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**EDUCATION FOR BIOETHICS FOOD AND FOR HEALTH BY
BIOLOGICAL AND NATURAL SCIENCES**

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Abstract

The present scientific research on education for bioethics food and for health of students was achieved mainly by “General Microbiology” and “Principles of genetics and GMO” as “Biological Sciences” and “Biochemistry” as “Natural Sciences” with students from the faculties with food profile from Bioterra University of Bucharest, starting with the 2012-2013 academic year until now, in Specialized Department with Psychopedagogical Profile. Teaching methodologies have been developed to achieve education for bioethics and health food of students, such practical-heuristic, based on laboratory experiments, i.e. for identification of counterfeit food such as some meat products and honey, for identification of old food, altered, which are toxic to the body, based on laboratory practical work, i.e. practical work of microscopy and observation, to avoid food contamination, such as honey of bees. Also have been developed interactive-heuristic teaching methodologies by discussions / debates on controversial problems as counterfeit food, GMO, i.e. potatoes resistant to Colorado beetle, genetically modified maize MON810 resistant to worm piercing, new genetically modified soybean and so on, but and food additives. Also, identified numerous examples of education for bioethics and health food, the scientific research undertaken objectives being met.

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Keywords: Education for bioethics food; education for health food; practical-heuristic teaching methodologies; interactive-heuristic teaching methodologies; GMOs (Genetically Modified Organisms); Biochemistry.

1. Introduction

As a subject of Pedagogy, education (Latin, “Educo-educare-educere” to increase, to grow, to guide, “Educatio”-growing, guidance, education) is socio-human phenomenon that contribute at general culture and at professional training of pupils and youth. One side of education is health education or hygienic-sanitary education (Greek Hygieia = health) which, by the definition of the World Health



Organization, is a group of organized efforts aiming to foster the development of knowledge, attitudes and behaviors aimed at improving the health of the individual and the community. Maintaining planetary health is possible with people at a good level of general education, including the education for health food and bioethics food. In actual society are many controversial issues in correlation our nutrition and food thus deep problems of bioethics and health food, such as: counterfeit food, GMO (Genetically Modified Organisms), toxic food, contaminated food, old food. Right to an adequate food and nutrition is a fundamental human right, being necessary the education. If the education for health food begins in the family, continues in school and reinforce in the faculties with specific profile, education for bioethics food is mainly carried in the final grades of high school and in faculties with profile food. This paper present the research of the didactical methodologies that contribute at achievement of education for health food and bioethics food of students from food faculties from BIOTERRA University of Bucharest.

2. Problem Statement

Bioethics food, which is the application of moral laws on food behaviors on the one hand, and on the other hand the manufacture, commercialize, handling, purchase of food or raw materials, mainly plants and animals, raises many controversial issues, such as: food production and marketing of counterfeit food products, falsified, production and commercialization of genetically modified organisms, beyond species barriers, but also economic and political, though the scientific researches demonstrated their toxicity and that affecting the health of human body. For overcoming these problems, it needs education, so education for health food and education for bioethics food.

3. Research Questions

In this research the students were answer at many questions including as these: “Is ethic to produce

and market counterfeit food, food from GMOs? Argue your answer!”; “Is ethic to market toxic food, contaminated food, old food, altered? Argue your answer!”; “Why do some states of the world, as well as the U.S. and some European countries accept GMOs, although scientists from France, Italy, England have shown that GMOs have any harmful effects on human health?”

The results of this research has responded at these the main questions: “Which are the didactical methodologies that can be developed for education for bioethics food and education for health food?”; “What the suggestive examples are for education for bioethics food and education for health food of students from food faculties?”.

4. Purpose of the Study

Purpose of Study: development of the teaching methodologies to achieve education for bioethics food and health food of students by Biological and Natural Sciences, the scientific objectives being:

- reconstruction of conceptualization and of teaching methodologies for achieving education for bioethics food and education for health food of students;
- identification of examples of education for bioethics food and health food.

5. Paper Theoretical Foundation and Related Literature

The term “bioethics” comes from two Greek words: bios-life and ethos-behavior, moral character, marking the formula most cursory ethical and moral life. The term “Bioethics” has were introduced by Van Rensselaer Potter, which proposed the term “Bioethics in order to emphasize the two most important ingredients in achieving the new wisdom that is so desperately needed: biological knowledge and human values.” (Potter, 1971, p. 2), and which chose bio-to represent biological knowledge and the science of life systems, which chose ethics-to represent human value systems.

“Bioethics is the vitally necessary balance that will not allow the “spirit of knowledge”, rebellious and troubled by its nature, to throw the humanity into the darkness of non-existence.” (Țîrdea & Gramma, 2005, p. 70).

Bioethical education is at the center of moral, ethic education and it is one of its basic components. “Ethics is a way of qualifying actions and states of things from a “moral point of view”, but it is also a way of getting answers.” (Botezat & Copoeru, 2013, p. 108)

“Man becomes moral when complying with applicable laws and morals both in everyday life and in scientific research biological, medical, agricultural, business, in all its scientific enterprises. This is the direction in which it is recommended bioethical education of young people as a means of moral education and also as a component of moral education.” (Iancu, 2014 a, p. 101).

Bioethical education is performed depending to both age peculiarities, but and individual features of the youth. “This type of education, as a component of moral education, can be briefly started in the family and is to be further nourished in adolescence when not only the intellectual abilities, but also the national curriculum for high school level makes its achievement possible. This education continues in specialized universities in accordance with the academic curriculum and later on, at adult age, through continuous training and development, self-development and self- training...” (Iancu, 2014 b, p.74)

A component of bioethics education is the education for bioethics food, being necessary a such education of students from faculties with food profile. “The objective of integrating science and ethics in an educational setting is to enable science and pre-health students to begin to develop the critical-thinking skills and knowledge required to identify and address bioethical challenges intrinsic to their chosen professions.” (Loike et. al, 2013, p. 702).

The education for bioethics food correlate with education for health food, because the food produced non-ethic, i.e. food from GMOs, the body can become sick, being necessary and education for health food, for avoid such food, in order to have a healthy body.

Education for health include knowledge and practical rules to be known and respected by man to avoid unfavorable factors contributing to disease, but also for the approximation of the factors favorable body growth and development, health and his life and lies at the crossroads of science foundation as well as “Biological Sciences, “Medical Sciences”, “Natural Sciences”, “Educational Sciences” and “Psychology”.

A component of education for health is and the education for health food that materialize the professional education of students from faculties and specialization with food profile. Sciences on which

based education for health food of students are: “Biochemistry”, “Microbiology”, “Principles of Nutrition”, “Educational Sciences”, “Psychology” and so on.

6. Research Methods

6.1. General Presentation

The research methods: laboratory experiments, laboratory practical work, observation, literature review, debate, discussion, questionnaire.

6.2. Laboratory Experiments: Hypotheses, Materials, Procedures

An example of laboratory experiment of “Biochemistry” that contributed to education for bioethics and health food of students is identification counterfeit food such as sausages and honey, the methodology being practical-heuristic. Also, in the practical work of “General Microbiology”, by practical work of microscopy, didactical observation, demonstration and heuristic conversation, students were educated both professionally and for health food, to avoid food contamination, such as honey of bees.

Students were involved in research conducted on biochemical examination (physical and chemical), organoleptic examination and microbiological examination of a total of 100 different samples of honey, on biochemical examination for identification the addition of starch, flour and derivatives thereof in sausages, for identification of old food, adulterated.

One laboratory experiment to detect counterfeit honey by density. In forgery detection based on density, we started from the assumption that all the products are natural and not fake. Natural honey is 1.4 times higher density than water and not dissolved. Adding honey in water. Most counterfeit has a lower density and was dissolved.

Other laboratory experiment to detect counterfeit food were based on identification the addition of starch, flour and derivatives thereof in meat product, i.e. salami and sausage. The students prepared samples with meat product and in a test tube were added 5 ml. starch solution prepared, sitting in the stand; was dropped on each slice of meat product from samples, using the dropper, a few drops of iodine in potassium iodide and waited, observing the color for a few minutes; also, in parallel, the same way was dripping and in the test tube with starch preparation and observing the coloration.

Another investigation by laboratory experiments was to identify old food, which are toxic to the body based on determine the presence of ammonia in free using Nessler method in meat samples. Principle consists of: the ammonia in free state of aqueous extract of the sample to be analyzed forms with tetraiod-mercuriat-dipotassium, $K_2[HgI_4]$, (Nessler reagent) a yellow-orange complex (oxidation of mercury ammonium). The hypothesis set forth before the onset of biochemistry, was: “If we determine ammonia in free state using Nessler method in different samples of pork, we identify based on precipitation reactions coloring and pork in various qualities.”

Materials used in conducting this investigation were: fresh pork, relatively prosperous and altered, test tubes, pipette, and Nessler reagent.

Working mode consisted of: in a clean tube was introduced 1 ml. extract analyzed, then added using a pipette to drop by drop the Nessler reagent (up to 10 drops), while the tube was shaken, watching the color change, clarity of solution and precipitate formation.

7. Results

7.1. Education For Bioethics Food and Education for Health Food of Student: The Avoidance of Counterfeit Food, of Old Food, Altered

In determining the counterfeit food, i.e. the presence of starch in some meat products and honey, the “energizing honey”, in determining the old, altered and toxic food the teaching methodologies were practical-heuristic by laboratory experiments, and observation of results. Regular consumption of honey is healthy, but unfortunately, there are many methods of falsification of the foodstuff, including sugar boiling infusion of herbs until broth is brought to the consistency of honey, such as broth and sugar flowers in saffron “honey energizing” sold for research quality honey.

Students involved in laboratory experiments for determination of counterfeit food, i.e. the diluted honey, adding honey bees in water, it should fall to the bottom and not spread rapidly in water (Figure 1 a). Most counterfeit has a lower density and was dissolved (Figure 1 b).

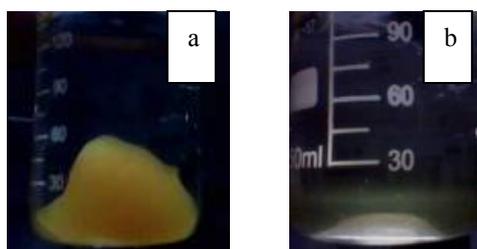


Figure 1. Berzelius glasses with water and honey bees (a), water and “energizing honey”- forged (b)

The hypothesis was disproved, samples “energizing honey” and represents false, the product spills rapidly in water.

Some meat products slices used in the present research stained in reddish brown color in the place where dripping $I_2 + KI$. The hypothesis has not been confirmed; the meat products researched are not containing starch and so there are not counterfeit, falsified.

The results of laboratory experiment for identification the old, altered and toxic meat were, as follows. In tube with fresh meat extract solution did not change color or even its clarity even after adding 10 drops of Nessler reagent: the reaction is so negative, not detected ammonia in free state and the meat is fresh (Figure 2 c). Tubes with relatively fresh meat extract solution became yellow color pronounced and appeared a slight precipitate after adding 6 drops of Nessler reagent: so weak positive reaction, ammonia is present in small amounts and relatively fresh meat (Figure 2 b). In tube with old extract meat, altered, the solution became yellow and orange shade appeared an abundant precipitate of the same color, even after adding the first 2-3 drops of Nessler reagent: so the reaction is positive, ammonia is present in large

amounts and the meat was old, altered (Figure 2 a). The hypothesis was confirmed, thus being identified various qualities of pork respectively fresh moss, moss relatively fresh and altered muscle.

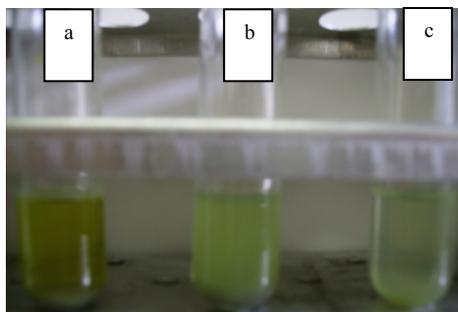


Figure 2. Identification of old and toxic meat by used meat extract solutions

- a) Tube with old, altered extract meat
- b) Tubes with relatively fresh meat extract solution
- c) Tube with fresh meat extract solution

The laboratory experiments were completed with discussions and debates, the students responded at some questions previously mentioned and adressed by professor to their. The students considered that is not ethic to produce and to market counterfeit food, old food, altered food, toxic food, contaminated food, wich put the health of body in danger, the organism can get sick, being necessary the avoidance of such foods and also, the education for bioethics food in correlation with education for health food.

7.2. Education for Health Food in “General Microbiology”

An example of education for health food of students through “General Microbiology” is the one for the microbiological examination of food products such as honey of bees, that in apitherapy “constitute natural remedies for treatment, with no adverse or harmful secondary effects...” (Petruța, 2010, p. 374), very good for health of body.

In the practical work of microbiology, through practical and heuristic methodology based on practical work of microscopy, observation, demonstration and heuristic conversation, students were educated both professionally and for health, to avoid food contamination, such as honey of bees.

Microbiological examination of samples for example microscopic observation of the honey of bees did not reveal the presence of microorganisms, although there are possibilities of contamination mentioned below. Yeasts are one of the few microorganisms which may multiply in honey, as they tolerate acidity and large levels of sucrose. “Certain yeasts osmofile of the genus *Zygosaccharomyces* support high concentrations of sugar which can cause fermentation of concentrated syrup of sugar and honey.” (Bălăucă & Atudosiei, 2004, p. 165).

Specialized literature indicates the presence of black mold in honeydew honey. Encountered species belonging to the genera: *Aspergillus*, *Cephalosporium*, *Chetonium*, *Penicillium*, and so on. By comparison with other unprocessed foods, the number of bacteria in honey is much lower (tens of hundreds), the encountered species belonging to the genera: *Bacillus*, *Brevibacterium*, *Enterobacter*, *Flavobacterium*, *Micrococcus*, and so on.

Honey of bees has the capacity to inhibit the multiplication of microorganism or destroying them, for which microbiological examination of honey was not been a concern for specialists in the field. However, a risk, even if it is insignificant, there is, reason for which some countries require that honey, to be tested for its microbiological quality before placing it on the market.

The education for health by microbiological examination of food products through practical work of microscopy is necessary for awareness of students about the danger of food contamination with microorganisms, the illness of human, growth of morbidity and mortality by eating the contaminated food, to beware of pathogens for their health well, to realize the importance of producing, marketing and consumption by the population of uncontaminated food but also the the importance of withdrawal from the market of contaminated food.

8. Discussions

8.1. Conceptual Reconstruction of Education for Bioethics Food and Education for Health Food

Bioethics education is the result of interference of many sciences, such as: “Biological Sciences”; “Natural Sciences”, “Medical Sciences”, “Agricultural Sciences”, “Educational Sciences” and “Psychology”; and so on. One side of bioethics education is education for bioethics food, focused on proper food and nutrition.

In Didactics of Biology and Natural Sciences, namely in the instructive-educational process at biological and natural disciplines, must exploited the information content in terms of education, including education for bioethics food of students, that it is based on the mainly biological disciplines, i.e. “Principles of genetics and GMO”, “General Microbiology”, “Genetics of microorganisms”, and natural disciplines, i.e. “Biochemistry”, on the one hand, and on the other hand is based on “Educational Sciences” and “Psychology” (Figure 3).

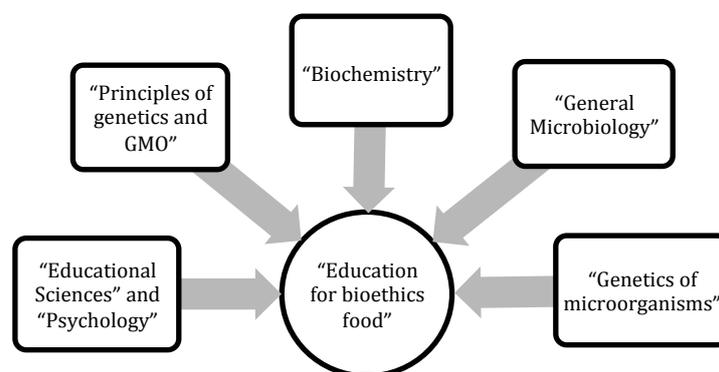


Figure 3. Main sciences on which is based the education for bioethics food

In Didactics of Biology and Natural Sciences, namely the instructive-educational process in biological and natural disciplines, must exploited the information content in terms of education, inclusive education for health and bioethics food.

A component of education is and the education of health with the side of education for health food that materializes the professional education of students from faculties and specialization on food domain. The sciences on which is based on education for health food of students are: “Educational Sciences”, “Psychology”, “Biological Sciences”, i.e. “General Microbiology”, “Natural Sciences”, i.e. “Biochemistry”; and so on. As a result of scientific research undertaken on education for health food and bioethics food of students, we identified and applied processuality education for health food and bioethics food that is done in four stages informative-formative, successive, interconnected and interdependent:

- cognitive stage, theory stage is to familiarize students with the concepts of biochemistry, microbiology, GMOs, etc. on the basis of their teaching by the professor;
- stage of awareness of the need and importance of knowledge of biochemistry, microbiology, GMOs, etc. food knowledge both for students of food profile, as well as for their daily life in order to avoid infection, for use of the information in the personal favor of the fellows personal, the environment, in a constructive and positive sense;
- stage of formation some attitudes of professional values and health food; involving affective-emotional training of students, positive-affective guiding to beneficial use of information in “Biochemistry”, “Microbiology”, “Principles of genetics and GMO” etc. which is an affective-emotional stage;
- skills and professional-food habits and behaviors of health food, capacity of practical action in the profession and daily life correlate with public food, family, individual, the will to act with a sense of professional responsibility and health in everyday life family, personal and social-the stage with praxiological function, pragmatic stage.

8.2. Education for Bioethics Food and for Health Food and GMO (Genetically Modified Organisms)

Bioethics food focuses on proper food and nutrition. At the courses and practical works of biological and natural sciences of students from faculties food, can be discussed / debated controversial problems as counterfeit food, GMOs, food additives, the didactical methodology being interactive-heuristic.

“The interactive methods/techniques are applied successfully in the educational practice, both abroad and in our country, the didactic activities becoming this way more attractive...” (Petruța, 2013, p. 649).

The Bioethics food controversial issues can be discussed, debated with students at the scientific contents of the “Principles of genetics and GMO”. Bioethics food issues is vast, several examples are presented below, the students of the food specializations within Bioterra Univesity from Bucharest discussed in correlation with education for bioethics food, in the didactical research laboratory.

The etymology of the discussion is the Latin word “discussio” suggesting that the image of a shaking building to see if it is pretty solid. “When it is broad and thorough discussion on an issue (often controversial and still open), aiming to influence students' beliefs, consciousness, behavior, it is the form of debate.” (Ciobanu, 2009, p. 331).

Through discussion, students determine that the GMO or transgenic organisms are organisms created artificially in the laboratory only, crops or animals apparently normal, which, by means of genetic engineering techniques were transferred genes from other species: viruses, bacteria, plants,

animals and even human genes to confer new characteristics, they may be toxic, extremely dangerous to human health and can cause many diseases. "The best known plants until now as GMO are maize, potatoes and soybeans." (Mencinicopschi, 2008, p. 91). Students discuss numerous examples of GMO plants, such as potatoes resistant to Colorado beetle, genetically modified maize MON810 resistant to worm piercing, new genetically modified soybean, tomato with delayed ripening and high solid content and so on. The discussions and debates, teaching methodology being interactive and heuristic, were worn as answers to questions previously mentioned asked by the teacher to students, they argued the toxicity of GMOs, as follow.

A potato genetically modified is a transgenic being, in order to obtain it, the genetic material encoding a toxin from the bacteria *Bacillus thuringiensis* was taken, a being very different in the level of structural and functional organization of potato and has been introduced in genetic material from potato (*Solanum tuberosus*). And so, the potato starts to produce a toxin which kills Colorado potato beetle. But one of the natural laws of living is that species do not mix one to each other; they can evolve.

Education for bioethics food must eliminate this contradiction, so that experts in the field to signal the states authorities about the risks of production, marketing and consumption of GMOs, in such a way as to be exceeded political and economic barriers to the detriment of the species reproductive barriers and be aware of all business decision makers, whatever the level can increase the degree of morbidity and mortality of the human population. As some food additives which were until recently harmless to human health and GMOs could be disastrous for human health in the future. An argument in discussion and debate is the exposure of the negative results of scientific studies. For example, one of the numerous scientific studies with negative results made on genetically modified food was conducted by the researcher Dr. Arpad Pusztai which fed the laboratory mice with genetically modified potatoes, the laboratory mice fed this way after this experiment they have smaller brain, liver and testicles, deficient immune system and a large number of pre-cancerous cells in many tissues of the body.

Through genetic engineering, the genetically modified maize MON810 resistant to worm piercing contains a gene from a soil bacterium (*Bacillus thuringiensis*) that produces a toxin that acts as a pesticide that confer resistance to worm piercing maize. Scientific studies have shown that after repeated consumption of GMOs is irreversible negative effects on medium and long term on human health.

Even if scientists from France, Italy, England showed that GMOs have adverse effects on human health in some countries of the world are supported, such as the U.S. and other European countries, including Romania, where he obtained since 1998. Are states of the world, political - economic and financial reasons, supports and promotes GMOs in food and nutrition human population's risks to human health because it is known that negative effects do not occur acutely, but medium and long term manifest.

The students considered that should have a word to say on the issue of GMOs and that an education for bioethics food is required. It is unethical to produce GMO and then to sell it, without knowing their effects on health in the future, knowing that these GMO do not produce an acute effect. But even more immoral is to produce and commercialize GMO, whose negative effects have been proven by

scientific research in the field. All these only for money, unethically, hanging the “balance of judgment” over financial gain and not for the human life and the normal evolution of life on Earth.

“Through bioethical education, young people understand that throughout their lives they have to act responsibly towards science and humanity, regardless of their professional goals and career objectives in the future.” (Iancu, 2014 b, p.74)

9. Conclusions

Studying the university curriculum by students from food faculties and specializations from Bioterra University of Bucharest, professional education is done in addition, they provide continuing education for health and bioethics food, which is the application of moral laws on food behaviors on the one hand, and on the other hand on the manufacture, commercialize, handling, purchase of food or raw materials. The education for bioethics food and for health food materializes professional education of students from food faculties and based on “Biological Sciences” like “General Microbiology”, “Principles of genetics and GMO” and “Natural Sciences” like “Biochemistry”, based on the knowledge of professor in “Educational Sciences”, “Psychology”. Also, education for bioethics food and education for health food achieve in four informative-formative stages, successive, interdependent in its processuality-cognitive stage (theoretical), stage of awareness of importance of food knowledge, affective-emotional stage with axiologic role and practical stage-stage with praxiological function.

Teaching methodologies have been developed, as those practical-heuristic, based on laboratory experiments, laboratory practical work, didactical observation, but and those heuristic-interactive based on discussion, debate, fishbowl, focusing on fundamental concepts, for example, the concept of “GMO”, the modern teaching methods in learning process of biological and natural disciplines concentrates on the student, making them interactive subjects, co-participant and co-authors in their own training, being identified numerous examples of education for bioethics food and education for health food, the scientific objectives being met. “Is up to each teacher to declare options for methods considered to be more appropriate and efficient in these situations...” (Cerghit, 2006, p. 13). It requires both educations for bioethics food and for health of students, both for their profession and for their individual lives, family, social future, given the increasingly complex situations in which are placed people in contemporary society and that can be solved by creating viable solutions even for controversial issues such bioethics food.

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