

GCE Nutrition and Food Science

A2 2 Research Project - Subject Guidance for Summer 2021-22

Exemplar Task for 2021/22 only

Title: Antioxidant Supplements: Friend or Foe!

Introduction (Word count 340)

There is a huge range of products sold as ‘food supplements’, including vitamins, minerals, herbal products, protein supplements and many others, all with a nutritional or physiological effect, alone or in combination (BNF, 2019). The consumption of food supplements has increased in the UK over recent decades. Latest sourced data reveals 59% of consumers (aged 16+) reported taking a supplement during 2018 (BNF, 2019) and market spending is set to reach £515 million (Mintel, 2020).

While situations exist when supplements are recommended by the government, such as pre-conception and early pregnancy, this report focuses on food supplements which have the intended purpose of being ‘an antioxidant’ and unlikely to have been prescribed by the medical profession. These are micro-nutrient supplements namely, vitamins A, C, E and potentially D, recognised for having antioxidant properties which are suggested to reduce the risk of chronic diseases and are freely available over the counter.

The reasons behind current uptake levels of synthetic antioxidants are wide ranging and varied. Recently, Cassidy (2017) revealed that fruit and vegetables, recognised as natural sources of antioxidants, are only consumed by 43% of the adult population in Northern Ireland. Multi vitamin supplements are marketed and consumed as a guard against winter colds and flu and many consumers would acknowledge them as immune boosters. A major suggested benefit of antioxidant supplements includes increased protection against cancers (Healthline, 2021). As an example, vitamin A has properties which prevent free radical damage of the cells, a primary cause of cancer. This is certainly an incentive to consume vitamin supplements.

Conversely, is there evidence to suggest that people may be doing their health a disservice by supplementing with antioxidants? Has the threat of antioxidant stress to the body, enabling many potential risks and dangers to human health, been established? Risks of long-term excess can be potentially fatal, depending on the antioxidant supplement. Are some individuals more at risk of excess, especially those who already have a well-balanced diet and therefore risk exceeding the recommended amount of each vitamin?

Aim To examine the health benefits of antioxidant supplementation and the health concerns of antioxidant stress.

Literature Review (Word count 1053)

Popular food supplements include the micro-nutrient vitamins (Mintel, 2020) which can provide a range of health benefits. Thus, it was unsurprising to read that 59% of UK consumers (aged 16+) reported taking a supplement during 2018 (BNF, 2019). With market spending set to reach £515 million in 2021 (Mintel, 2020) the popularity of vitamin and other supplements show no sign of decline.

The published benefits of micronutrient supplements are numerous, including boosted immune health, prevention of heart disease, cancers and other chronic diseases. However, like many good things, taking too much of a vitamin can be harmful (Oberg and Stoppler, 2020). Both are acclaimed medics and authors of international research papers and textbooks. Additionally, there has been some dispute regarding 'artificial' micro-nutrient consumption. Cooperman's (2019) proposal that it is possible for people to easily over consume micro-nutrients in the form of supplements, was deemed acceptable. However, it is questioned whether the human body's ability to naturally expel what is not needed, and the influence on bioavailability from enhancers/inhibitors, which may differ greatly between individuals, had been fully considered.

Colia (2017) was in support of the suggested risks to health, stating that too many antioxidants in the form of supplements could lead to an increased risk of death and disease. However, others claimed it does not seem to matter if the excess is due to dietary foods or supplements, but natural sources of antioxidants do appear 'safer' than the supplement form (Channel, 2012). Both these sources are a few years old but the materials were reviewed/updated in 2020 and validated by a credible Department of Health. However, neither provided a detailed reason for their statements.

A major suggested benefit of antioxidant supplements includes increased protection against cancers. Vitamin C supplements are often marketed as having powerful antioxidant benefits that can strengthen the body's natural defence (Healthline, 2021), and is potentially a marketing ploy by this business source. In support though, the vitamin is an electron donor which uses electrons to stabilise free radicals that may cause harm to body cells and singular DNA strand (Ware, 2018), thus reducing the risk of cancer. This was sourced from a Registered Dietician Nutritionist, this was a fact cited by many, therefore deemed valid. However, potentially this was a reference to the vitamin in its natural form in foods, not supplements. It is debatable if the average consumer is capable of distinguishing between the two sources. Perhaps supplements provide an easier route of consumption and may even encourage the low fruit and vegetable consumption recorded earlier.

In laboratory studies, the presence of increased levels of exogenous antioxidants has been shown to prevent the types of free radical damage that have been associated with cancer development. However, nine randomized controlled clinical trials did not provide evidence that dietary antioxidant supplements were beneficial in primary cancer prevention (NCI, 2018). This was believed to be an acceptable claim by a reputable US Government organisation. Indeed, shockingly a report by NIH, 2017 found that antioxidants such as vitamin C administered to women had health risks, including higher rates of skin cancer. The data though had potential limitations, for instance - other lifestyle factors were perhaps not considered such as sun protection practices (Imperial College London, 2019).

Furthermore, in excess vitamin C can cause haemochromatosis, the storing of excess iron in the body, consequently causing damage to body tissue (GB Health Watch, 2021) which can be fatal. Colia (2017) in support, stated too many antioxidants in the form of Vitamin C supplements could lead to an increased risk of death and disease. The relationship

between free radicals and health may be more complex than had previously been thought. Under some circumstances, free radicals may actually be beneficial, and removing them may be undesirable. It was acknowledged by the author that this information was based on a small size clinical trial.

Vitamin A supplements enable the intake of the antioxidant beta-carotene which protects against free radical damage, and by extension cancer of the cells. Excess vitamin A can lead to teratogenic hypervitaminosis, of which side effects include: dizziness, nausea and joint/bone pain (Healthline, 2018). Both deemed accurate statements as the factsheet providing this information was assembled by multiple international health professionals. Beta carotene has additional adverse effects on those who are smokers, including an increased risk of lung cancer and cardiovascular disease (NIH, 2013). Pregnant women are also made aware of the dangers of excess to the foetus and thus the need to avoid supplementation. This suggested that antioxidant stress can be multi-factual.

The UK Department of Health recommends that everyone should consider a daily Vitamin D supplement, especially during the autumn and winter months (Vitabiotics, 2021). Vitamin D is formed by the action of sunlight on a provitamin present in the skin and access to this source is reduced at this time. Some groups of people are more at risk of deficiency such as the elderly, the housebound and those who cover up to a great extent during winter months. This vitamin has antioxidant potency and the ability to decrease the risk of atherosclerosis and in some aspects aid cardiovascular disease prevention. However, further reading revealed a suggestion that most of the randomised trials led to 'inappropriate' conclusions (Imperial College London, 2020). Unlike Vitamin C which is water soluble and excess is more effectively eliminated by the body, Vitamin D is fat soluble. Taking extremely high doses of vitamin D for long periods may lead to excessive build up in the liver. Importantly, toxicity occurs almost exclusively in people who take long-term, high-dose supplements without monitoring their blood levels (Healthline, 2019). This gives rise to concern as the public often take action based on media coverage and advertising but which is not necessarily medically approved.

Vitamin E also helps heart health, targeting low-density-lipoprotein cholesterol enabling prevention of atherosclerosis, and blockages that could result in coronary vascular disease. However, conflicting studies from Harvard (2019), stated that those who participated in trials and received large doses of Vitamin E had none of the above benefits. In contrast, negatives were established including diarrhoea, flatulence, bloating, weakness, headache, fatigue, and blurred vision which occurred when vitamin E supplement was consumed in excessive amounts. Therefore, while epidemiological studies have produced some intriguing results, they have yet to clearly establish that a high intake of antioxidants leads to a decreased cardiovascular disease risk. Furthermore, recent findings from this prestigious and trusted source of medical education Harvard University (2019), revealed 'current criticism of antioxidants, claiming they are hyped'. Supplement manufacturers may be guilty of pedalling this 'hype' and the disease-fighting properties of all sorts of antioxidants, advocating profit over health.

Conclusions and Recommendations (Word count 308)

It was generally accepted that antioxidant vitamins play an important part in the body's immune response, thus offer protection against a range of chronic diseases. Nevertheless, major research bodies would recognise that more research is necessary. Harvard University would claim that the value placed on antioxidants is 'hyped'. Academic research appeared to recognise that natural sources are a safer form and provide greater benefits than supplements. Other sources promoted supplementation or used a lack of understanding by the consumer of how vitamins behave.

A wide range of health concerns was discovered though it was concluded that the risk of antioxidant stress was more likely from excessive consumption of the fat soluble vitamins which the body stores, namely Vitamins A, D and E. Unlike Vitamin C which is water soluble and therefore removed in the urine, these are stored in the liver. Since these are often taken as a multi-vitamin supplement this adds to the concern. Most worrying was to read that the health concerns are somewhat serious and pose major threats to well-being.

Often marketing techniques, media, hearsay, peer and family pressure can be more influential than evidence based information. Consumers are often prepared to accept the easy option of pill popping rather than devote the time, skill and energy required for planning, purchasing and preparing food naturally rich in antioxidants.

There appears to be a lack of research to determine the differences in the effects of supplement antioxidants on individuals who consume a well-balanced diet and those who do not.

Consumers' understanding of possible effects of over consumption of antioxidants through supplements and their willingness to revert to natural food sources could be investigated.

Antioxidants are comprised of vitamins and minerals such as zinc and selenium. The role of mineral supplementation could be investigated to consider if they too have both pros and cons to human health.

(Total Word Count 1701)

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