

## Deadly Missiles or Delicious Morsels?

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### Abstract

*Exposure to substances in the environment and foods and their relationship to various human diseases have interested scientists and others for many years. It is often difficult to establish a linkage between exposure to substances and human disease on account of the low concentrations of the chemicals of interest in the environment. These materials may be in the general working environment or in food items. It is the later group that we investigate here. Our primary interest is with the intake of nitrates/nitrites and amines for when these are simultaneously present in the body powerful carcinogenic nitrosamines are generated. We look at the foods in which they are often found and draw on this information to reflect on some statements made by Ellen White more than 100 years ago warning of the dangers apparently inherent in eating certain food items.*

### Introduction

Environmental and food-associated carcinogens have come into focus in recent years. In 1970 the respected journal *Nature* highlighted the potential significance of nitrites consumed in our foods. It was alleged that nitrites in our food could react with amines to form a group of chemicals called nitrosamines which have carcinogenic potential.<sup>1</sup> Nitrites are used as preservatives in some food items such as fermented meat products in order to stabilise red meat colour, contribute to flavour, and to inhibit some spoilage and food poisoning organisms. This made them the instant target of heated debate.<sup>2</sup> The subsequent discovery that the incidence of lymphatic cancer increased in rats fed nitrite only served to intensify the discussion.<sup>3</sup>

This discussion took my interest as amines are present in foods other than fermented meats and nitrites are readily converted to nitrites in the digestive tract. The possibility of predisposing ourselves to the formation of some cancers as the result of dietary choices is of considerable interest. It is possible, too, that these and other recent scientific developments may shed light on sometimes puzzling statements made by Ellen G. White many years ago. But first of all, let us start at the beginning and establish a base for our discussion.

### Nitrates and Nitrites

Nitrites can be added to dietary items as preservatives, but they may be generated through microbial activity in the mouth and intestines following the ingestion of nitrates. These are a natural part of a plant based diet but may also be ingested in contaminated water.<sup>4</sup> Vegetables sometimes provide the largest daily intake of nitrates and they may also be the most important source of nitrites entering the stomach.<sup>5</sup> Whereas the level of nitrates and nitrites may be well regulated in developed countries, this is by no means the case in developing countries.

Nitrates are reduced readily to nitrites (an oxygen molecule is lost) in an environment lacking oxygen (anaerobic). The significance of this was realised some years ago when the condition known as methhaemoglobinaemia was investigated. In this condition the oxygen carrying capacity of haemoglobin is reduced by the presence of nitrites. This may lead to cyanosis and death, especially in children. As a consequence of these phenomena, the World Health Organization regards nitrate contamination levels of waters as of considerable importance.<sup>6</sup>

### Amines

We have accounted for nitrite generation, but what about the amines. These are normal constituents of fermented foods and may be found in selected fruit and vegetables. They do not normally represent any hazard unless they are ingested in large amounts or natural mechanisms for their disposal are not possessed by the individual.<sup>7</sup>

A number of common food substances can be sources of amines (some names noted in brackets). For example, rich sources of amines may be carried by mature cheeses (tyramine) and chocolate ( $\beta$ -phenylethylamine). Histamine poisoning may result when excessive amounts of this amine are ingested. Such poisoning often is associated with the consumption of scrombroid-type fish (these carry high levels of the amino acid histidine), but cheese may also be involved.<sup>8</sup>

In certain predisposed individuals, the consumption of amines present in foods may cause unusual adverse effects. Hypertensive crises may be observed following the consumption of amine rich products (e.g., cheeses and Marmite). These effects are usually seen in individuals who lack enzymes which normally degrade these amines, and also in psychiatric patients treated for depression by certain drugs which inhibit the action of essential enzymes. In other individuals classical migraine headache may be precipitated by the intake of foods rich in amines such as certain cheeses and chocolate.<sup>9</sup>

While the final word has not been written on this subject, there is a clear advantage in reducing the intake of amines, nitrates and nitrites.

### Nitrosamines and Cancer

The advantage of reducing the amine intake becomes even clearer when we consider what happens when amines react with nitrites (often derived from nitrates). Nitrosamines are produced when amines and nitrites interact especially in the acid environment of the stomach and many of these reaction products are carcinogenic. Some early authors considered that nitrosamines were likely to be causally related to cancer in humans because carcinomas are induced in test animals through the application of nitrosamines.<sup>10</sup> Subsequently, close to 300 nitrosamine and N-nitroso compounds have been shown to induce cancers in a variety of experimental animals.<sup>11</sup> Indeed, at this point it is well to remember that a tobacco-specific nitrosamine is associated with neoplastic transformation of cells.<sup>12</sup> This and other evidence means that there may be no particular strength to arguments which assert that high levels of amines in the diet are irrelevant to our health. They could very well be involved in disease states depending on their nature, level and on other regulating factors.

Following on from the above animal experiments, it is interesting to observe that a high correlation has been noted between nitrate ingestion and gastric cancer in humans in some countries.<sup>13</sup> Definitive evidence of a link between dietary intake of nitrosamines and cancer in humans has not been obtained, but there are indications of such a link as well as indications that the association is far from simple and straight forward.<sup>14</sup> Suggestive evidence is given by several studies, as follows. Strong associations have been established between exposure to dietary nitrosamines and oesophageal cancer in China. The high frequency of the same cancer in Linxian county, Henan province, was strongly associated with the intake of N-nitroso-N-methybenzylamines. This nitrosamine induced tumours in human oesophageal epithelium cultures in the laboratory.<sup>15</sup> Then a study in Hong Kong established a relationship between pickled vegetable consumption (N-nitroso compounds involved) and oesophageal cancer risk.<sup>16</sup> A somewhat related study dealing with environmental exposure of rubber workers to nitrosamines supports the proposition that nitrosamines predispose to cancers of the oral cavity, pharynx and oesophagus.<sup>17</sup>

### Carcinogenic foods?

Amines are present in fermented foods such as wine, dry sausage, processed meats, sauerkraut, miso, soy sauce, cheese, and chocolate, but are also present in high concentrations in spinach and baked eggplant.<sup>18</sup> There are many factors that influence the level of these amines in foods. In the manufacture of cheese, for example, there are a variety of metabolites produced and their nature is dependant upon the starting material, age and the type of micro-organisms used.<sup>19</sup> This means in practical terms that we cannot assert that all foods containing amines and related materials are carcinogenic. However, of particular concern to this discussion is the knowledge that many commonly found proteins can be converted to carcinogenic derivatives when they react with nitrite originating from ingested nitrate in the human body. It is well known that nitrate salts increase in crops and agriculture run-off water as the level of fertilizer usage increases so that the suggested scenario of significant nitrite-amine reactions in the body is not outlandish.<sup>20</sup> Furthermore, it is well known that some of the amines found in meat, beer, cheeses and other food items are potentially carcinogenic. The intake of these items and biogenic amines differs from country to country. What is lacking is conclusive epidemiological evidence.<sup>21</sup>

Can we use the above information to help us understand some statements written by Ellen White many years ago? I think that we can attribute partial reasons to her caution. In 1868 she penned the following

comment to a couple suffering from ill health as a consequence of their intemperate habits. She wrote: 'Cheese should never be introduced into the stomach'.<sup>22</sup> This advice may be construed as being specific to these individuals on account of their poor health status and flowing from a desire to direct them to foods that were easy to digest. However, a more general case potentially can be argued along the lines that the combined effects of eating cheese potentially rich in fats and amines and laden with disease carrying organisms rendered it unfit for consumption. There is the added problem that should be mentioned in that cheeses can be covered with luxuriant mould growth and these organisms can sometimes produce damaging toxins in the food item. The growth of some toxin-producing moulds is hardly noticeable.<sup>23</sup> Against this background of information, it must be remembered that environmental and legislative controls were not extensive in the time when Ellen White lived making some food items together with drinking water inherently more dangerous than they may be today.

Somewhat later (1905) we read: 'Cheese is still more objectionable [than butter]; it is wholly unfit for food'. In the German language edition, White permitted the editors to use the term 'strong and sharp cheese' to underscore what she meant by 'objectionable'. The editor's comment accompanying the English print edition indicates that the term did not apply to 'cottage cheese or foods of a similar character'.<sup>24</sup> This statement is clarified further in Arthur White's publication. He wrote: 'There was a large garden at Elmshaven, so usually there were some fresh vegetables, and in winter there was an abundance of dried corn and canned tomatoes. A baked dish of macaroni, with beaten corn and eggs, frequently appeared on the table. Cottage cheese was served, but not cured cheeses. Ellen White liked cooked greens every day, and these would vary according to season. From the fields came dandelion and mustard greens, and, of course, there were other more conventional leafy dishes'.<sup>25</sup>

Individual Adventists have puzzled over the meaning and accuracy of the 1868 and 1905 statements for years. Some have accepted them at face value and have rejected cheese as an item of food because that was the way that Ellen White is perceived to have acted after she accepted the health reform message. Others have sought to understand the basis for the statements and how they may be applied today. The following information may help to give greater clarity to the words of inspiration.

In the time in which the first statement was written, milk-borne diseases were more prevalent than now, since infectious diseases were not well understood and sophisticated forms of control such as pasteurisation were unknown. At the time of the second statement, pasteurisation had been perfected and was being more generally used so that food-borne diseases were in the process of being reduced. Some have considered the disease-load carried by cheese the chief reason for the Spirit of Prophecy advice. Deeper consideration of this idea leads us to reject it as the primary reason. The statements about cheese mentioned above were made around the same time that other dairy products were spoken about more supportively.<sup>26</sup> Furthermore, the manufacturing processes for both unripened and ripened cheeses are very similar in the initial phases, including the possible use of animal rennet to process the milk. It is during the latter phases of the process where we must search for possible clues as to the differential advice. Both cheeses (unripened and ripened) have the potential for disease-carriage. Disease organisms may arise from the donor animal or be introduced during the manufacturing process.<sup>27</sup> Indeed, outbreaks of various diseases have been traced to contaminated cheeses whether mature or immature.

The point of departure in the preparation of unripened and ripened cheeses is, as the name suggests, in the ripening process. Cottage cheeses are marketed within days of preparation whereas other cheeses are matured under defined conditions for periods of some months (most cheeses are ripened for at least three months). The length of the maturation time determines the classification of cheddar cheeses as 'mild', 'strong', or 'mature'. The first indication that all was not well with some matured cheeses for selected individuals came in 1963. It was observed that in some psychiatric patients hypertensive attacks were precipitated by cheese intake when the patients were on certain drug medication schedules. The episodes were characterised by high blood pressure, headache, fever, and maybe perspiration and vomiting. The culprit found in the cheese was tyramine which is a biogenic amine.<sup>28</sup> Reflecting back on the writings of Ellen White, we notice with interest that even a relatively new cheese was given a poor report card in another statement written in 1870. She said, the cheese 'although new, it was altogether too strong for the stomach, and should never be introduced into it'.<sup>29</sup> We suggest that the apparently 'strong' features referred to may have reflected the strong taste produced due to the by-products of vigorous microbial activity. It might be noted that taste products classically are manufactured towards the end of metabolic pathways and that selected microbes can accelerate the process under ideal conditions to produce defective cheeses within short time periods.<sup>30</sup> In summary, I suggest here that the reasons for rejecting 'strong' cheeses as suitable food items may be for a

variety of reasons. However, I will continue to emphasise what I consider the main cause for concern.

During the ripening of cheese the protein casein is broken down by the added rennet and bacterial action (fermentation) to yield simpler molecules such as peptides and amino acids. Some of the bacteria produce amines from these substrates. The most significant amines in cheese are tyramine, histamine, phenylethylamine, tryptamine, putrescine and cadaverine. In short-ripened cheeses, the opportunity for the production of various by-products is limited. Even in well-matured cheeses, biogenic amines may be present in small quantities (we cannot be too free with our generalisations). In broad terms, however, the amine content increases with increases in storage time.<sup>31</sup> And cheeses made from pasteurised milk shows much lower levels of amines than those made from raw milk.<sup>32</sup>

From the scientific evidence available, we can argue with some degree of credibility that the advice given by E. G. White is reasonable. First, there is the issue of the difficulty that may be experienced with the digestion of cheese. Then we understand that the vegetarian life-style may provide a rich source of nitrates coming from plants and perhaps liquids and that the body converts these into nitrites. In addition, moderate to high levels of amines may be added through the consumption of other food items, including cheeses, leading to the formation of nitrosamines in the human body under specific circumstances. However, White's writings are not meant to be read like a recipe book, but rather underlying principles are enunciated. With this background information, we can now partly appreciate the scientific basis for her warning concerning some cheeses. We can say that amine-associated illness has been connected with certain cheeses and other food items and that some individuals are at greater risk than others. Furthermore, individuals may be predisposed to cancers through the intake of nitrosamines and mycotoxins. The dangers vary in different parts of the world and have changed over time. It is up to us to exercise appropriate care in our eating choices with foods rich in amines.

Ellen White urged us to think and to reason from cause to effect.<sup>33</sup> Her books imply that we should follow the best scientific advice. We can assert this with reasonable confidence if we care to trace carefully her instructions regarding the safe use of milk.<sup>34</sup> When the scientific world was divided over the usefulness of heat-treating milk, she chose the correct course when some of the world's great scientists took the alternative route (however, that is another story). We can also say this if we look at the principles underlying her advice regarding the use of three fermented products, namely cheese, olives, and pickles.<sup>35</sup> Her advice differs for the three food items mentioned. The question is: Why is this? And what are we to conclude about the dozens of fermented products that are not mentioned in her books? Are they always safe? I think that we are in the process of gaining the answers and establishing principles as outlined above.

A prophet's advice should have more than regional applicability when the universal principles of health are involved. In seeking to emphasise the general rather than the particulars, we make the message of the prophet of far greater importance. I have addressed some of the principles in this article that are relevant to a number of fermented products, but this should not be considered an exhaustive treatment of the issues associated with all fermented food items. The scientific community is continually adding to our resources of knowledge. Perhaps not surprisingly we are finding that this corresponds closely with that supplied by the source of all wisdom, God (Proverbs 8:22-35).<sup>36</sup>

## Endnotes

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