

## Review Article

# Search for the most complete multivitamin

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The group descriptor "multivitamin" doesn't guarantee that all vitamins are included in the product or that they are present in proportion to nutritional requirements. In fact the great majority of multivitamin preparations do not contain all the 13 established vitamins. We have reviewed the stated composition of all vitamin products registered with the Australian Therapeutic Goods Administration. All containing fewer than five vitamins were excluded and so were those containing non-culinary herbs or amino acids, or intended only for export, or designed for children and pregnancy or in the form of powder and injections. 163 multivitamins were left for scoring. One point was awarded for each vitamin but a point was deducted if the amount was below or clearly above the Recommended Dietary Intake (RDI). We found two multivitamin preparations containing 13 vitamins at levels close to the RDIs: Centrum Complete (our score 11) and Centrum Select 50+ (score 10); five multivitamins containing 12 vitamins: the best Avon Women's Complete (score 12) and Pluravit (score 10). Others contain fewer vitamins (or scored less than 10). Centrum and Pluravit are available at major outlets and their cost is moderate. We recommend that these most complete multivitamins should be clearly listed in MIMS and dispensed in public hospitals when "Rx multivitamins" is prescribed. People who take a multivitamin supplement to insure that they obtain their vitamin requirements would be best to ask for a multivitamin that contains all (or nearly all) the 13 true vitamins.

**Key Words:** multivitamins, supplements, Australian Therapeutic Goods Administration

### Introduction

Multivitamin tablets or capsules are pharmaceutical products that capture a major part of 20<sup>th</sup> century nutrition research: discovery of the vitamins, their chemistry and functions. Multivitamins are inexpensive and easily available, but generally taken for granted or dismissed as a distraction from "a good diet that includes bread and cereals, vegetables and fruit, meat or meat substitutes and dairy products".<sup>1</sup>

Yet there are people who can benefit from multivitamin supplements. The sensible purpose of a multivitamin preparation is an insurance policy for people whose diet may be restricted or unbalanced but neither they nor their health professional is sure which vitamin(s) may be lacking.<sup>2</sup> The clinical features of early vitamin deficiency are vague and non-specific. A reliable dietary history may not be obtainable; several vitamins occur in the same foods.

There is a case for multivitamin supplements for people with low calorie intake because of poor appetite or a weight reducing diet or frailty; also for food faddists, the emotionally disturbed and socially disadvantaged people.<sup>2</sup> People who are, in contrast, healthy and well organized also may take vitamin or multivitamin preparations that they buy over the counter. Perhaps they don't trust the nutritive quality of modern foods or they look for health benefit from extra vitamin intake. The individual vitamins such people choose to take have been shown to be sometimes not the one(s) inadequate in their diet.<sup>3</sup>

The term "multivitamin" means only that a preparation contains more than one vitamin, not that it contains all that you might need or all the 13 vitamins that humans ultimately require. This number is long established and recognised by all authorities, NH & MRC, USA, UK, EU, FAO and WHO. In Australia recommended dietary intakes (RDIs) were set for 9 vitamins by the NH & MRC in 1991.<sup>4</sup> The remaining four vitamins are included in sets of dietary reference values<sup>5</sup> for the UK and Dietary Reference Intakes for N. America<sup>6-9</sup> and the NH & MRC's Working Party on Nutrient References Values is preparing recommendations for 13 vitamins at present.

People who take a multivitamin preparation and even medical practitioners who prescribe one may assume that all possible vitamin needs are covered by this one tablet. But there is no preparation in MIMS monthly that contains more than 9 vitamins, most contain fewer, and many of these contain some vitamins at well over the nutritional requirement/dietary reference value, but not others. For anyone prescribed multivitamins in a Sydney public hospital most of the dispensaries will supply Vitaminorum BPC, which contains only 6 vitamins (3 of

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these at half the nutritional requirement). Only one Sydney hospital at present has a contract for a multi-vitamin preparation that contains all 13 vitamins. This scarcity of a complete multivitamin preparation is very general, not confined to Australia. In the British National Formulary (March 2003)<sup>10</sup> for example the principal product under "Multivitamin preparations" contains only vitamins A, C & D, thiamin, riboflavin and nicotinamide and their dosage varies from 0.38 to over 1.0 times the UK's dietary reference values.

Compounding the confusion is that some manufacturers add non-culinary herbs to multivitamin preparations: ginkgo bilobata, ginseng, saw palmetto, etc. The consumer may not have asked for these or realise they are not nutrients. Orthodox medical practitioners may not be equipped to recognise side effects or sensitivity to herbal preparations. It seems to us that a *model* multivitamin should satisfy three criteria. It should be *complete* and contain all 13 established vitamins. It should be *balanced* and contain these in the proportions of their nutrient reference values (RDA, RDI, etc). Thirdly it should contain only *nutrients* and not contain any pharmacologically active ingredient, herbal or other. The dose of each vitamin should be near the daily nutritional requirement, so that anyone taking it can be sure that their vitamin needs are covered.

Some multivitamin preparations also contain one or more inorganic nutrients (minerals, trace elements). While these might be thought to increase the nutrient insurance cover, there are some possible problems. First, the inorganic nutrient requirements cannot all be crowded into a single tablet. While the total daily requirements of all 13 vitamins add up to just over 100mg, total daily needs of inorganic nutrients is over 5grams (50 times greater). Inorganics in a multivitamin preparation are therefore not the full number (probably 15) essential for humans. If present, calcium and potassium are well below the requirement amount. There could also be incompatibilities between inorganics, within the tablet or in the

gastro-intestinal tract. Iron is a special case; it could act within the tablet as a free radical donor and affect some of the vitamins, that are liable to oxidative damage.

As far as we know, there has been no review in Australia or elsewhere of how clearly the multivitamin preparations on the market match this concept of the model multivitamin, that is complete, balanced and contains only nutrients (except for the excipient). Our study was not concerned with the indications for *individual* vitamin supplements, whether in nutritional or mega dosage. Most of the individual vitamins (C, E, folate, etc) are freely available, though vitamins A and D are restricted (because toxicity can occur at doses only a few times the nutritional requirement).

### Methods

We obtained a list of all the *vitamin* products registered with the Australian Therapeutic Goods Administration, Commonwealth Department of Health, Canberra. We first excluded products with fewer than 5 vitamins from our review. Children's and pre-natal vitamins were not included because micronutrient needs for these subgroups differ from those of the general adult population. Vitamin injections and powders were also excluded and so were formulas that contain herbs and/or amino acids. Those containing natural sources of concentrated vitamins were included e.g. wheat germ oil as a natural source of vitamin E, yeast (for B complex) and also cod liver oil (for vitamins A and D). Products containing minerals were included unless they contained more than 16 mg of iron (the RDI for women), i.e an excess.

We would have preferred to consider products containing only vitamins, but to do so would have eliminated some with the largest number of vitamins. Likewise we accepted products containing amino-benzoic acid, choline, lecithin, hesperidin, inositol and rutin (historically proposed to be vitamins); they are widely used in vitamin products and (in the dosage used) appeared to be harmless.

**Table 1.** Daily requirements and vitamin scoring cut-offs

Vitamins		RDI	Minimum	Maximum
Vitamin A	mg	0.75-1.0 (2500-3000IU)	0.38 (1250 IU)	1.06 (3500 IU)
β-carotene	mg	-	3	6
Thiamin	mg	1.1	1	5
Riboflavin	mg	1.7	1	5
Niacin	mg	19	10	30
Vitamin B-6	mg	1.5	1	5
Pantothenic acid	mg	5*	3	10
Biotin	μg	30*	20	50
Folic acid	μg	200-400	100	400
Vitamin B-12	μg	2	1	5
Vitamin C	mg	40-60	30	100
Vitamin D	μg	10* (400IU)	5 (200IU)	15 (600IU)
Vitamin E	mg	5-10	5	20
Vitamin K	μg	90-120*	60	150
Iron	mg	7-16	-	16

\*USA dietary reference intake used because there is no Australian RDI

**Table 2.** Top scoring multivitamins

ARTG Id*	Multivitamin	No. of vitamins	Our Score	Price 1 month	Available at major retail outlets?	RDI Panel	Vitamin A (a), $\beta$ -carotene (b) Vitamin K (k) Iron (i)
81579	Avon Vitadvance Women's Complete I <50	12	12	\$8.50	No	No	a,b,i
81577	Avon Vitadvance Women's Complete II >50	12	12	\$8.50	No	No	a,b,i
75827	Centrum Complete	13	11	\$5.40	Yes	Yes	a,b,k,i
67506	Centrum Select 50+	13	10	\$6.60	Yes	Yes	a,b,k,i
72142	Life One Origin Multivitamins & Minerals	12	10	\$1.80	No	No	a,i
47562	Nutriway Daily Multivitamins and Minerals	12	10	\$14.95	No	Yes	a,i
92479	Pluravit Multi Vitamins & Minerals	12	10	\$5.40	Yes	No	a,k,i
78253	Jenny Craig Multivitamins & Minerals	11	9	\$16	No	No	a,i
70310	Golden Nature Multivitamins & Minerals	11	8	\$2.10	No	No	a,i
74085	Healthcare Multivitamins & Minerals	11	8	\$2.10	No	No	a,i

\* ARTG Id = Australian Register of Therapeutic Goods Identification

This left 163 multivitamin products for scoring:

- One point was awarded for each vitamin contained, with a maximum score of 13 points. Vitamin A activity was in some products present partly or entirely as  $\beta$ -carotene, the pro-vitamin.
- One point was then deducted if the amount of the vitamin was too high or too low, using criteria we pre-set (Table 1). The content of a vitamin needed to be at least 50% of the Australian RDI (or if not available, the US adequate intake, AI). For vitamins with a small margin of safety, especially vitamins A and D the content could not be much higher than the RDI. For other vitamins an upper cut off was set arbitrarily at a round number 2 to 3 X the RDI. Where  $\beta$ -carotene was present (for vitamin A) an upper cut off was set at 6 mg, corresponding officially to 1 mg of retinol (the Australian RDI).

Content of some vitamins in pharmaceuticals is expressed as international units (IU), but elsewhere in weight units, which can be very confusing. IU were converted to mg or  $\mu$ g for comparison with the requirement values used.

## Results

The highest scoring multivitamins are collected in Table 2, which also records a typical price for a month's supply, availability at major retail outlets and whether the label shows the RDI for vitamins, to compare with the stated vitamin content in the product. The table also has letters in the R hand column to indicate whether the formulation contains preformed vitamin A, retinol (a) and/or  $\beta$ -carotene (b) and whether it contains vitamin K (k) and/or iron (i).

Vitamin A intake should be limited in pregnancy and can be replaced by  $\beta$ -carotene. Vitamin K intake can be critical in people taking warfarin and similar anticoagulant medication. Iron requirement is higher for women.

*Avon's* multivitamins scored the highest by our criteria but they are not generally available at retail outlets, do not have an RDI panel, do not contain vitamin K and

are relatively expensive.

*Centrum Complete* multivitamins are more widely available and less expensive. The label has an RDI panel. This product actually does contain all the 13 vitamins at safe levels. It lost points for containing biotin above the USA recommendation (there is no Australian RDI) though well under the toxic level, and for containing vitamin K below the USA recommendation. Otherwise *Centrum* meets all our criteria of what constitutes the best multivitamin.

*Centrum Select 50+* is similar but contains more vitamins B-12 and E and less vitamin K. It is designed for people above the average adult age.

*Pluravit* is widely available and reasonably priced. It contains all the vitamins except biotin.

*Nutriway* contains biotin but has vitamin A at double the RDI and is more expensive.

*Jenny Craig* multivitamin only omits biotin and vitamin K; vitamin A activity is provided here by  $\beta$ -carotene. But it is only available for participants in their weight-loss programme.

## Discussion

It is difficult to understand why there are so many multivitamin products on the market. But when the plan is to take vitamins to back up a questionable diet it would surely be best to include *all* the vitamins, or at least all except those least likely to be lacking. To avoid imbalance they should all be present in amounts near the nutritional requirements. Fortunately there are a small number of complete (or almost complete) multivitamins (Table 2) that doctors can prescribe, that people can buy for themselves, that public hospitals should carry and to which MIMS should devote its "multivitamins" section.

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