PROCEEDINGS OF THE NUTRITION SOCIETY

The Four Hundred and Nineteenth Scientific Meeting (One Hundred and Sixty-seventh Scottish Meeting) was held in the Walton Centre, Southern General Hospital, Glasgow on 1 November 1985

SYMPOSIUM ON 'NUTRIENT RECOMMENDATIONS FOR MAN—THEORY AND PRACTICE'

Variations in recommended nutrient intakes

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Tables of recommended daily intakes or amounts (RDA) of nutrients have now been published by international agencies and by governments or scientific institutes in more than forty different countries, and a number have issued more than one set. Few are the same, and an indication of just how much the values can vary even for one of the better-understood nutrients is shown in Table 1 for vitamin C.

It is not my intention to summarize or review all the differences, for this has already been comprehensively done by the International Union of Nutritional Sciences (IUNS) (1983). I shall concentrate more on how such differences can arise and on some of their consequences. This will require consideration of how the concept of 'recommended allowances', 'recommended intakes' or 'recommended amounts' began; of some of the ways in which they have been derived from often limited experimental evidence; and of some of the many purposes for which the concept and the numerical values have been developed.

Table 1. *Variations between the recommended intakes of vitamin C for young men in selected countries (mg/d)**

Argentina, Uruguay, Venezuela	30	UK	30
Bolivia, Colombia	40	German Democratic Republic	45
Spain	45	USA	60†
Mexico	50	Federal Republic of Germany	75
Philippines, Portugal	75	Bulgaria	95

*From International Union of Nutritional Sciences (1983).

†75 mg in 1941, 60 mg in 1968, 45 mg in 1974, 60 mg in 1980 (from reports from (US) National Research Council, National Academy of Sciences).

https://doi.org/10.1079/PNS19860072 Published online by Cambridge University Press

Recommendations, requirements and safety margins

Faced with the need to provide nutritious diets for deprived populations or in emergencies, charitable bodies and then governments long ago worked out 'recommended intakes', but couched in terms of foods and not of nutrients. For philosophical or practical reasons the amounts allowed to cover the needs of the whole group varied in their generosity; for example, in times of shortage they might merely be sufficient to 'avert starvation diseases in the poor at least cost' (Smith, 1863), but on the other hand they could aim to achieve 'buoyant health . . . and the building up of our people to a level of health and vigor never before attained or dreamed of . . .' (National Research Council, 1941). Such differences in approach still exist for recommendations in terms of specific nutrients.

RDA are usually said to be derived from estimates of physiological requirements plus an added safety margin, the size of which can vary. The amount of each nutrient that anyone requires for health can, in theory at least, be measured, but in practice accurate quantification is almost impossible and considerable judgement is required. Traditional balance studies suffer the disadvantage that man can adapt to wide ranges of intakes, and many of the more relevant deprivation and re-feeding experiments are no longer acceptable to ethical committees. Nutritional health can also be defined in different ways. Nevertheless, the evidence demonstrates that requirements for many if not all the nutrients differ somewhat with age, sex, size, physical activity and physiological state (e.g. menstruation, pregnancy or lactation), and with the intake of certain other nutrients, although even after all these factors are taken into account the requirements of apparently similar individuals may still differ twofold (Widdowson, 1947).

Fig. 1. represents the probable distribution of requirements within a homogeneous population and indicates four recommendations that might be based on this evidence. Recommendation *a* is the same as the average requirement. Recommendations of this kind are usually confined to energy and should differ between countries only in so far as some populations are physically larger or more active than others. Widely different recommendations have nevertheless been made. For example, for typical men in or around their twenties they vary from 10·6 MJ (2530 kcal)/d to 13·4 MJ (3200 kcal)/d, and even when specific physical activities have been addressed they still vary from 9·6 MJ (2300 kcal)/d to 11·5 MJ (2750 kcal)/d for light activity and from 15·9 MJ (3800 kcal)/d to 18·8 MJ (4500 kcal)/d for very heavy work (IUNS, 1983). Another of the many examples that could be given is the supplement recommended for lactation, which is as high as 4·2 MJ (1000 kcal)/d in Mexico but negative for the previously physically active women of eastern Europe; nevertheless, most countries recommend an additional 2·1–2·5 MJ (500–600 kcal)/d at this time (IUNS, 1983).

The UK RDA are defined as the average amount of the nutrient which should be provided per head in a group of people if the needs of practically all members of the group are to be met (Department of Health and Social Security, 1979). This is usually equated with the mean requirement plus two standard deviations, or point

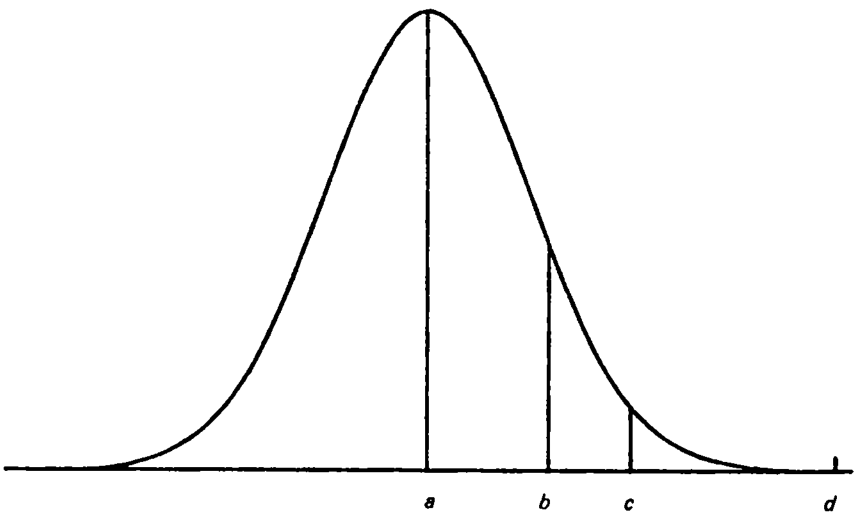

Fig. 1. Representation of the distribution of nutrient requirements, with four possible recommended intakes that might be based on it. (*a*) At the mean requirement, (*b*) at a habitual intake for a healthy population, (*c*) at the mean + 2 SD, (*d*) at the mean + 4 SD.

c in Fig. 1. The residual 2·3% of the population is 1·27 million people in the UK and more than 5 million people in America, so if such RDA appear to give an inadequate diet for so many people, and if every other uncertainty in the evidence is a reason for adding a further safety margin, recommendations may well be made that are higher than any possible need, at point *d* (Fig. 1).

Some high recommendations may be hard to meet even in developed countries. For example, the American RDA for calcium is 800 mg/d for most adults and 1200 mg/d for adolescents, which may be impossible to reach when little milk is drunk. Their RDA for zinc is also hard to achieve. When populations have long thrived on intakes less than those needed to meet biochemical criteria for adequacy from a Western laboratory, there is a logic to recommending that such intakes should continue even if they appear to be only at point *b* in Fig. 1. This is not to say that RDA should necessarily be lower in developing countries: the UN recommend, for example, that diets which are now recognized as being high in dietary fibre should have twice the iron and four times as much Zn to compensate for reduced absorbability (World Health Organization, 1970, 1973). Table 2 shows some of the recommendations that have been made for these minerals, and it is apparent that other criteria must also have been used in their development. It would also be more useful for Northern than for tropical countries to recommend dietary sources of vitamin D, but this is not always the situation (Table 2).

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Table 2. *Recommended daily intakes of iron, zinc and of dietary vitamin D for 16 to 17-year-old males in selected countries**

Iron (mg)		Zinc (mg)		Vitamin D (μg)	
FAO/WHO	5–9	FAO/WHO	7–28	Australia, India, Mexico	0
Caribbean	6	Uruguay	15	New Zealand, Thailand	10
Uruguay	15	Canada	9	Finland, UK	0
Mexico	18	Czechoslovakia	11	USSR	2·5
India	25	Australia, German Democratic Republic, Italy, USA, New Zealand, Spain	15	Scandinavia	5
Finland	5			Hungary	10
Canada, UK	10				
Norway	12				
Sweden, USA	18				

*Based mainly on International Union of Nutritional Sciences (1983).

Constraints imposed by different uses

The uses for which RDA are primarily intended may also influence the choice of values. Guidelines for the simple prevention of overt deficiencies require low recommendations, as high ones would be wasteful. So too does the need to determine whether diets that are eaten are nutritionally adequate. Thus a recommendation for vitamin C of 10 mg/d or less would be most useful if the prime aim is to screen populations or individuals for a risk of scurvy. But if the intention is to encourage diets which are more than adequate for anyone in a population or to allow any benefits from tissue saturation or from pharmacological action, and if there is no risk from excessive intakes, then a recommendation of 60 mg/d or more may well be appropriate provided it is realized that there need be no concern if it is not reached.

Nutrition labelling

One of the increasingly important uses for RDA is the labelling of foods. If nutritional values are shown as g, mg and μg of each nutrient per 100 g food, consumers need these quantities to be interpreted by comparison with recommended intakes, simply worded and preferably using internationally agreed recommendations to avoid problems when the foods are compared in different countries. The consumer can then appreciate that a food that provides, for example, 2 mg Fe and 10 mg Ca is actually a much better source of the former than the latter. The mineral and vitamin contents of a large number of American foods have been given on the label in this way for many years, and the generous RDA that must be used are shown in Table 3. In Britain, foods for which nutritional claims are made must show the percentage of the UK RDA of the nutrient which would be provided by a reasonable daily intake of the food (Food Labelling Regulations, 1984). The UN Codex Alimentarius Commission (Food and Agriculture Organization, 1985) has made similar recommendations using the current American RDA for 23 to 50-year-old men (Table 3) as the basis for

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Table 3. *Daily amounts of nutrients officially recommended for food-labelling purposes*

	UK*	FAO†	USA‡
Energy (MJ)	—	9·5	—
(kcal)		2300	
Protein (g)	—	50	65
Vitamin A (μg)	750	1000	1000
Thiamin (mg)	1·2	1·4	1·5
Riboflavin (mg)	1·6	1·6	1·7
Niacin (mg)	18	18	20
Vitamin B_6 (mg)	—	2	2
Vitamin B_{12} (μg)	2	3	6
Folic acid (μg)	300	400	400
Biotin (mg)	—	—	0·3
Pantothenic acid (mg)	—	—	10
Vitamin C (mg)	30	60	60
Vitamin D (μg)	2·5	5	10
Vitamin E (mg)	—	10	20
Calcium (mg)	500	800	1000
Copper (mg)	—	—	2
Iodine (μg)	140	150	150
Iron (mg)	12	14	18
Magnesium (mg)	—	300	400
Phosphorus (mg)	—	800	1000
Zinc (mg)	—	15	15

*Food Labelling Regulations (1984).
†Food and Agriculture Organization (1985).
‡Office of the Federal Register (1984).

Table 4. *Variation between the daily intakes of selected nutrients recommended for moderately active men in the countries of the EEC**

	Range for all twelve countries	Range excluding values from highest and lowest countries
Protein (g)	37–101	54–85
Vitamin A (μg)	750–1000	750–1000
Thiamin (mg)	1·2–1·6	1·2–1·5
Riboflavin (mg)	1·6–2·0	1·6–1·8
Niacin (mg)	9–20	18–20
Vitamin B_{12} (μg)	2–5	2–3
Vitamin C (mg)	30–80	30–75
Vitamin D (μg)	0–10	0–10
Calcium (mg)	400–800	500–800
Iron† (mg)	10–28	12–18

*Based on International Union of Nutritional Sciences (1983).
†Recommendations for women.

https://doi.org/10.1079/PNS19860072 Published online by Cambridge University Press

international comparison. Such high RDA may, however, be disadvantageous if they mislead consumers into believing that traditional diets are inadequate if they do not provide 100% of these standards (this is especially likely for women and children who eat less food than men). They could also increase the difficulty of educating people to improve their diets through a better choice of (unlabelled) unprocessed foods as well as of the processed foods which would be labelled to show their nutritional value, and perhaps encourage the unnecessary use of nutrient supplements.

Because the use of different RDA on food labels in different countries could result in barriers to trade as well as in consumer confusion, the European Economic Community is now actively developing harmonized RDA for labelling purposes. Table 4 shows that there is some way to go, but pressures such as this may in time lead to a reassessment of RDA throughout the world. Their various roles may then become better defined, specific values may be developed for each role, and within each role variations between the values may finally disappear.

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Printed in Great Britain