

**Nutrichemistry, a means of preventing and healing chronic diseases**

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**Type of article:** Review**Abstract**

The burden of chronic diseases, such as cancer, diabetes, heart disease, and hypertension is so heavy that health care systems' provisions are hampered in many countries. The high incidence of chronic diseases might be mainly explained through poor diets and detrimental conditions of lifestyle. A distinct insight on healing and preventing those diseases will be described in this short review, which includes our own work.

**Keywords:** Heart diseases, Cancer, Chronic diseases, Diabetes**1. Introduction**

As far as contemporary medicine is concerned, almost nobody discusses the efficiency of Western therapies. Holistic medicine, as practiced for millennia in India and China is sometimes considered folk medicine despite it demonstrating its effectiveness. Needless to say, that African medicine is simply considered as spiritual magic. However, as time passes, many trials are conducted against drug companies for devastating the lives of sick people as a results of huge side effects and conflicts of interests (1-4). As a result, more and more people turn towards natural, soft or holistic medicines to avoid the detrimental side effects of modern drugs (5). As a matter of fact, modern drugs are designed and developed around a single or an array of clearly identified compounds so that one can have an accurate insight on their beneficial or side effects. On the other hand, holistic medicine uses mixtures of natural products, the advantage of which, is taken from the mutual counteract of undesirable effects of compounds present in mixtures. Many biochemical processes are based on redox reactions. When equilibrium is disrupted between oxidation and the reduction system, many chronic diseases such as cancer, diabetes, inflammation, hypertension high blood pressure, etc. set on. It is obvious that inflammation or high blood pressure is not a disease but a symptom of something hidden that deserves to be researched carefully. Therefore, addressing such basic mechanisms of life as redox would be a novel approach to healing and preventing chronic diseases. How could chemistry involve itself in prevention and healing diseases when it is almost considered a source of pollution and cancer? We are therefore, at the beginning of a novel era, beyond the genetic era and taking advantage of almost forgotten ancient knowledge and revamping old wisdom (6) based on a first citation: "A food system dependent on chemicals is not a food system. It is a chemical system" (Natural Society). Another one, older than the former is from Hippocrates and he says: "Your food should be your first medicine". Then, what is nutrichemistry? Nutrichemistry involves the use of everyday life nutrients, along with the design of nutrition-based drugs that could bring essential nutrients to the human body while healing its diseases, decreasing side effects and alleviating health system financials. This approach takes into account both complexity and susceptibility of the human body along with environmental variables. Doing this, nutrichemistry is joining a global motion advocating personalized treatment of diseases while making "Precision chemistry for Precision Medicine" (7).

**2. Discussion**

A few chronic diseases are discussed below, among which have a particular financial burden on health systems as well as on individuals and their families.

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### 2.1. Obesity, hypertension and heart diseases

Many existing diet guidelines are considered nonsense as they entail chronic diseases and complications. Meanwhile, those who follow those guidelines are often caught in a vicious circle. Those popular guidelines relate to fats, cholesterol, and sugar. Nowadays, they are so outdated that the US has implemented new ones to cope with obesity along with related diseases such as hypertension, stroke, and cardiovascular trouble and so on. Therefore, well-known cardiologists and nutritionists have come to a conclusion that “Low-Fat High-Carb Recommendations Have Been All Wrong” because conflicts of interests hamper the implementation of truthful nutrition guidance (8, 9). The global obesity epidemic is not related just to fats, but more likely to widespread carbohydrates consumption, since sugar is hidden almost everywhere and slow sugars are neither slow nor low energetic. Only choosing wise nutrition guidance makes diabetes reversible (10). Moreover, sugar triggers production of reactive oxygen species that induce chronic inflammation, a common cause of chronic diseases (11, 12). For a long time, cholesterol has been blamed for being the only offender responsible for cardiovascular diseases. (Figure 1) However chemically speaking, only a compound identified as cholesterol actually exists, with a unique and single structure along with its stereochemistry. Why is this compound talked of as two distinct products, i.e. “good” and “bad” cholesterol? This kind of misuse of science is simply a deceptive science. As a matter of fact, analysis of blood clots of a person who has died resulting from stroke showed that cholesterol is just a 10% part of clots responsible for cardiovascular troubles, whereas the remaining greater part is made of calcium, lipids, proteins (13), etc... Therefore, in order to cope with obesity and “high” cholesterol, it would be advisable to address bad fats and especially, trans fats that are considered major factors of cardiovascular diseases (14, 15). Moreover, carbohydrates and sugars are the roots of heart diseases, but not fats (16-20). Obviously, Science does not have all the truth in sui generis, we do not have to blindly follow “God” science, but instead use our minds to keep our decision-making freedom and keep the ability of comparing “truths” for ourselves and relatives, keeping in mind that everyone is distinct from another. In this way, no one would be just a statistic in a health system. The human body is an electric power system where the heart plays a crucial role; the heart is indeed a big energy-consumer organ as evidenced by the huge amounts of mitochondria in it to power its function. Should those be depleted, either because of illness, burnout or another reason, the heart no longer works as wished. This situation could lead to arrhythmia, atrial fibrillation, and high blood pressure. Besides, optimal functioning of the heart needs magnesium, vitamins D2, D3, K2, the series of B vitamins and selenium along with some useful micronutrients (21). Those who had suffered from this kind of trouble could counteract it simply by using coenzyme Q10, selenium, magnesium, vitamin D3, reasonable antioxidant consumption and exercise. Therefore, preventing cardiovascular trouble at any age could be achieved through affordable diet and life discipline.

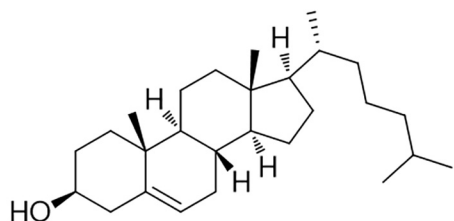
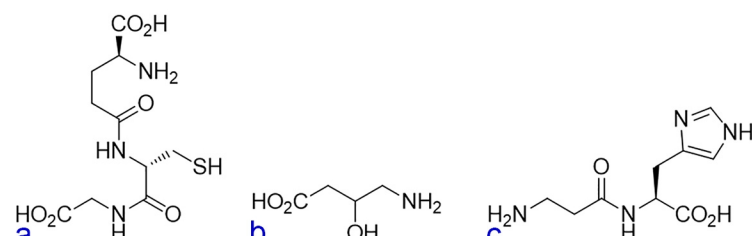


Figure 1. Structure of cholesterol

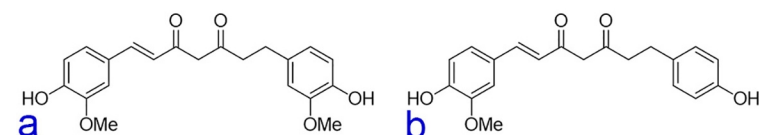
### 2.2. Cancer

Cancer is usually believed to come from genetic and environmental factors. Almost nobody thinks about the impact of nutrition on this disease onset. Many healing approaches are being implemented to control tumor cells, and description of each among them is far beyond the scope of this text. However, it is more and more obvious that chronic diseases are the result of chronic inflammation. This process comes from aggressive chemical species' that invade mainly the cardiovascular system that the body attempts to control and eliminate. In our mind, not only high blood pressure and cardiovascular diseases are generated by this aggression, both cancer and diabetes are concerned as well, and are rooted in a common main mechanism, i.e. failure of a redox system. At whichever age, those species entail mutations so that to some extent, everyone might have cancer cells within them. The big difference between those who suffer from this disease and those who do not develop it, lies in the ability of a person's body to cope or not, with those aggressive species. Antioxidants and essential amino acids play a crucial role in controlling the onset of the disease, beginning by such naturally-occurring compounds such as glutathione (Figure 2a), L-carnitine (Figure 2b), carnosine (Figure 2c), Coenzyme Q10, and a series of useful nutrients among which garlic and onions play important beneficial roles (22-24). Now it is well established that the contribution of nutrition to cancer

incidence is very high; for example, overuse of cooking oils associated with high temperature cooking conditions generate free radicals that are detrimental to the redox system, depleting the amount of glutathione and other natural antioxidants. Once again bad fats, but not saturated fats and cholesterol, have a major impact on the building up of clots. On the contrary, sugar is a major contributor to cancer as it is one of the preferred nutrients for the cancer cells they use to power their growth. Therefore, evidence is more and more given that cancer is a metabolic disease (25). Cancer cells are known to have an accelerated metabolism; therefore, many drugs have targeted cell division to control the spreading of the disease. However, countries such as India where holistic medicine is practiced and curcumin (Figure 3a) has been traditionally consumed in meals almost every day for millennia, show the lowest incidence of any type of cancer in the world. Moreover, many investigations have shown the positive impact of curcumin, curcuminoids (Figure 3b), and derivatives on controlling and healing cancers and other diseases (26-33).



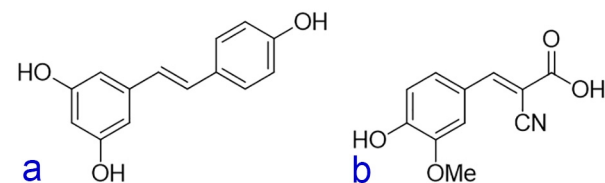
**Figure 2.** Glutathione, L-Carnitine and Carnosine.



**Figure 3.** Curcumin and Demethoxycurcumin

### 2.3. Our approach

Curcumin and its derivatives belong to the phenolic family, so we set on a task of searching for natural polyphenols and derivatives that could be used as a starting material, and turn them into useful diet tools and drugs that could contribute a great deal to prevent chronic diseases with low or no side effects. As literature describes and continuously updates antioxidants' health benefits, we focused on resveratrol (Figure 4a), a natural polyphenol that is found in a variety of natural sources such as grape skins, berries and pomegranate among others. By means of extensive literature we were aware this compound gave evidence of its efficiency in inhibiting damaging free radicals, preventing cancer and Alzheimer's diseases, depression and extending life span. It is obvious that the whole of this literature is far beyond the scope of this paper (34, 27). Moreover, the compound improves brain blood flow, thus crossing the blood brain barrier as a promising neuro-protective and healing drug. Because of all those effects, we designed a resveratrol-derived fragment to be assessed as an anti-cancer treatment. Compounds developed exemplified by the one shown in Figure 4b showed a very interesting anti-cancer profile and two of them show no side effect on normal cells, only hampering the development of cancer cells (38). According to the "Warburg effect" (39), we made an assumption that the synthesis of hybrids that aim at destructing cancer cells' power plants, inducing apoptosis on cancer cells but not on normal cells, could be an interesting approach to developing an affordable nutraceutical which could alleviate health system finances and decrease undesirable side effects of chemotherapy. Then we designed simple compounds based on the assumption that the more the energy-consumer cells, the more they will be destroyed or be impaired in their development, while normal cells will be less affected. This work deserves further development and to be amplified. As exemplified by the figures below, resveratrol (RES) and 3-bromopyruvic acid (3-BrPA) gave interesting results on the growth inhibition of reference breast cancer cells. Results of 3-BrPA effects are already described in the literature on a series of cancer lines (40) and we observed the same behaviour. From these results, ongoing work is performed on the synthesis of hybrids, the activity of which, is much more promising than those preliminary results.



**Figure 4.** Resveratrol and  $\alpha$ -cyano-4-hydroxy-3-methoxycinnamic acid

### 3. Conclusions

Literature clearly shows that using natural sources to improve and restore immunity would be a wise approach to taking care of health. Those compounds used in developing drugs would be safe and would not negatively interfere with vital processes. Drugs are necessary when they are needed, and when associated with wise good nutrition guidelines, things could be improved. Finally, Nutrichemistry, with an aim to use natural resources to achieve such a goal would preserve present and future generations' survival and wellbeing.

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### Conflict of Interest:

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