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L-TYROSINE CONTAINING FOOD SUPPLEMENTS – HEALTH CLAIMS

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Summary. The aim of this study is to assess the health claims of proclaimed food supplements containing L-tyrosine according to regulatory requirements on the basis of label's information of 21 food supplements, containing L-tyrosine available in the Bulgarian marketplace, 89 food supplements, containing L-tyrosine available in the USA marketplace, and current scientific information, analysis of the optimum conditions for L-tyrosine administration, possible interactions with drugs, foods and food supplements. Of the investigated food supplements two products available in the Bulgarian marketplace have impermissible health claims according to Bulgarian legislation to treat diseases: narcolepsy and depression. The present research confirms the statement that the application of food supplements containing L-tyrosine could be favorable for the health but physicians, pharmacists and other health care professionals should be warned about the permissible claims and the precautions and follow the daily intake of amino acids including L-tyrosine and L-phenylalanine obtained by food.

Key words: L-tyrosine, food supplements, health claims

L-TYROSINE СЪДЪРЖАЩИ ХРАНИТЕЛНИ ДОБАВКИ – ЗДРАВНИ ПРЕТЕНЦИИ

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Резюме. Цел на настоящото проучване е да се направи оценка на здравните претенции на производители на хранителни добавки, съдържащи L-tyrosine, в съответствие на нормативните изисквания на базата на етикетна информация от 21 налични на българския пазар и 89 налични на американския пазар хранителни добавки, съдържащи L-tyrosine, и на литературни данни, както и анализ на оптималните условия за приема на L-tyrosine, възможни взаимодействия с лекарствени продукти, храни и хранителни добавки. От проучените хранителни добавки два продукта, налични на българския пазар, имат неразрешени според действащото българско законодателство здравни претенции да лекуват заболявания: нарколепсия и депресия. Настоящото проучване потвърждава, че употребата на хранителни добавки, съдържащи L-tyrosine, може да има благоприятен ефект върху здравето, но лекарите, фармацевтите и специалистите по здравни грижи трябва да се информират относно приемливите здравни претенции и предпазни мерки, както и да проследяват дневния прием на аминокиселини, включително L-tyrosine и L-phenylalanine, приети с храната.

Ключови думи: L-tyrosine, хранителни добавки, здравни претенции

Introduction

In the meantime, the information regarding health benefits and risks associated with the use of food supplements continues growing. Among them, L-tyrosine is one of the most exploited and used due to its multifunctional health benefits. L-tyrosine is a conditionally essential amino acid that is synthesized in the body from the essential amino acid L-phenylalanine or is directly obtained by food. Furthermore,

it is a precursor in the biosynthesis of catecholamines, thyroid hormones and melanin. L-tyrosine can be found in broad spectrum of food proteins as caseine, especially in cheese, milk, soy products, chicken, fish and nuts [11, 16].

The aim of the present study was to assess the health claims of proclaimed food supplements containing L-tyrosine according to regulatory requirements in Bulgaria. In addition, analysis of the

safety of high doses of L-tyrosine, possible interactions with drugs, foods and food supplements on the basis of described references were also within the scope of this study. Finally, the optimum conditions for the administration of food supplements containing L-tyrosine and rationale combinations with other ingredients with the aim to enhance the effect were also investigated. The purpose of the study required:

- Analysis of the current scientific information;
- Analysis of the Bulgarian legislation concerning food supplements;
- Assessment of the health claims for 21 L-tyrosine containing food supplements in the Bulgarian marketplace and 89 food supplements, containing L-tyrosine available in the USA marketplace.

Materials and methods

21 food supplements, containing L-tyrosine available in the Bulgarian marketplace, 89 food supplements, containing L-tyrosine available in the USA marketplace are surveyed to create a label-based assessment of the L-tyrosine containing rate, the claims of producers and the most common combinations with other active ingredients. For the aim of the present study, the information of producer's Web Sites, the databases from PubMed, Medline, Medscape, Science Direct and the Dietary Supplements database of the US National Institutes of Health, published evidence from peer-reviewed journals, the claims from promoters and non-peer-reviewed publications are explored.

Discussion

Preliminary evidence suggests that L-tyrosine supplementation may be of benefit in following conditions:

- Depression;
- Phenylketonuria;
- Drug abuse and withdrawal: Dopamine related addictions like cocaine, amphetamines, smoking;
- Narcolepsy [13];
- Parkinson's disease [14];
- Vitiligo [3];

A number of studies have found L-tyrosine to be useful during conditions of stress, cold, fatigue, prolonged work and sleep deprivation with reductions in stress hormone levels as well as to improve the cognitive and physical performance. Supplementation with L-tyrosine containing supplements may influence any of these conditions:

Phenylketonuria

L-tyrosine is considered conditionally essential amino acid for the patients with phenylketonuria. Patients with phenylketonuria might theoretically replace the intake of L-phenylalanine with food supplements, containing L-tyrosine. In the management of phenylketonuria, the health care professionals should follow the daily intake of L-tyrosine, not only the containing of L-phenylalanine [17, 23, 24, 27].

Depression

Depression might be associated with low concentration of catecholamines in blood. Evidence suggests that neurotransmitter precursors can be helpful in patients with mild or moderate depression. There is no definitive data that supplementation with L-tyrosine leads to elevated mood and cognitive or physical performance [5, 11, 21, 25].

Drug abuse and withdrawal

Chronic cocaine use is believed to cause catecholamine depletion, and similarities exist between cocaine withdrawal and depression. Tyrosine as precursor of catecholamines is believed to be effective in the treatment of dopamine related addictions. The results of a historically controlled trial of tyrosine for cocaine dependence do not support the utility of tyrosine in the treatment of cocaine dependence [10]. A double-blind amino acids, L-tryptophan and L-tyrosine, and placebo study with cocaine-dependent subjects in an inpatient chemical dependency treatment center demonstrated that the amino acids do not significantly reduce most symptoms of cocaine craving and withdrawal when used alone [12]. The data from a study of L-tyrosine influence on amphetamine self-administration and brain catecholamines in the rat suggest that the success or failure of an experimental pharmacologic treatment strategy in psychomotor stimulant abusers might be dependent on the subjects history of drug abuse [14].

Sleep deprivation

A study suggests that L-tyrosine may be helpful after condition of sleep deprivation. One study in healthy young men compared the effects of L-tyrosine 150 mg/kg, caffeine 300 mg/70 kg, phentermine 37.5 mg and D-amphetamine 20 mg at 15.30 h following overnight sleep deprivation on cognitive performance in sleep deprived subjects. Less effective than D-amphetamine, L-tyrosine improved performance on several tests [9].

Athletic performance

L-tyrosine supplementation in theory might work, but the available data do not suggest definitively that L-tyrosine supplementation affect athletic performance in healthy individuals [6, 8, 16].

Stress conditions

Some animal and human studies suggest that tyrosine supplementation may improve memory and physical performance during conditions of stress [8, 16, 19, 20, 22, 25, 26]. One study investigated the effect of 100 mg/kg L-tyrosine on mood, performance, heart rate and blood pressure of 16 healthy young subjects. L-tyrosine was found to improve the performance on two cognitive tasks, which were performed 1 h after administration and which could be characterized as highly sensitive to stress, and decreased diastolic blood pressure 15 min after ingestion [7].

Health claims of food supplements, containing L-tyrosine

The main claims by producers of food supplements, containing L-tyrosine as first-rate composition are:

- Ability to offset physical and mental fatigue;
- May heighten mental alertness;
- Increase feelings of well being;
- Protect the integrity of the skin. May increase melanin in the skin;
- Influence the biosynthesis of thyroxin;
- Influence basal metabolic rate;
- Suppress appetite;
- Increase thermogenesis and lipolysis;
- Reduce body fat.

These claims are permissible according to the existing legislation in Bulgaria [1, 2].

Treatment of disease such as depression, phenylketonuria, narcolepsy or vitiligo is not permissible claim for food supplements according to Bulgarian legislation [1, 2]. Of the investigated food supplements one product, available in the Bulgarian marketplace has impermissible health claim to treat depression and one product also, available in the Bulgarian marketplace has impermissible health claim to treat narcolepsy published in websites of producer and distributor.

Food supplements, containing combinations of L-tyrosine with other active ingredients

The most common combinations of L-tyrosine from the surveyed products are with following compounds:

- Vitamins and minerals: L-tyrosine may be used in synergic combination with vitamin B6 and

vitamin C for the maximum rate of biosynthesis of catecholamines.

- Amino acids: Combined with tryptophan. Studies show an attenuation of L-tyrosine effect when coadministered with L-valine, a large neutral amino acid that competes with L-tyrosine for uptake into the brain, suggesting a central locus for the action of L-tyrosine [15].

- Botanicals such as Green tea (*Thea sinensis* extract) and *Mucuna pruriens*. *Mucuna pruriens* extract contains L-dopa that may interfere with the absorption of L-tyrosine;

- Thermogenics and sympathicomimetics as synephrine, octopamine, caffeine, tyramine;

- The use of such supplements could increase the risk of cardiovascular toxicities and ischemic stroke [4, 9].

Recommendations for use of food supplements, containing L-tyrosine as first-rate composition:

For optimum results food supplements, containing L-tyrosine must be taken on empty stomach, preferably before 16 pm. The dose suggested by investigated manufacturers varies between 100 and 2000 mg per day.

Besides their benefits, there is a risk for the health when the administration of food supplements is not controlled or correct especially for those containing L-tyrosine. The simultaneous supplementation with L-tyrosine could lead to certain risks like drug interactions or and other adverse reactions.

Food supplements, containing high doses L-tyrosine may interact with [5, 11, 19, 21]:

Monoamine oxidase Inhibitors (MAOIs) such as but not only nialamide, moclobemide, tranlycypromine, selegiline. Theoretically, the combination of food supplements, containing high dose of L-tyrosine with MAOIs increases the risk of tachycardia, hypertension and psychic disorders.

Thyroid hormone – T3, T4 – risk of tachycardia and hypertension, associated with hyperthyroidemia.

Levodopa (L-dopa) – Levodopa may interfere with the absorption of L-tyrosine.

Food supplements, containing high dose L-tyrosine should not be taken in conditions associated with increased dopamine levels such as mania affective disorder and schizophrenia. Patients with malignant melanoma, neuro- or glioblastoma, pheochromocytoma, cardiac disorders must avoid the use of L-tyrosine as food supplement without health professional supervision [4, 9].

Conclusion

The present research confirms the statement that the application of food supplements containing L-tyrosine could be favorable for the health. Besides the benefits, there is a risk of health damage when food supplements, containing L-tyrosine are combined with drugs or when such supplements are used in some conditions. It is necessary that physicians, pharmacists and other health care professionals obtain up-to-date information for permissible claims and safety of food supplements containing high dose L-tyrosine and observe the daily intake of amino acids including L-tyrosine and L-phenylalanine obtained by food. The study shows that not always the producers and distributors adhere to the regulatory requirements for food supplements in the Bulgarian legislation. Of the investigated food supplements two products, available in the Bulgarian marketplace have impermissible health claims according to Bulgarian legislation to treat diseases: narcolepsy and depression. The producers of food supplements should adhere to the claims as regulated by the legislation of the country in which their products are registered and distributed.

It is important that patients inform their general practitioner or pharmacist in case they administer such supplements.

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