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Are Natural Products Safe?



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ABSTRACT

In recent years, many food and cosmetic products that claim to have been made from natural components have become prevalent in Japan. Interestingly, the term “natural” invokes a sense of safety and security. In this study, we investigate whether natural products are safe and whether chemically synthesized products or artificial products harmful. Furthermore, we examine why people regard natural products as relatively safer and feel more comfortable with them. We do this mainly by examining the safety of natural products by comparing them with natural foods such as vegetables that people consume daily.



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INTRODUCTION:

In recent years, Japan has witnessed a surge of food and cosmetic items claiming to be made of natural components or naturally-derived components. This may be because the word “natural” evokes the image of “safety” and “security.”¹⁾ However, are natural products really safe and chemically synthesized products, or artificial products, harmful? Moreover, why do people feel relatively safer natural products? Since natural components are substances synthesized by living organisms within their bodies, they may be biocompatible with the human body¹⁾. However, substances produced as a result of the metabolism of living organisms also include those created as part of the organism’s defense mechanism against other living organisms in the fight for survival. Certainly, not all of these are toxic to the human body, but some require caution. In this paper, we examine the safety of natural products, by comparing them with foods such as vegetables that people consume daily. We also consider the reasons why Japanese people feel safer when using natural products.

Harmful natural components

It is well-known that plant-derived natural products—not limited to food items—exhibit extremely high diversity and functionality.¹⁾ This plays a vital role in a plant’s life cycle. All plants exhibit a variety of physiological responses to adapt to their surroundings, but a typical one is an attack on foreign enemies using chemical substances¹⁾. Plants protect themselves against pathogens by accumulating antibacterial substances and against herbivores by accumulating repellents or toxic compounds that they produce. The production mechanism of these species-specific protective substances has evolved over millions of years of evolution, leading to a vast variety of plant species in the ecosystem. Plants are known to accumulate different groups of substances depending on the species. Differences between species greatly contribute to the diversity of plant-derived natural products.

Some examples of such protection substances affecting food safety are provided as follows. It is a well-known fact that potato sprouts contain toxins that are meant for preventing diseases. These toxins are solanine and chaconine, which are steroid saponins (alkaloids), possessing antibacterial properties that protect potatoes against pathogens¹⁾. Moreover, since they inhibit cholinesterase, they can cause toxic symptoms and even death in the worst case when ingested by humans. Consumption by humans is not originally planned within the potato’s life cycle. Therefore, from the plant's perspective, a human’s exposure to such toxins is by

their own free will. Similarly, estragole, a scent component found in herbs such as basil, has been reported to be carcinogenic. In addition to plants, mushrooms are also known to possess toxic substances²⁾, and among animals, tetrodotoxin of globefish is also well known (Table 1)^{3,4)}.

So, how much of this protective, or pesticide, substance is contained in our regular diet? Nowadays, there are many surveys available on naturally occurring pesticide substances, the one published by Ames *et al.* in 1990 is considered to be the most representative one.¹The report states that all the plants surveyed contained dozens of natural pesticide-like components per species.⁵Additionally, the concentration of these natural pesticide-like substances in plants is at the ppm-level. It is suggested that they are present in very high concentrations compared to the residual amount of synthetic pesticides and the general concentration of water pollutants (ppb)⁵⁾. There is no evidence to suggest that this is due to their low toxicity. Some of these natural pesticide-like substances are carcinogenic, and their risks are also mentioned in the same paper. The present study is about the potential risks of natural products, and although opinions about their effects on the human body vary, it is imperative to clarify that natural products are not always safe for humans.

Why natural products are often considered good?

It must be noted that both natural and synthetic products are chemical substances. However, the term “chemical substance” carries a negative connotation.¹Moreover, the general public believes that chemical substances include only artificial substances and that they are hazardous to human beings. On the contrary, natural products are associated with safety and security. Generally, people with limited scientific knowledge tend to think this way, which facilitates the mindset that as long as it is natural, it is safe for human consumption—which is factually incorrect^{6,7)}. We today know that natural products are not necessarily safe, and artificial ones are not necessarily dangerous. However, no one has precise knowledge about every food product. Therefore, albeit mistakenly, people tend to favor natural products when making quick decisions in daily life. In general, all substances—natural or synthetic—are risky for human health, and it is advisable to believe that the risk is directly proportional to the quantity consumed⁸⁾. Even if a small amount has a medically beneficial effect on humans when consumed in large quantities, it may cause illness or even death²⁾. A simple example to support this is nutrients in food. Sugars, proteins, and lipids are important components that form the human body and produce energy for activity. However, if consumed in excess, they

can cause diabetes, kidney disease, obesity, etc⁹⁾. This is true for both natural and artificial food products, and cosmetics.

CONCLUSION:

No significant difference in toxicity levels has been found when comparing naturally occurring pesticide-like substances with major synthetic pesticides¹⁾. Synthetic pesticides are not chemically synthesized natural products, but either partially modified based on the chemical structure of natural products, or artificially designed and synthesized from the beginning.¹ Artificial objects are also generally optimized to suit human physiology and are intended to reduce negative effects while exhibiting usefulness. When artificial products are put on the market, unexpected effects may occur, so it is imperative to conduct safety evaluations and environmental load evaluations carefully and extensively. In other words, when artificial products are used as medicines or foods, it can be considered that people have come to use them after thoroughly examining their toxicity. In the case of natural products, the amount and part of food that can be eaten is determined experientially and through scientific knowledge regarding its toxicity.

One should not trust the safety of a natural product simply because it is naturally derived. As explained above, natural products have evolved to match the life cycle and physiology of their species, and are not designed for human convenience. Their chemical components, therefore, are rarely beneficial to humans. It is commonly believed that humans consume only those parts of organisms that have beneficial aspects. This is because they are used by humans for a purpose completely different from the physiological, chemical, or ecological significance of the active substances originally produced for use by the living organism. Before being used by humans, the potential negative effects must be thoroughly investigated and considered. This approach in dealing with natural components is well-controlled by human wisdom: the harmful aspects—if miniscule—are tolerated or concealed, and the beneficial aspects are magnified⁴⁾. This balanced approach must be properly understood by us all.

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Table No. 1: Natural poison

Name	Causative organism	Symptoms
Inside the plant solanine	Potato [germination part, green part]	abdominal pain after a few hours of incubation, gastrointestinal disorders, sleepiness, mild disturbance of consciousness
amygdalin	Plum	cyanide poisoning
muscarine	Fly agaric (<i>Amanita muscaria</i>)	peripheral parasympathetic excitatory action, vomiting, diarrhea, visual impairment, coma (death is extremely rare)
aconitine	Aconitum [root]	mouth pain, yellowing, salivation, nausea, vomiting, dysphagia, mydriasis, speech disorder
Inside the animal tetrodotoxin	Pufferfish [internal organs]	akinesia, paralysis, speech disorder, dyspnea, decreased blood pressure
pyropheophorbide-a	Abalone [midgut gland]	photosensitivity
ciguatoxin	Southern fish	digestive disorders, nervous system disorders, circulatory disorders
saxitoxin	Paralytic shellfish [midgut gland]	similar to tetrodotoxin

A natural poison is a physiologically active substance produced and possessed by an organism and has an adverse effect only on other organisms.

Based on the data in reference 3).

