Are Vitamins good for you
(and how much do you really need)?

This seems a strange topic/title since we all *know* that of course Vitamins are good for us, or do we?

The prime example that we can all quote is lack of Vitamin C and Scurvy in seafarers backing in the era before lime juice rations and Captain Cook[1]. Months or years at sea without fresh fruit and vegetables and sailors would start to show symptoms of Scurvy with their gums rotting and their teeth falling out and many dying. Then along came Captain James Cook who, along with his epic voyages of discovery, is also famed for supplementing his sailors' atrocious diet with a concentrated extract from lime juice.

Suddenly the problem of scurvy was solved although it would be another couple of centuries before we knew why.

It was even longer before we understood why, even after years on Vitamin C deficient diets, some sailors did not succumb to Scurvy.

Obviously some people are different in their requirements for Vitamin C. Not surprisingly, the same sort of thing was found with the other Vitamins as well.

The classic study came out of World War II. The armed forces in England had all these men to feed and they wanted them as healthy as possible right up to the time they were told to stick their heads over the top.

They knew about Vitamins by then but no one really knew just how much people really needed. So, with the willing (?) cooperation of a large group of conscientious objectors, the definitive study was undertaken.

It went on for years. These volunteers lived on horrible artificial diets where individual Vitamins were omitted. Apparently the diets were remarkably unpalatable.

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[1] Actually a Scottish surgeon, James Lind, discovered the beneficial effects of citrus juice but Captain Cook was an early adopter amongst Royal Navy commanders.

For the lucky ones, they showed symptoms of vitamin deficiency in a few months. The vitamin was then added back to their diet in increasing doses until the symptoms went away. Others went for years and some went for the whole time without showing any symptoms of deficiency at all – just like some of those crewmen on the old sailing ships who went for years without developing Scurvy.

Just like some of us are short and some are tall, these studies showed that there is a great variation in our requirements for Vitamins.

Now, put yourself in the place of those scientists running these studies. You have to make a recommendation to the military just how much of each of the Vitamins should be in the daily ration packs for the troops. What do you do? Like any good British Civil Servant, you play it safe. You take the Vitamin requirement of the extreme outlier in each group with the highest Vitamin requirement (not the average requirement or the median) and then you double it just to be safe.

You can then hold your hand over your heart and say that such and such a daily dose of such and such a vitamin will be enough to keep the troops healthy.

Somehow in the intervening years, this safe excess dose has been transformed into the "Average Daily Requirement"!

What do we make of all this and what does it mean for us?

Firstly, let's think of why we require Vitamins at all. Vitamins are small molecules that play essential roles in our metabolic processes (coenzymes). If our cells don't have enough, they just don't work properly.

Many simple unicellular organisms make all of these essential coenzymes for themselves. Before you ask what relevance simple one-celled organisms have to us and our metabolism, you have to realise that all life on this planet basically the same right from its very foundations. For example, your genes have at least 30% homology with those of a banana and, when it comes to a rat, the differences are tiny.

The rat is an interesting case in point when it comes Vitamins; in particular Vitamin C. Rats make their own Vitamin C – lots of it too. Before large-scale chemical synthesis of Vitamin C was perfected (all of it you buy now comes out of a chemical factory), Vitamin C was extracted from rat urine. Imagine large rooms full of rat cages with plumbing underneath each one to collect the precious urine.

If rats make all the Vitamin C they need why don't we? A species that doesn't make its own Vitamin C eating foods lacking it will develop scurvy, be very unhealthy and be very poor in producing offspring, with that population ultimately dying out. Since this did not happen with our hunter-gatherer forbears, deficiency in Vitamin C (or any of the other essential vitamins for that matter) must not have been a significant factor.

In other words, the diets of our forbears and evolutionary progenitors had more than enough of all the Vitamins to support their reproductive fitness – there was no evolutionary selection against populations that have lost their ability to make these various molecules we call vitamins for themselves.

The take home message is that any halfway reasonable diet will have more than enough Vitamins to satisfy your requirements and the so-called "average daily requirement" will be wildly in excess of what you really need.

However, if a little bit of something is good, isn't more obviously better (or at least not harmful)?

In the case of Vitamins, the answer is both Yes and No, depending on the Vitamin.

There are two classes of Vitamins: fat soluble and water-soluble[2].

Large doses of the water soluble ones are not so much of a problem. If your body has excess of them, they are readily excreted in the urine. (Aficionados of megavitamin therapies should think of collecting their urine and recycling it, just like we used to do with rats for their Vitamin C.)

Fat-soluble Vitamins are more of a problem. They accumulate in our body's fat deposits and are not readily excreted. Large and prolonged doses of fat-soluble Vitamins can be potentially toxic. For example, cats fed too much liver will have their vertebra fuse together. This is due to over-accumulation of a fat-soluble vitamin (Hypervitaminosis A).

With the U.S. Institute of Medicine now recommending "Daily Tolerable Upper Levels" for at least Vitamin A[3], this should ring major warning bells with everyone other than the megavitamin fanatics.

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[2] I suggest doing a Wiki search for Vitamins for more information.

In summary, eat a varied diet of good quality foods and you can forget about Vitamins, avoid large doses of any fat soluble Vitamins and don't take large doses of any of the water soluble Vitamins unless you just want to line the pockets of the Vitamin manufacturers and suppliers.

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[3] Try a Wiki for Hypervitaminosis A.