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EVALUATION, RISKS, ANALYSIS OF CONSUMPTION OF FOOD ADDITIVES

In this paper, a sociological survey summarizes data on the consumption of food products with daily food supplements (meat, dairy, flavoring, confectionery and drinks). The frequency of consumption of foods containing nutritional supplements by students KNTU over a month was studied. The most commonly used supplements that are classified as medium and high risk are identified. In some food products, the photocolometric analysis of the content of synthetic dyes was investigated: tartrazine (E102), ponso (E124) and yellow "sunset" (E110).

Key words: food additives, synthetic dyes, risks, sausage products, photocolometry.

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ВИЗНАЧЕННЯ, РИЗИКИ, АНАЛІЗ СПОЖИВАННЯ ХАРЧОВИХ ДОБАВОК

У даній роботі за соціологічним опитуванням узагальнено дані щодо споживання продуктів з харчовими добавками щоденного вжитку (м'ясні, молочні, смакові продукти, кондитерські вироби та напої). Досліджувалась частота споживання продуктів з вмістом харчових добавок студентами ХНТУ протягом місяця. Виявлені найбільш часто вживані харчові добавки, які відносяться до категорій середньої та високої небезпеки. Досліджено у деяких харчових продуктах фотоколориметричним методом аналізу вміст синтетичних барвників: тартразин (E102), понсо (E124) і «сонячний захід» (E110).

Ключові слова: харчові добавки, синтетичні барвники, ризики, ковбасні вироби, фотоколориметрія.

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ОПРЕДЕЛЕНИЕ, РИСКИ, АНАЛИЗ ПОТРЕБЛЕНИЯ ПИЩЕВЫХ ДОБАВОК

В представленной работе на основании социологического исследования обобщены данные о потреблении продуктов с пищевыми добавками (мясные, молочные, вкусовые продукты, кондитерские изделия и напитки). Исследовалась частота употребления продуктов с содержанием пищевых добавок студентами ХНТУ на протяжении месяца. Выявлены наиболее часто употребляемые пищевые добавки, которые относятся к категориям средней и высокой опасности. Исследованы в некоторых продуктах питания фотоколориметрическим методом анализа содержание синтетических красителей: тартразин (E102), понсо (E124) и «солнечный закат» (E110).

Ключевые слова: пищевые добавки, синтетические красители, риски, колбасные изделия, фотоколориметрия.

Formulation of the problem

Food additives are understood as a group of substances of natural or artificial origin, which are used to improve the technology of manufacturing of special purpose products with specific organoleptic characteristics, corresponding properties. According to the Law of Ukraine "On the quality and safety of food products and food raw materials", a food additive is a natural or synthetic substance that is specifically introduced into a food product to give it the needed properties [1]. The Food Additives Commission of the FAO / WHO Codex Alimentarius refer food additives to "... any substance that is not used as a food in normal conditions and is not used as a typical food ingredient, regardless of its nutritional value, specially added for technological purposes, including for improvement of organoleptic properties, during manufacture, processing, packaging, transportation or storage of food products ... "[2]. The nutritional supplement is indicated by the label "E" (Europe) with a three- or four-digit number. This confirms that this compound has been tested for safety; it has set criteria for cleanliness and hygiene standards in food products (maximum allowable levels, permissible daily dose, and allowable daily intake).

The sanitary rules and norms for the application of food supplements, approved by the Ministry of Health of Ukraine dated July 23, 1996 No. 222, stipulate that the development, application and sale of food supplements on the territory of the state should be carried out with the permission of the Ministry of Health of

Ukraine. By the Resolution of the Cabinet of Ministers of Ukraine of January 4, 1999 No. 12 approved the list of food additives authorized for use in food products [3]. The classification of food supplements includes 23 functional classes: acids; acidity regulators; substances that interfere with thickening; foam suppressor; antioxidants; fillers; dyes; substances that promote color preservation; emulsifiers; sealants; amplifiers of taste and smell; substances for processing flour; foaming agents; gel formers; glazers; moisture-retaining agents; preservatives; aerosol dispenser; raising agent; stabilizers; sweeteners; enrichers. Additives that are banned in Ukraine can be used in other countries, this should be taken into account when imported goods arrive. Legislative acts prohibit the import and sale of food products that do not meet the sanitary requirements.

Analysis of general research and publications

The problem of using nutritional supplements is complex and multifaceted. Due to the fact that nutritional supplements are not medical products, they undergo a simplified approval procedure, which in most cases does not involve clinical trials. For compliance with the norms are responsible managers of catering, trade, etc. Over the past decade, the range of dietary supplements has increased significantly. Many substances, if taken in, especially in combination with other similar substances, may be harmful; this is especially true for substances that are capable of accumulation or transformation in the body from a non toxic to a toxic form [4,5,6]. In the case of accumulation there is a complex tie between the biological activity of the substance, the dose, the rate of withdrawal from the body and the interval of getting into the body. Therefore, the issue of the safety of food additives was acute. The urgency of this problem increases with the consideration of the factor of dietary intake of people of different ages for most of their lives. A survey conducted in the United States showed that over 80% of the population consider it necessary to reduce the content of fats, cholesterol, pathogens, pesticides and only 20% of people want to restrict the use of preservatives, fillers, hormones, antibiotics, and sugars. This paradoxical situation has arisen due to misunderstandings by the population of the probable health damage as a result of the constant use of a complex of various nutritional supplements [7]. Investigated the linear range of dependence of optical density on the concentration of individual synthetic dyes, in particular, tartrazine E102, indigo carmine E132, which allows to conduct express analysis of their content in food products [2]. The literature describes the Merckelsson-Rosenthal syndrome, Quincke's disease, which is induced by tartrazine. To get out of this state a person can only be on a strict diet. In one of 10,000 people, after the use of the food supplement E102 appear evidence of allergic reaction [8].

Formulation of the purpose of research

The aim of the research was to identify possible risks for the consumption of nutritional supplements by students at the Higher Educational Institution, as well as the determination of synthetic dyes in the food products by photometric analysis.

Presentation of the main research material

We conducted a sociological survey among 102 first-year students of the Kherson National Technical University which was based on a specially designed questionnaire. Summarizing data was completed on consumption of food products with daily food supplements: meat, dairy, flavorings, confectionery and beverages; awareness of students about possible health risks. The frequency of consumption of foods containing nutritional supplements by students over a month was investigated (Fig. 1).

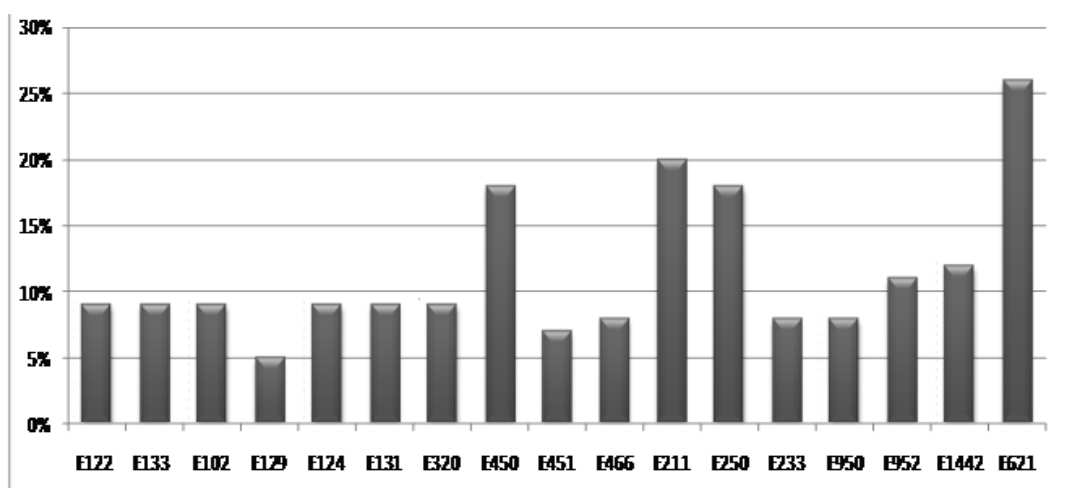


Fig.1. Percentage of consumption of nutritional supplements by students of the first year of KNTU

The most commonly used food supplements that are classified as medium and high risk are found (Table 1). Sausage products are consumed by 95% of students of the survey [9]. The content of food additives in sausage products in the chain of stores "ATB" of Kherson is shown in Figure 2.

Table 1

Danger categories of individual nutritional supplements

Nutritional supplements	Category, function	Category of danger
E133, E102, E129	E100-199 – dyes that enhance or restore the color of the product	Average
E124, E131, E122		High
E211 E250	E200-E299 – preservatives, which increase the shelf life of products, protecting them from microbes and mushrooms	High Average
E320	E300-E399 – Antioxidants that protect products from oxidation	High
E433 E450	E400-E499 – Stabilizers that store the required consistency of products	Average
E621	E600-E699 Amplifiers of taste and aroma	Low
E950, E952	Sweeteners	High
E1442	Emulsifiers added to foods to stabilize emulsions and other disperse systems	Average

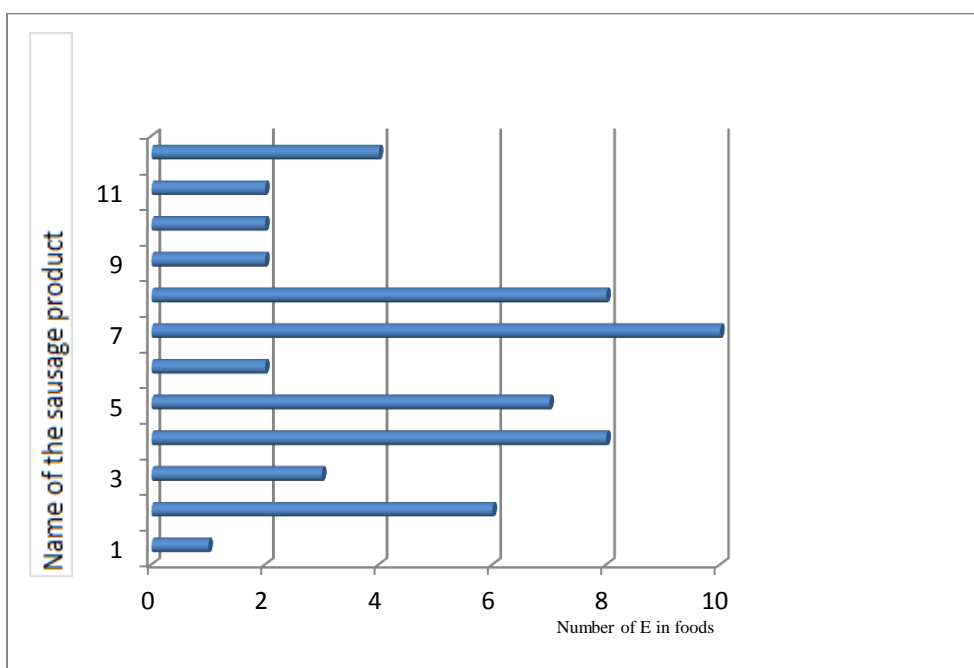


Fig. 2. Number of food additives in sausage products: 1 – Krakivska, 2 – Salami Finska, 3 – Zolotysta (meat shop), 4 – Kuzmych, 5 – Shynka varena, 6 – Dytyacha, 7 – Apetytna, 8 – Hot-Dog, 9 – Balykova, 10 – Moscovska, 11 – Zolotysta (dobrov), 12 – Milano

The analysis showed that sausage "Krakivska" contains only one food additive E-250; sausages "Dytyacha", "Balykova", "Moskovskaya" and "Zolotysta (dobrov)" sausages – have two additives, respectively (E316, E250), (E621, E450), (E250, E316), (E621, E575). The largest number of food additives had the following sausages: "Apetytna" – ten additives (E621, E631, E450, E451, E452, E407, E412, E415, E508, E250); "Hot-Dog" – 8 (E-250, E450, E451, E300, E316, E330, E331, E621) and "Kuzmych" – (E250, E300, E316, E331, E407, E451, E452, E508). Among the sausages analyzed "Zolotysta (Meat Shop)" contains 3 food additives (E250, E575, E621), Milano – 4 (E250, E316, E330, E621), Salami Finska – 6 (E250, E300, E450, E451, E575, E621), "Shynka varena" – 7. The situation gradually acquires signs of senselessness: the moment when in sausages can not be found meat. It should be noted that the quality of sausage products does not always correspond to the price and often instead of a real meat product you can buy its surrogate.

We conducted a study on the actual content of synthetic dyes in foods – tartrazine (E102), ponceau (E124) and yellow "sunset" (E110), which are part of the so-called Southampton list. The use of additives E110, E102, and E124 in the children's diet leads to hyperactive behaviour and loss of concentration in children. This pattern has been scientifically proven in the latest research conducted by the order of the Food Standards Agency of Great Britain (FSA) [10]. The dye "sunset" yellow E110 is banned in many countries of the world (Finland, Norway, USA). Danger of dye - is high. Yellow dye "sunset" (also used under a name "special yellow") refers to

a group of water-soluble dyes. The synthetic dye E110 is especially effective for coloring products that are fermentable during heat treatment. It is often added to icing, jams, ice cream, marmalade, cool and strong drinks. "Sunset" E110 is a sulfated version of the dangerous dye Sudan I, which is a carcinogen.

In the dye E110, a Sudan I dye may be present as an impurity. Independently, the E110 dye may cause allergic reactions, especially in people who are not taking aspirin. Other side effects of the additive E110 may be: nausea, urticaria, nasal congestion, rhinitis, swelling of the mucous membranes, chromosomal damage. Also, the food supplement E110 can cause stomach upset, vomiting, abdominal pain, and eating disorders. Tartrazine E102 – food coloring of synthetic origin, in nature in its pure form does not occur; made from waste products (coal tar). Tartrazine has been widely used due to its low cost; it is one of the cheapest synthetic dyes. The E102 dye is used in the food industry to give the products a yellow color, often mixed with other dyes for a variety of shades. Research results in Europe and the United States have shown that the E102 food supplement is a strong allergen, provoking anxiety attacks. Normative acts of most countries set the dose of tartrazine in the range of 100-150 mg of dye per kilogram of finished product or 7.5 milligrams per kilogram of human weight [10]. Ponceau, named bright red (food additive E124) – a dye of synthetic origin, which has a bright red color. It opens up a whole range of shades: when adding yellow or orange dyes, we get a brown color, and when mixed with a blue dye, ponceau gives a violet color. In its chemical composition, the color E124 is sodium salt: granulate or powder of red color. The additive E124 is thermostable, perfectly soluble in water, resistant to light, reducing agents and oxidants. Products processed by ponceau can be subjected to any technological operations (sterilization, pasteurization, cooling, freezing). Like other dyes, the E124 is used to give a vivid color to food or to restore its color. It's used for colouring sausage and fish products, seafood and canned berries and fruits. It's used in the manufacture of desserts, bakery and confectionery products (cakes, pastries, candies, puddings), various soft drinks, ice cream and milk desserts (cheese products). Dye E124 is also used in other industries: in the production of liquid detergents for the coloring of shampoos, liquid soap, gels; it's also used for colouring wool and silk products. Dye E124 refers to substances that cause oncological neoplasms. In many countries (USA, Norway, Finland) this additive is prohibited. In addition, ponceau causes allergic reactions, strangulation, therefore it is prohibited to use in the manufacture of food for children. In Ukraine, the food additive E124 is prohibited in the manufacture of medicinal products, and as a food dye is allowed within the permissible daily limit of 4 mg / kg body weight.

Research of synthetic dyes tartrazine (E102), ponceau (E124), "sunset" (E110) in food products was carried out on a concentration photocolorimeter KFK-2MP in a cuvette with a thickness of 1,070 mm. According to the spectral characteristics of aqueous standard solutions of dyes, optimum wavelengths were found: for tartrazine – 400 nm, ponso – 490 nm, and "sunset" – 490 nm. Calibration graphs of dyes based on standard solutions are given (Fig. 3). The linear range of concentrations for tartrazine is 0-600 mg/l, "sunset" – 0-500 mg/l, ponso – 0-200 mg/l, which allows to apply calculations not only according to the calibration schedule, but also according to the standard. The content of the dye was analyzed by the yellow "sunset" in the Mirinda beverage. It was revealed that the producer of Sandora Ltd. has content of the dye – 80 mg/l in the product, which significantly exceeds the permissible recommended dose (30 mg/l).

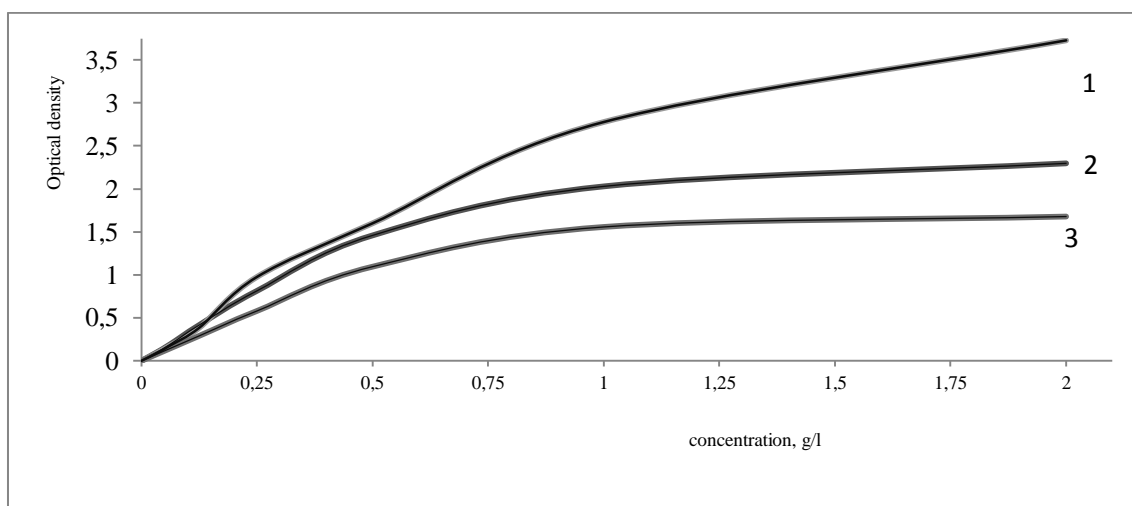


Fig. 3. The dependence of the optical density on the concentration of dyes: ponceau (1), «sunset» (2), tartrazine (3)

The content of the dye in the drink "Cactus" was analyzed. It was found that in this product the content of dye ponso was 13 mg/l, which does not exceed the recommended dose. It was found out that the producer of

LLC "PRODUCTION COMPANY GOOD FOOD" in the drink "Tarkhun" content of dye "sunset" fluctuates within 15-30 mg/l. The amount of tartrazine in canned peppers (Peru country production) was estimated at 124 mg/l, which does not meet acceptable standards.

Conclusions

The analysis showed that only 30 % of students pay attention to the labeling of goods. A sociological survey shows that students are eating dangerous food (excessive consumption of food supplements that are related to the medium and high risk category); the need to enhance educational awareness among students, including training on the right choice of food based on reliable information on the dangers of nutritional supplements.

The use of photocolometric analysis of the content of synthetic dyes is possible in the presence of only one or two dyes in the food product, which differ in the optimal wavelengths. Taking into account the availability of equipment, expressiveness, seriality, controlability, automation, and the use of photocolometric analysis, is an effective method for controlling the content of dyes in syrups, soft drinks, and the like.

Further studies on control, taxonomy, identification, and safety of the use of nutritional supplements (in particular, coloring agents) will contribute to solving problems aimed at establishing conformity of products with formulations, safety requirements. It is necessary to strengthen the requirements of the sanitary legislation on the safety of the use of food additives, to monitor the list of authorized E-additives, to conduct groundbreaking research on the consequences of the use of nutritional supplements. Manufacturers in accordance with European legislation must indicate the content, name and code of food additives; Inform consumers about possible health effects.

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