EMBJ.ORG FOR YOUNG DOCTORS

EUROMEDITERRANEAN BIOMEDICAL JOURNAL
2021,16 (36) 157-161
(*FORMERLY: CAPSULA EBURNEA*)

Review

NUTRACEUTICALS, A TOOL FOR PSYCHOPHYSICAL WELL-BEING ALSO IN THE OCCUPATIONAL FIELD

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ARTICLE INFO

Article history:
Accepted 24 Aug 2021
Revised 20 Oct 2021
Published 25 Nov 2021

Keywords:
nutraceuticals, occupational risk, occupational medicine, vitamins, Omega 3, melatonin, food supplements.

ABSTRACT

In the original definition: "nutraceutical is a food or part of it, as well as a dietary supplement, which has a benefit on health or a disease condition". In the professional field, together with the specific risks responsible for occupational pathologies, there are additional factors, such as psychosocial and environmental ones, which are difficult to identify and interpret that contribute to the onset of organic and behavioral disorders. Therefore, the importance of nutrition for maintaining psychophysical well-being, and for the prevention of many diseases, appears to be fundamental. Foods contain not only the nutrients that provide energy to our body, but also substances that are beneficial for its proper functioning, and it is in this context that nutraceuticals are inserted in the occupational field. The advantages of taking these elements are essentially linked to the great anti-inflammatory and antioxidant power they possess. In this context it is therefore necessary to insert the possible use of nutraceuticals, which can be taken and prescribed in work activities in which the psychophysical effort is particularly evident, and which expose to particular specific risks. To do this, it appears necessary, therefore, that nutraceuticals acquire more and more scientific value.

1. Introduction

In the original definition: nutraceutical is a food or part thereof, as well as a dietary supplement, that has a benefit on health or a disease condition [1], thus including both prevention and treatment of a disease. Food can therefore be an extremely useful tool for achieving and especially maintaining a state of well-being. In fact, food contains all the nutrients (macro and micro nutrients) necessary for the body's functions, for well-being and for maintaining a state of health; food also contains micro quantities of substances with potential beneficial action against certain diseases [2].
It is important to remember that alterations in the balance of health status are often linked not only to genetic or functional alterations and malformations, but also to the environment, lifestyle, the work carried out, and how these factors affect eating habits.

In today's industrialized society, there has been a steady increase in pathologies including diabetes, cardiovascular disease and obesity, all signs of a body under stress and an unhealthy diet [3-4]. Nutraceuticals have elements in common with both foods and drugs, but do not belong to either category. In contrast to medicines, nutraceuticals are used with therapeutic value even in the absence of clinical studies demonstrating their efficacy, safety and any undesirable effects related to their use [5-6].

2. Review

In the occupational sphere, in addition to the specific risks responsible for occupational diseases, there are other factors, such as psychosocial and environmental factors, which are difficult to identify and interpret and which contribute to the onset of organic and behavioural disorders [7].

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DOI: 10.3269/1970-5492.2021.16.36
 ISSN: 2279-7165 - Available on-line at www.embj.org

The use of nutraceuticals in the world of work has been around for some time, for example the diets and nutritional supplements used by astronauts [8], military personnel on missions, professional athletes and those in extreme working or sporting conditions.

The importance of food in maintaining psychophysical wellbeing and preventing diseases such as cardiovascular, neurodegenerative and inflammatory diseases, as well as the alterations underlying mental disorders such as those linked to alterations in sleep-wake rhythms and work-related stress, is therefore fundamental [9-10]. Food contains not only the nutrients that provide our bodies with energy, but also substances that are beneficial to its proper functioning, and it is in this context that nutraceuticals in the field of occupational medicine come into play. Many nutraceuticals have fewer side effects than drugs [11], can be taken naturally either with the diet or in the form of products derived from the extraction of the active ingredients, with greater compliance than their pharmacological counterparts [12].

The main disadvantage, at first, seemed to be their limited efficacy, which has recently been refuted by some studies in the literature, which have highlighted the increasingly evident role that these substances have for performance and psychophysical well-being. Studies on the effectiveness of the combination of drugs and nutraceuticals in treating or improving certain symptoms or occupational pathologies have been in the literature for some time, for which there are currently no recognized, truly effective treatments; in this connection, the use of cannabinoid receptor agonists in the treatment of tinnitus, which is appreciated for its neuroprotective activity [13], is associated with the administration of Ginkgo biloba, lipoflavonoids, magnesium, melatonin, vitamin B12 and zinc, with an overall improving effect, a reduction in the particularly intense perception of the symptom, accentuated hearing loss and insomnia [14].

The work activities in which the use of supplements is increasingly common are certainly those in which a high level of physical performance is required, or which are particularly demanding from an emotional point of view; vitamins, omega-3 fatty acids, monacolines, curcumin and phenols, and melatonin are some of the commercially available products most commonly used in this area [15]. The benefits of taking these elements are essentially linked to their great anti-inflammatory and antioxidant power [16]; they have long been used in sport, helping to recover from injuries, both in amateur and competitive competitions, where emotional stress plays a major role [17-18]. The beneficial effects of these substances can be attributed both to the increased supply of oxygen to the tissues, and therefore to the muscles [19], and to the neuro-protective effect that these substances possess, improving the efficiency of nerve impulse conduction and responsiveness to stimuli, and thus leading to a considerable improvement in performance [20-21]. From a commercial point of view, nutraceuticals are:

(a) dietary supplements including botanicals (e.g. vitamins, minerals, coenzyme Q, carnitine, ginseng, Gingko Biloba, St. John's wort);

(b) functional foods, i.e. foods that, in addition to their nutritional value, contain substances that are generally non-nutritious and that interact with one or more physiological functions of the body, exerting beneficial health or preventive effects;

c) true nutraceuticals, i.e. active ingredients with therapeutic or preventive activity; these are derived from foods, plants or microbial sources and are used, for example, to prevent or treat diseases or to slow down the ageing process [5-6].

Among the main nutraceuticals are:

Vitamin C and Vitamin E

Vitamin C, also known as ascorbic acid, is a substance required for normal growth and health of cells and tissues. It is a micronutrient, i.e. a molecule that is required by the body only in small quantities, but is essential for its well-being. Vitamin E, or tocopherol, is a fat-soluble vitamin, the most widespread and common of the vitamins and has antioxidant properties, fighting free radicals and promoting cell renewal. Nutritionally, vitamin E deficiency may promote carcinogenesis and increase the risk of cancer. Supplementation with vitamin E could probably reduce the risk of cancer. This concept is partially supported by the results of LNIT25-27 and studies in animal models.

The administration of vitamins such as E and C, in 'fatigue' work, or in those who work at night, for whom the literature has shown an increase in serum cortisol levels, systolic and diastolic blood pressure, resting heart rate and certain haematochemical parameters, can play a protective role by delaying the onset of cardiovascular disease [22]. Finally a protective effect of ascorbic acid against damage from acoustic trauma is also reported [23].

Remember how there are different risk factors involved in the onset of hearing loss, these factors include aging, loud noises, heredity, professional noises. A more recent study extends the indications for the intake of vitamin C also to contrast presbycusis [24-25].

Vitamin D

This vitamin is synthesised in the skin by exposure to natural light, and can also be obtained from a diet rich in fish, eggs and mushrooms. The receptor for vitamin D3 is present on endothelial cells and regulates their growth. Low serum levels of vitamin D have been shown in people with high blood pressure, and low levels of 25-hydroxyvitamin D3 (25 -OH-D3), which is the predominant proportion of vitamin D in the normal population, have been associated with a poor prognosis for these diseases [26], as it is associated with a higher incidence of cardiovascular events, suggesting endothelial dysfunction associated with vitamin deficiency. Vitamin D supplementation, especially in those whose work imposes a lack of exposure to UV rays, can improve endothelial function and reduce lipid oxidation and blood pressure. Last but not least, it is also used in the workplace to prevent adverse effects related to SARS-CoV-2 infection [27-29].

Omega-3

Omega-3 is a family of unsaturated fatty acids found in fish (eicosapentaenoic acid EPA, docosahexaenoic acid DHA) and in some plants (alpha-linoleic acid ALA).

They are defined as essential because humans are unable to synthesise them themselves. They are found in foods such as shellfish, dried fruit, legumes, cod liver oil, seed oils, olive oil, fish, oil seeds, currants, eggs, grapes, saffron and green leafy vegetables. Omega-3 intake has a protective effect on the cardiovascular system against coronary damage [30].

Recent evidence suggests that at least part of this protective effect is mediated by a relatively small but significant reduction in blood pressure levels [31], and that beneficial effects are realised through a hypotriglyceridemic effect, a reduction in platelet aggregation and an improvement in endothelial function [30].
An omega-3-rich diet should be suggested to all workers who perform shift work and in particular night shifts, for which a change in leucocyte count, an increase in systolic and diastolic blood pressure and resting heart rate induced by an increase in cortisol secretion have been observed [32].

Polyphenols, flavonoids and resveratrol

Polyphenols are natural antioxidants found in plants and may be useful in preventing lipoprotein oxidation and reacting with and eliminating free radicals; they have also been shown to have beneficial effects on the cardiovascular system, in age-related diseases and in halting tumour growth [33]. One problem associated with dietary intake of polyphenols is their low bioavailability. Flavonoids are polyphenols contained in vegetables, fruit, tea and wine. Reduced intake of flavonoids has been associated with increased mortality from coronary heart disease, although it is clear that these effects also vary according to the region where the studies were carried out. This could also be related to the diversity of foods consumed at the same time [34]. Resveratrol is a molecule of plant origin, belonging to the polyphenol family, extracted mainly from Polygonum Cuspidatum, but also found in grapes, berries, peanuts and pine nuts. The roots of this plant contain a very high concentration of resveratrol.
The beneficial effects associated with resveratrol were identified in research into the so-called 'French paradox'. It was noted that people living in the south of France were less prone to cardiovascular disease despite having a similar daily diet to that of some American states. After studying the various components of wine, a product widely consumed in France, it was discovered that it contained high concentrations of resveratrol. Resveratrol therefore has numerous beneficial properties, including anti-inflammatory and antioxidant action, protection against cardiovascular disease, the ability to slow down tumour processes and cholesterol-lowering activity [35]. Another interesting field of research is neurodegenerative diseases, particularly with regard to the search for new formulations in the treatment of Alzheimer's disease. Researchers at the Alzheimer's Research Centre in New York have carried out several epidemiological studies showing that moderate wine consumption is associated with a lower incidence of the disease [36]. Resveratrol has been observed to exert a neuroprotective activity, significantly lowering the levels of secreted and intracellular amyloid beta peptides (Aβ) of several cell lines, reducing the expression of the amyloid precursor protein and achieving an improvement in the efficiency of spatial working memory [37].

Fermented red rice and monacolines

Fermented red rice (RYR), Orizaya sativa L., is a product of Chinese folk medicine fermented by Monascus purpureus, a miscroscopic yeast, whose presence is responsible for the red colouring [38]. Red rice has been used for hundreds of years to season food and to promote blood circulation. Monascus purpureus produces numerous substances, including monacolines, molecules from the statin family, which are able to inhibit cholesterol synthesis by acting on the key enzyme in its synthesis, hydroxymethylglutarincoenzyme A reductase.
Of the various monacolines produced by Monascus purpureus, the one present in the greatest quantity, and also the most active, is monacolin K, also known as lovastatin, a molecule known for years and marketed as a cholesterol-lowering drug [39]. The effectiveness of such low dosages is most probably explained by the synergistic effect of other substances present in the natural extract, such as polyphenols and other monacolines.
The need for very low doses of the active ingredient in order to obtain the cholesterol-lowering effect also explains the extremely low incidence of adverse effects reported, unlike with common statin drugs [40]. A great deal of evidence therefore supports its inclusion in the diet for the management and prevention of work-related psychological disorders such as anxiety, insomnia, disorders linked to altered sleep-wake rhythms and dependence on drugs or substances of abuse.

Spirulina and other nutraceuticals

Spirulina, whose primary active component is phycocyanobiline, has protective activities in mitigating the toxic effects of alcohol abuse, as it has been shown to inhibit NADPH oxidase, an enzyme induced by acetaldehyde, the main metabolite of ethanol, which is responsible for the many toxic effects of alcohol abuse, including altered mental status, motor slowing and dependence [41-43].
Finally, taurine, pantetine and lipoic acid can increase the synthesis of the mitochondrial isoform of aldehyde dehydrogenase, ALDH-2, accelerating the conversion of acetaldehyde into acetate and thus achieving possible protective effects [44].

Melatonin

Melatonin is a natural molecule secreted by the pineal endocrine gland, the use of which is absolutely harmless [45]. Melatonin is present everywhere, in many plants and in all living beings. The best form is of plant origin and is extracted from cocoa.
It acts directly on sleep induction, being the natural substance that determines the sleep-wake cycle, does not induce atrophy of the pineal gland and is neither addictive nor habituating, and its administration should be indicated in those workers who work shifts and specifically during the night. Night work alters the body's exposure to natural light, disrupting the normal circadian rhythm of many hormones and neurotransmitters, with a major impact on the pathogenesis of many diseases, including some neoplasms [46].

3. Conclusions

The evolution of the concept of health and wellness has led to the development of cross-sectional segments from a commercial point of view, and to an ever-increasing demand for pharmaceutical health products.
Many studies have already provided significant evidence of the health benefits of nutraceuticals, and this scientific evidence supports the hypothesis that nutrition can also have very important effects on the health of the worker, opening the field to future clinical studies that will expand knowledge in this area.
The possible use of nutraceuticals, which can be taken and prescribed in work activities where the psychophysical effort is particularly evident, and which expose people to specific risks, should therefore be included in this context.

In order to do this, nutraceuticals need to be given an increasingly higher profile, through precise and accurate legislation, through careful studies conducted with the same scientific rigour as that adopted for pharmacological molecules, and by setting new standards for industry wishing to approach the research and development of such clinically effective compounds, as distinct from the production of mere food supplements.

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