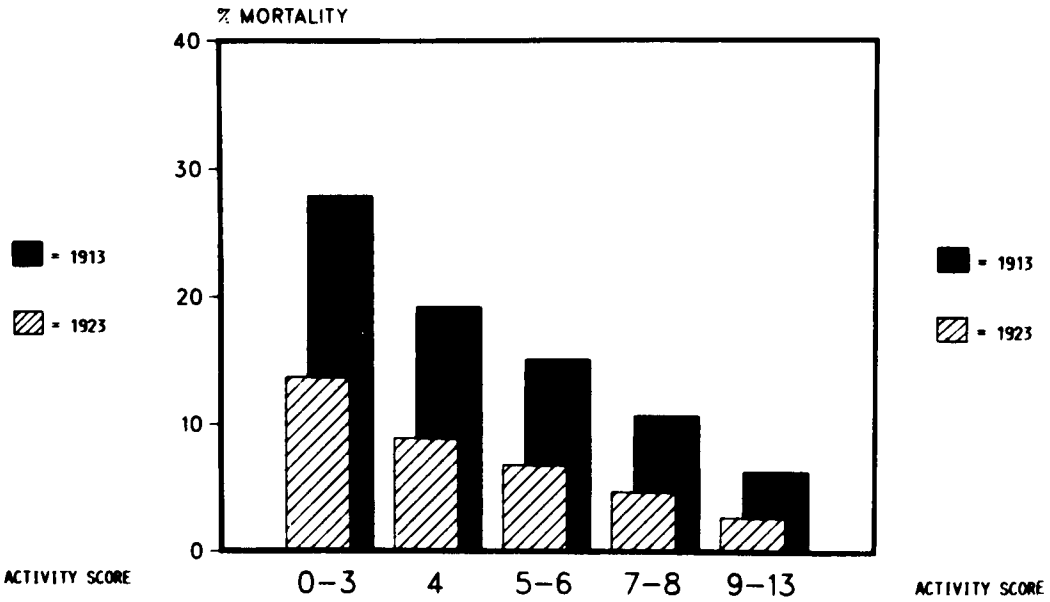


**Fig. 1. Mortality rates in relation to social activity scores[6].**

It is worth considering as well that the setting for patient communication may also influence the extent to which food serves in a therapeutic sense. This context will include socio-cultural-economic dimensions. It will require negotiation, explanation and the provision of information. A therapeutic contract emerges between therapist and patient, and with it, implicitly or explicitly, informed consent.

## The chemical complexity of food

Food is a physico-chemically and chemically complex unit of material for oral consumption[7]. Chemically it comprises not only nutrients but numerous other components, some of which have known biological actions and others whose potential for influencing human physiology and pathophysiology is unexplored. The nutrients can be categorized as macronutrients (protein, carbohydrate, fat, ethanol and dietary fibre), and micronutrients (vitamins and elements, both major

and minor). Non-nutrients, by present definition, include natural pharmacologically-active components (eg steroids, amines, casein-derived peptides, phyto-oestrogens), natural toxicants (eg cyanogenetic glycosides), colours (natural and added), flavours (natural and added), additives (eg stabilizers, emulsifiers, and humectants), and contaminants (eg pesticides, packaging material, pollutants)[8].

The potential for biological activity of compounds in food is underscored by an examination of flavours and colours[8–11]. We know, for example, from gas chromatography of the volatile compounds developed during the roasting of coffee, that more than 30 different compounds develop over a 15 minute roast. Insofar as they are recognized by the sense of smell, they occupy receptors on the olfactory apparatus[10,11]. The structures of some of the important constituents of the aroma of coffee include furfuryl compounds, 2-methyl-6-vinyl-pyrazine, acetylpropionyl and pyridine[8,9]. Some of these compounds may have biological activity beyond the olfactory apparatus. Funder and colleagues identified ligands for opiate receptors in instant coffee[12,13]. The concentrate contains a number of isomeric (iso) feruloyl quinic acid lactones. Salsolinol found in dried bananas, the chocolate-milk-solids-based hot beverage Milo®, soya sauce, chocolate and cocoa-based products mimics the action of dopamine on its brain receptors[14]. Duncan has also found (personal communication) that Milo contains the alkaloid tetrahydropapaveraline, a precursor of morphine in the opium poppy.

We can reasonably expect that the physiological effects of foods will depend on their physico-chemical properties, their chemistry and on component interactions.

In respect of recommended dietary intakes (RDIs), it is worth remembering that, ahead of the time when a comprehensive set of recommendations were made for micronutrients, protein and energy, it was considered that marker nutrients could serve to guide the use of foods[15,16]. That is to say, if one had the recommended intake for, say, thiamin, riboflavin, vitamin B-6, vitamin C, iron and calcium from one's food, one would have a relatively comprehensive source of associated nutrients. It is in more recent times that, with the development of formulated feeds, statements have had to be made about all known nutrients. The difficulty remains as to how one should regard the role of other biologically-active compounds. Indeed, the dietary guidelines have emerged as a concept, in part, because of the need to give some direction about the macronutrients carbohydrate, fat, ethanol and dietary fibre, and because of the increasingly recognized importance of the physico-chemical properties of food. It is worth remembering also that even deficiency diseases like scurvy were originally seen as food deficiencies rather than nutrient deficiencies[17].

## Variability in response to food

In health, it is possible to tolerate a wide intake of a number of macro- and micronutrients. For example, variations in insulin response to different carbohydrate loads allow the maintenance of blood glucose homeostasis within the fairly narrow limits of 3.5 to 8 mmol/l. Some of the variability is determined by genetic and some by environmental differences. In the case of differential response in plasma lipoproteins to alcohol intake, there is apparently a basic genetic difference, but other dietary factors appear to modulate the alcohol effects[18]. With Keshan disease, low selenium intakes must be interactive with other presumed nutrient

factors in leading to cardiomyopathy, since comparable levels of selenium intake in parts of the world other than China do not necessarily lead to the same cardiomyopathy in childhood[19,20].

Investigators have now begun depicting food and nutrient intakes in percentile charts, for example in the prospective studies on Australian children from the age of 1 to 8 years by Magarey & Boulton[21] (Fig. 2). This allows the clinician to see where a patient fits on these distribution charts, so giving more confidence in relation to the question of abnormal food intake.

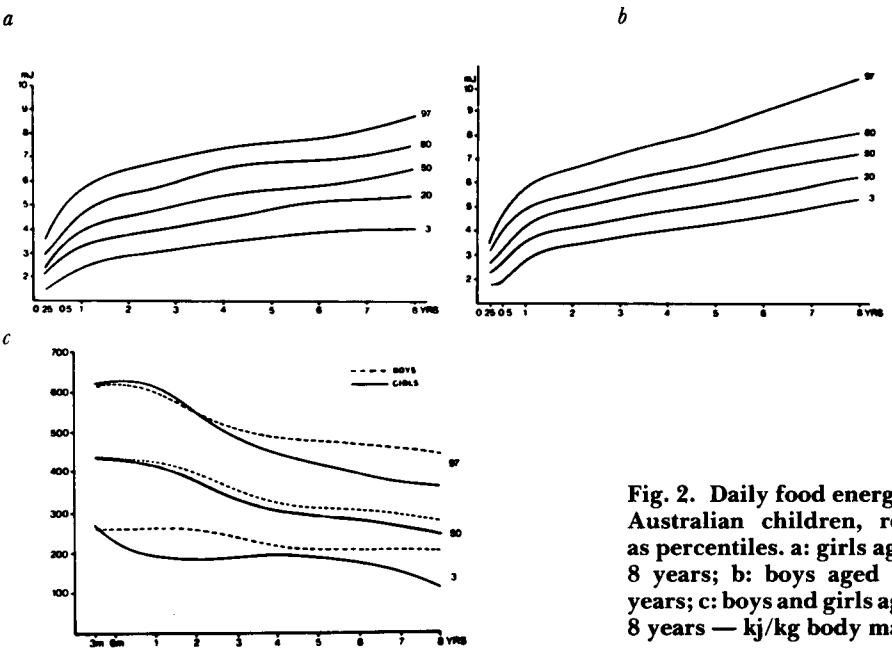


**Fig. 2. Daily food energy intake in Australian children, represented as percentiles. a: girls aged 3 mo to 8 years; b: boys aged 3 mo to 8 years; c: boys and girls aged 3 mo to 8 years — kj/kg body mass.**

The advent of disease is characterized by reduced tolerance to excursions in food or nutrient intake. Here the determinants of limiting factors merit definition and attention. An example would be blunted insulin response to a particular carbohydrate load in either impaired glucose tolerance (IGT) or diabetes. The genetic and environmental situations which lead to reduced tolerance can still be overcome or manipulated. This is the approach to inherited disorders of metabolism. Further, exercise and stress management can allow more food flexibility in the management of diabetes mellitus.

## Arranging therapeutic strategies and priorities

The various therapeutic strategies which need to be arranged in order of priority are:

(i) Lifestyle: (a) stress management; (b) alcohol and substance abuse; (c) cigarette smoking; (d) food intake; (e) physical activity; (ii); psycho-social; (iii) pharmacological; (iv) surgical; (v) no intervention.

In two long-term prospective studies[22,23] increased life expectancy has been demonstrated amongst men who have higher levels of physical activity. In the US

college alumni study[22], advantage was seen with increased energy expenditures in the vicinity of 300 to 500 calories per day. In the Finnish population study[23], physical activity was seen to be independently predictive of life expectancy, taking into account other major risk factors for coronary heart disease. It was possible that low physical activity was a lesser risk than cigarette smoking. Maximal achievable life span was probably not increased, but men with high physical activity lived 2.1 years longer than those with low physical activity (Fig. 3). High physical activity was defined as heavy occupational activity and the fulfilment of one of the following criteria: walking 5 km or more daily, cycling 150 km or more per month for at least 6 months of the year, or cross-country skiing for at least 200 km every winter. These details of alternative life-style strategies are worth taking into account in counselling about food since it is the other side of the energy expenditure equation.

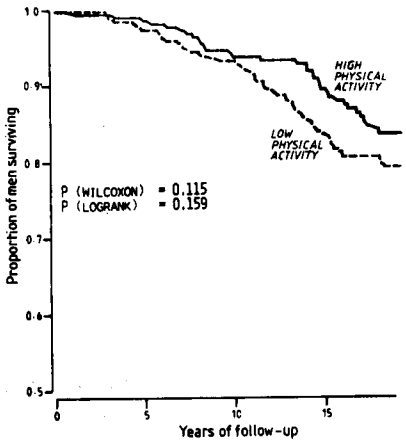


**Fig. 3. Relationship of crude mortality roles to high and low levels of physical activity, in a prospective Finnish study[23].**

In respect of the particular health problem, obesity, Bray has developed a risk-benefit classification for management[24] (Table 1).

Patients themselves have their own priorities as far as therapeutic options are concerned. Indeed, the health problem may not even be a priority; to make it so may constitute a counselling issue. In general, however, patients do want food or any other therapy to attend to their well-being[13]. This involves being disease-free, having the ability to engage in and enjoy daily activities, and to develop and maintain self-esteem.

**Table 1. A risk-benefit classification of obesity**

| *Class* | *Body mass index* | *Recommended weight gain during pregnancy* | *A classification relating risk to treatment** | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *Energy intake (kcal/day)* | | | *Exercise* | *Drug therapy* | *Surgery* |
| | | | *<200* | *200–800* | *>800* | | | |
| | $kg/m^2$ | kg | | | | | | |
| I | <25 | 10–12 | NA | 3 | 2 | 1 | NA | NA |
| II | 25–30 | 10–12 | NA | 2 | 1–2 | 1 | 3 | NA |
| III | 30–40 | 8–10 | NA | 1 | 2 | 3 | 2 | NA |
| IV | >40 | 6–8 | 2 | 1 | 1 | 3 | 2 | 1–2 |

*One refers to first choice, 2 refers to second choice, and 3 refers to third choice in the author's list of preferences.
NA = not applicable.

## Eating and food characteristics for therapy

There is little prospect of enabling food intake to change in a favourable direction unless one goes beyond the mere description of items of food eaten[25]. Food beliefs, food habits and food preferences all need documentation, to provide the broader socio-anthropological context of eating[2,26].

As far as the food intake itself is concerned, this may be considered in terms of contribution to nutrient intake, of foods, of meals or of snacks, or as a pattern of intake across a day, a week, or in and out of season.

In contemporary nutrition counselling in industrialized countries, the food nutrients of particular therapeutic interest are as follows: all the macronutrients, because of their relationship to the major chronic diseases; the micronutrients which may still be deficient in the diet (vitamins A and D, thiamin, pyridoxine, folacin, vitamin B12, ascorbic acid, iron, zinc, and magnesium); the micronutrients which may produce toxicity when taken in excess (vitamin A, vitamin D, pyridoxine, ascorbic acid, sodium and potassium); and micronutrients which may help to protect against disease (carotenoids and folacin). As essential nutrients of considerable current interest, the omega-6 and omega-3 fatty acids require consideration. Indeed, although presently there are recommendations for the intake of the omega-6 fatty acid, linoleic acid[15], there are currently no agreed recommendations for the intake of omega-3 fatty acids. This is a matter of some urgency since it is now being appreciated how important these fatty acids are in the development of neural tissue, and in lipid transport, membrane function and intracellular regulation by prostaglandins.

Because of the complexities of food, it is necessary to consider it in its entirety. One reason for this is that there remains a need to define biologically-active components. This is one reason why particular foods have been used in traditional therapies. An example of this is the use of ginger as an antinauseant. Recent work by Mowrey & Clayson[27] demonstrated that *z. officionale* (ginger) was more effective in reducing gastrointestinal sensations arising from motion than was dimenhydrinate or placebo. Another example is garlic. An isolate of garlic, allicin, has been shown by Shao Fa-Ji and colleagues in Shanghai[28] to be lipid-lowering, with reduction in serum cholesterol of 17 per cent and in triglycerides, of 27 per cent. The compound is now being synthesized as a lipid-lowering agent. Allicin is a precursor of another component of garlic, ajoene[29]. Ajoene inhibits platelet aggregation at the level of activation of contractile proteins. It would appear that it is biologically effective with a daily intake in the region of 3–5g garlic[30]. New roles for recognized components, such as tannin in oesophageal cancer, are also under scrutiny[31].

In Western food traditions, people have been encouraged to use nutrient dense foods such as liver, wheatgerm or whole grain products to ensure nutritional adequacy. In food therapy, the concept of nutrient density can be of great assistance. Nutrient density reflects the amounts of essential nutrients for a given energy value, say, per 100 kilojoule. Foods of low energy density may also be sought. These are foods with a low kilojoule value per unit mass or volume. They are generally low fat products and unrefined plant foods. A good example of the way in which fat can change energy density is the various preparation techniques

applied to the potato. A boiled potato has an energy density of 0.8 kcal/g (2.3 kJ/g). As its surface area increases and as it is exposed to, respectively, roasting and frying, its energy density increases. Finally, potato crisps, which are a thin sliver of potato, have fat from one side to the other, and about a four-fold increase in energy density over the original potato[7].

There is a great deal of interest at the moment in fish as a particular food in therapy, mainly because it is seen as a good source of omega-3 fatty acids, but it is worth noting that there may be relationships between fish intake and health, in particular protection against coronary heart disease, which are not entirely explained by the omega-3 fatty acid content of fish[32].

A helpful way to categorize food can be according to biological source[7]. Broadly, the sources of food are animal, plant and microbial, such as yeasts or fungi. The nutritional properties of biologically-related foods have a great deal in common. For example, ruminant meats have saturated depot fats and a characteristic nutrient profile for the muscle part of the meat. Citrus fruits have the vitamins folacin and ascorbic acid; their dietary fibre is also similar. Of course, the levels of essential nutrients vary within categories, folacin for example being found in citrus fruits in the descending order of oranges, grapefruits and lemons. Further one cultivar can have a food component not present in another and this can be of relevance in relation to food sensitivities[33,34].

Once foods have been classified according to biological source, the prospect of developing an index of food variety emerges. This is important, since encouragement to have a wide variety of foods on a regular basis forms part of the dietary guidelines of most countries[5]. This concept has evolutionary and historical validity, arguing the case that homo sapiens has been a hunter-gatherer for most of time. Further, having lost capacity with evolution to synthesize certain nutrients, these are required from a wide range of foods. This is in contrast to other species, such as the Australian koala which survives principally on eucalyptus leaves. The only period in human life where a single food suffices is during the first months of life with human breast milk. The other basis for the encouragement of food variety is that there are natural food toxicants and these are diluted out as one achieves variety. The resurgence in the concept of food variety in post-industrialized countries is due to the need to reduce the burden of nutritionally-related chronic disease. However, there are virtually no studies of the predictive power of food variety to protect against such disease. Recently, Wahlqvist *et al.* have demonstrated, using non-invasive techniques for assessment of macrovascular disease, that food variety is protective against macrovascular disease in type II diabetes mellitus[35]. Food variety was assessed from a week-long food diary, with a maximum score of 36. Food variety accounted for between 14 and 16 per cent of the variance in arterial wall compliance or pulse wave damping. In the nature of macrovascular disease, one can expect that a number of factors influence arterial wall change, but it remains possible that with improved measurements of food intake and arterial wall compliance, the predictive power of such an approach might increase.

We can see that there are several ways by which the therapeutic value of food might be expressed: (1) Contribution to variety; (2) Energy density; (3) Nutrient density; (4) Nutrient profile; (5) Contribution to nutrient RDIs; (6) Relationships to dietary guidelines; (7) Adverse factors. The approach may be at the level of nutrients, foods, meals, meal patterns or combinations of these (Table 2).

Something must be said about how food patterns might affect health. The question is how do feast and famine, seasons, day-to-day variation, and within-day variation affect health? Dugdale & Payne[36] have looked at some of the mechanisms whereby energy balance might be achieved in people who have lived through feast and famine. There is surprisingly little information on the health value or otherwise of seasonal change in food intake. This question will assume more importance as food is made available across the year irrespective of season. We know from casual observation that most people change their food habits from week days to weekend days, but we know little about whether some people make more of an adjustment on one day for error on another. It may well be that problems of this kind are in part the basis of weight gain or weight loss. The biological ability to cope with error is a mark of health and is sometimes referred to as biological reserve. The concept has already been alluded to in a consideration of metabolic responses to food.

The effect of food patterns on the development of macrovascular disease is probably underestimated. Thelle *et al.*[37] have shown that non-fasting blood lipid concentrations are influenced by the degree of fat tolerance. This is likely to be reflected in different levels of intermediate density lipoprotein (IDL) and of chylomicron remnants. In a case-control of study, Simons *et al.* have shown that chylomicron remnants are a marker for coronary artery disease[38]. Krauss *et al.* have demonstrated that changes in IDL over two years are predictive of coronary artery disease progression over five years[39]; the predictive power is similar to that of the LDL/HDL ratio. Thus the way in which one ingests fat across the day, and the exposure of arteries in the post-prandial state is likely to be of considerable importance for the development of atherosclerotic vascular disease.

There are more prospects for altering biological rhythms with food patterns than we currently realize. The work of Boulton *et al.*[40], a prospective study of food intake and growth in Australian children, indicates that most thiamin is taken at breakfast, most sodium at lunch and most zinc at the evening meal. Would human performance change if any of these were altered?

The pattern of food consumption by elderly people is sometimes influenced by Meals-on-Wheels (MOW) services. Specifications for such services assume how food will be eaten at other times[41–43]. The dietary fibre content of such meals has been found in Melbourne to range between 5 and 9 g per meal. With a mean daily intake of 16 g/day, the MOW meal thus contributes between 35 and 53 percent of daily fibre intake, so the development of food services for those at nutritional risk also requires an understanding of food patterns.

**Table 2. Therapeutic aspects of food**

| Nutrients | Food | Meals |
|---|---|---|
| • Macro | • Energy density | • Convenience-interest and edibility |
| • Micro | • Nutrient density | • Bioavilability of components |
| • (Non-nutrients) | • Physico-chemical properties | |
| | • Non-nutrients with biological activity | |
| | • Total package | |

*Requirements for change*

Some of the requirements for an individual to effect a change in food intake are:

(1) to comprehend the relationships between food intake and health.
(2) To have a food environment conducive to healthy choice
(3) To attend to food-related behaviours
(4) To accept that such change can be slow
(5) To work, as far as possible, within one's food culture
(6) To have meaningful and realistic endpoints.

*Preventive nutrition and food therapy*

Where food is scarce and malnutrition the principal problem, preventive nutrition requires the development of a local food supply and the ability to make the best use of it. In developed countries with our present understanding, recognition of the food pattern which relates to the prevailing disease pattern is required. Advocacy of dietary guidelines[5] is an effort to shift the food pattern in a more favourable direction to minimize the expression of major diseases.

There often needs to be a distinction between *prevention* and *management* of chronic disease. An example is neoplastic disease. Whereas there is growing evidence that a food intake pattern characterized by little animal fat, considerable plant food and minimal alcohol may be protective against colo-rectal cancers, it does not follow that this is the most appropriate way of eating should one have an advanced cancer of this kind.

*Chronic disease*

The chronic diseases for which nutritional therapy is most often sought are obesity, diabetes mellitus and macrovascular disease.

In respect of *obesity*, reference has already been made to the importance of arranging food therapy amongst other strategies, especially exercise. The more recent recognition that abdominal fatness is the principal component of body fat which predicts total mortality, ischaemic heart disease, diabetes, and stroke raises new questions about how it, in turn, is determined[44–46].

From clinical observations, alcohol might be expected to be contributory.

With *diabetes*, there has been a recent emphasis on the importance of increased intake of refined carbohydrate and a reduction in animal fat[47]. Those with limited insulin reserve may not, of course, tolerate a large amount of carbohydrate at once, but the prospects for doing so will be improved when the background diet is high in carbohydrate. The approach has therefore been taken to increase carbohydrate intake by spreading it out across the day. Yet it has not been investigated whether this should be an even spread through the day or whether carbohydrate might be handled better at one time of the day than another. Indeed, in healthy subjects glucose tolerance is greater in the morning than it is in the afternoon.

We have recently studied patients with Type II diabetes by comparison of two meal patterns, isoenergetic and with the same macronutrient composition, but with a main evening meal rather than an even distribution between three main meals and three snacks. With a main evening meal, there is a lower overall glucose profile. The major period of hyperglycaemia is post-breakfast where an even distribution of carbohydrate and energy is provided (Fig. 4).

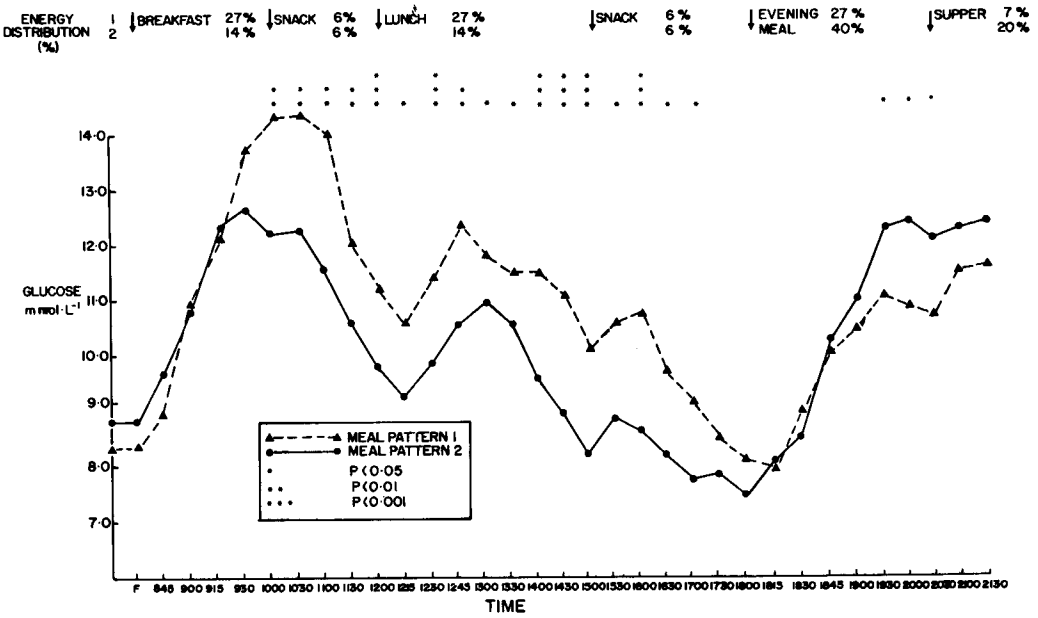


**Fig. 4. Blood glucose profiles in Type II diabetes when either an even distribution of energy and macronutrients between meals/snacks (meal pattern 1) or a main evening meal (meal pattern 2) is consumed.** The same subjects have been studied with each meal pattern (Wahlqvist, Simpson, Lo and Cooper, unpublished data).

The major risk factors for *macrovascular disease* which are nutritionally-related are hypertension, hyperlipidaemia and impaired glucose tolerance or diabetes. However, the other major risk factor, cigarette smoking, has its own nutritional inter-relationships, including increased metabolic rate, decreased interest in food through loss of taste, and displacement of food whilst cigarettes are being smoked. This more global view of the nutritional relationships with macrovascular disease is important both for prevention of macrovasular disease and for the management of macrovascular disease with food. It is also becoming clearer that hyper-aggregation of platelets[32] and blood viscosity[48,49] are influenced by food. It is conceivable, as well, that vascular reactivity may be influenced by sodium/potassium ratios in the diet[50,51] and by precursors of prostaglandin synthesis[48]. There is evidence that end organ function, such as proneness to cardiac arrhythmia, can be influenced by dietary fatty acid composition. Macronutrient intake also has the potential to influence cardiac substrate metabolism[52].

New insights are emerging into the ways in which food intake might influence blood lipids. There is no doubt that dietary saturated fat can raise serum total and LDL cholesterol concentrations and that the extent to which dietary cholesterol influences the serum cholesterol is dependent on how much saturated fat there is in the diet. The role of both omega-6 and omega-3 fatty acids in lowering serum cholesterol is now recognized[32]. More recent work indicates that olive oil, which is monounsaturated, can, when it replaces carbohydrate in a high carbohydrate diet, allow maintenance of the HDL cholesterol concentration whilst a fall in the total cholesterol occurs[44,53].

It appears that dietary fatty acid patterns may be predictive of coronary events such as angina pectoris and acute myocardial infarction[54]. In studies by Wood *et al.*[55] the fatty acid patterns in adipose tissue and platelets have been seen to predict these events. Thus for various reasons it would seem important to evaluate dietary fatty acid patterns in their own right in evaluating the therapeutic value of food.

There are several nutritional factors which affect blood pressure. These include energy balance[56], sodium/potassium ratio[57,58], ethanol[59], and possibly other macronutrients[60,61]. With a combination of the nutritional measures, weight reduction, sodium restriction and moderation in ethanol intake, Stamler and colleagues have recently demonstrated that following withdrawal of anti-hypertensive drug therapy there is a progressive divergence between nutrition intervention and control groups over four years in respect of medication usage[62]. At the end of four years, almost 50 per cent of the nutrition intervention group did not require drugs, whereas less than 5 per cent of the control group managed without drugs (Fig. 5).

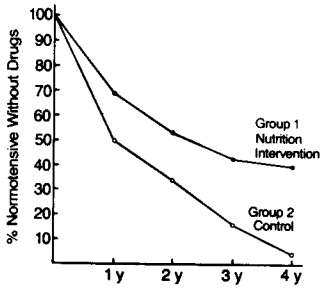


**Fig. 5. Effects of nutritional intervention in use of anti-hypertensive drugs in a 4-year prospective study[62].**

Although both alcohol and hypertension are now recognized as risk factors for stroke, it is of interest that potassium intake may be independently protective against stroke for both men and women[63]. In a 12 year prospective study the lowest tertiles of potassium intake for men and women were less than 59 and less than 49 mmol/day respectively and the highest tertiles > 76 and 67 mmol; the relative risks from lowest to highest tertiles were 3.4 for men and 5.3 for women.

*Wasting states*

Food therapy in hospitals in developed countries is still frequently required to manage the reversible components of wasting states. Examples are peri-operative malnutrition, nutritional support for those with neoplastic disease undergoing radiotherapy or chemotherapy, and the wasting seen in cardio-respiratory failure[64]. The rekindling of interest in this area came through high technology nutrition support, total parenteral nutrition and then enteral nutrition, but there is now increased focus on food or nutritionally-complete oral feeds.

## Emerging areas for food therapy

When one looks at a conventional medical text book, it is surprising in how many disease states aetiology is not yet understood. The possibility that food might contribute to aetiology or pathogenesis is still to be raised in many conditions. There are some, however, where these questions are now being asked.

*Rheumatoid arthritis*

Kremer *et al.* have examined the effects of fish oil fatty acids supplementation in active rheumatoid arthritis and their effect on neutrophil leukotriene levels[65]. The study was double-blind, placebo-controlled and crossover with fourteen week treatment periods and 4-week washout periods. With fish oil, mean time to onset of fatigue improved significantly and number of tender joints decreased significantly. Neutrophil leukotriene B-4 production was correlated with the decrease in number of tender joints. Although non-steroidal anti-inflammatory drugs may be more potent, there is a larger human experience with these fish acids than with all NSAIDS except possibly aspirin.

*Peptic ulcer*

Much of the nutritional interest in peptic ulcer in previous years has been in the development of bland foods and foods which might buffer gastric acid. Such approaches have now fallen into disrepute. However, there is a growing interest in possible dietary factors which might be protective against breakdown of the gastric mucosal barrier. Current interest centres on linoleic acid, cysteine (a glutathione precursor), alpha-tocopherol (a free radical scavenger) and dietary fibre (cereal bran)[66]. With powerful pharmacological methods now available to aid in the healing of peptic ulcer, largely through inhibition of gastric acid production, dietary approaches may have little to offer in the healing phase. However, for maintenance against relapse there may be scope.

*Asthma*

Maimonides, in medieval times, places particular emphasis on food therapy for asthma[4]. He suggested the use of bread, fish, young fowl and game, chicken soup, lean meat, rabbit, fox, hedgehog and various vegetables like beet, asparagus, fennel, parsley and radish. He urged avoidance of fried foods, unleavened wheat dishes, flatulent seeds, nuts, garlic, onion and leek, heavy meats, and cooling vegetables, which he considered to be lettuce, pumpkin, and cauliflower, and of most fruits.

In recent times, the interest in food and asthma has been restricted to those components to which an individual might be sensitive. There is now renewed interest in epidemiological studies which show a marked difference in prevalence of asthma in communities with different food intakes. Although other factors may well be involved in such differences, it is intriguing that the Inuit, with a high fish diet, have little asthma[67]. It remains to be shown whether alteration in fish consumption will in any way alter the development or management of asthma.

*Endstage cardiac failure*

In the light of studies demonstrating a protective effect of pre-treatment with selenium against adriamycin cardiomyopathy, it remains a possibility that altered selenium status might be contributory to endstage cardiac failure[19]. An added reason for raising this possibility is that cardiac cachexia, with marked likelihood of nutrient deficiency, is often seen in this state.

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