

# Vitamins: Issues of definition and regulation

G Morgan

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## Abstract

The term vitamin is scientifically inaccurate and furthermore, there appears to be a need for a contemporary definition of a vitamin. In addition, there is powerful evidence that the intake of certain vitamin supplements confers an increased risk of premature mortality. A regulatory and licensing framework therefore appears to be required in the interests of public protection. The Cochrane Collaboration, an evidenced based organisation, might have a lead role in taking these important matters forward.

## INTRODUCTION

The historical use of citrus fruits, a rich source of ascorbic acid, to alleviate scurvy on sea voyages provides a well known example that certain organic chemicals have vital importance to human health. Subsequent investigations into organic chemicals with putative vital importance to health erroneously suggested they belonged exclusively to the chemical amine family (<sub>1</sub>). The word vitamin, a hybrid of vital amine, is therefore a scientifically inaccurate term.

Vitamins exert a diverse array of effects upon human biochemical systems and if they are not consumed in sufficient amounts, then deficiency leading to compromised health or disease may occur (<sub>2</sub>). The vitamin system therefore provides an important public health nutrition mechanism to help improve the health of the population.

Vitamins may be either fat soluble or water soluble and the current classification runs alphabetically from A to E although in addition to this, there is also vitamin K. Other letters of the alphabet has been used in the vitamin system at various times. For example, although vitamin PP, niacin, has been renamed as vitamin B3 the term vitamin PP still appears in the research literature (<sub>3</sub>). Essential fatty acids, such as linoleic acid, have also been historically classified, albeit temporarily, as vitamin F (<sub>4</sub>) although it appears that numerous websites still make reference to products containing vitamin F (<sub>5,6</sub>).

It therefore appears that revisiting the alphabetically based vitamin classification would be helpful for reasons of both scientific clarity and product licensing. Furthermore,

vitamins present several issues of both definition and regulation that deserve to be given further consideration.

## DEFINITION OF A VITAMIN

There are variable definitions of a vitamin published in the literature. Perhaps one of the most comprehensive of these is presented in Table 1 (<sub>7</sub>). Although this definition is helpful, it is not entirely satisfactory. For example, 100% of the human requirement for vitamin D, secosteroids, may be met through synthesis in the skin following exposure to sunlight (<sub>8</sub>). This is at variance to the definition which requires that vitamins cannot be synthesised within the body. This example suggests that there is a need for an evidence-based contemporary consensus definition of a vitamin to be produced.

The absence of a contemporary consensus definition of a vitamin creates yet another difficulty. There is increasing interest in so called nutraceuticals, another hybrid term of nutrition and pharmaceutical, to improve human health (<sub>9,10</sub>). Nutraceuticals may be targeted to particular tissues for specific benefits, analogues to the pharmacological principle of drug targeting (<sub>11</sub>). As a related dimension, there is interest in using technological methods in food production to increase nutraceutical related health benefits (<sub>12</sub>) and perhaps some nutraceuticals may eventually satisfy a contemporary vitamin definition.

For example, salicylate is an organic chemical present in fruits and vegetables (<sub>13</sub>). There is an increasing evidence-base that human intake of dietary or pharmaceutical salicylate may help reduce the risk of cancer (<sub>14</sub>). Perhaps

salicylate may be reclassified as vitamin S (<sub>15</sub>) and possibly acetylsalicylate, better known as aspirin, may counteract deficiency (<sub>16</sub>). Such possibilities are contingent upon further evidence on the benefits of salicylate to human health as well as the contemporary vitamin definition. It may be recognised, however, that the term vitamin S is already in the public domain (<sub>17</sub>).

### IMPORTANCE OF A REGULATION SYSTEM

There is powerful evidence, derived from meta-analyses of randomised controlled trials, that taking certain vitamin supplements increases the risk of premature mortality. A systematic review of randomised trials on vitamin supplements published by Cochrane Collaboration (<sub>18</sub>), an evidenced based organisation, found that people taking supplements of vitamin A, beta-carotene or vitamin E had increased premature mortality risks. However, there is no regulatory and licensing framework for vitamins (<sub>19</sub>) which contrasts with medicines in which there are organisations, such as the UK Medicines and Healthcare Products Regulatory Agency, who ensure that medicines work and are acceptably safe (<sub>20</sub>).

Given the potential harm associated with the excess use of some vitamins and also the extensive product range available to the general public, a regulatory and licensing framework would appear to be an important health protection development. Such a framework, however, would firstly need to work from a contemporary definition of a vitamin and also take into account wider range of context issues. This might include the revisiting the evidence on optimal intake levels, dietary patterns within the population and also the community use of vitamins. This last issue is most important and for example, one study has suggested that perhaps 40% of the U.S population use vitamins and mineral supplements weekly (<sub>21</sub>).

Table 1 : Definition of a vitamin

1. An organic chemical required in small amounts for complete health and well-being of the organism
2. Not utilised primarily to supply energy or as a source of structural tissue components
3. Function to promote physiologic processes vital to continued existence
4. Cannot be synthesised by the organism and must be supplied de novo

5. Deficiency causes a well-defined disease that is prevented or cured by the appropriate vitamin

From : Young V.R, Newberne P.M. Vitamins and cancer prevention : Issues and dilemmas. *Cancer* 1981;47:1226-1240.

### CONCLUSIONS

Adequate dietary intake of organic chemicals that are currently classified as vitamins are important to promote the health of the population (<sub>22</sub>), particularly in groups who may be predisposed to increasing risks of ill health or chronic disease such as the elderly population. Furthermore, the potential of vitamins to be beneficial in other contexts, such as the prevention and treatment of childhood cancer (<sub>23</sub>), has also been suggested and further research appears warranted. However, limitations to maximising the public health potential of vitamins include the absence of a contemporary definition and also the need for a regulation system to ensure appropriate intake. Evidenced-based approaches to taking these developments forward appear needed and there are examples in the literature of how new evidence has led to changed recommendations, such as hormone replacement therapy (<sub>24,25</sub>).

Perhaps the Cochrane Collaboration initially could be the organisation that might usefully help to progress these important matters with respect to vitamins. Furthermore, developments on vitamins need to be set within a wider context of nutritional interventions to maximise health, such as control of caloric intake (<sub>26</sub>).

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**Author Information**

**Gareth Morgan, FRSPH**

National Service Framework for Older People Project Manager, Welsh Assembly Government