DEVELOPMENT OF NOVEL PROTEINS FOODS AND ENVIRONMENTAL PROTECTION

EVOLUTIA NOILOR ALIMENTE PROTEICE SI PROTECTA MEDIULUI

MILAN PAVLOVIC[1*], ISIDORA RADULOV[2], MIROSLAV STANOJEVIC[3], MILICA VELIMIROVIC[1]

[1] Technical Faculty ''Mihajlo Pupin'', University of Novi Sad, 23000, Zrenjanin, Serbia
[2]Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine of the Banat, 300645 Timisoara, Romania
[3]Faculty of Mechanical Engineering, Belgrade University, 11120 Belgrade, Serbia

Abstract *The increased interest in novel technologies without addition of chemicals, are very much in demand. The Serbian Sustainable Development Strategy should provide a framework for sustainable economic development of Serbia, by using the experience and findings arrived at through the implementation of the Poverty Reduction Strategy and the Strategy of the Accession of Serbia to the European Union and by identifying specific measures for the preservation of resources along with an accelerated progress in the relevant segments of Serbia's accession to the EU. Possible way to reducing this environmental burden and dependency is to develop substitute products that might fulfil the function of meat but which are produced through more eco-efficient routes in The Republic of Serbia.*
The aim of this paper is to describe how development of novel protein foods in the region of Serbia have impact on environment.

Rezumat *Interesul crescut in noile tehnologii fara adaus de substante chimice, este in crestere. Strategia Sarba pentru Dezvoltare Sustenabila trebuie sa puna la dispozitie un cadru pentru dezvoltarea economica a Serbiei, utilizand experienta si descoperirile implemntate prin Strategia de Reducere a Saraciei si Strategia de Includere a Serbiei in UE si prin identificarea masurilor specifice pentru conservarea resurselor alaturi de progresul accelerat in domenii relevante pentru includerea Serbiei in UE.Caile posibile de reducere a infestarii mediului sunt dezvoltarea unor produse inlocuitoare care pot indeplini rolul carnii dar care sunt produse pe cai mult mai eficiente economic in Republica Serbia. Scopul acestei lucrari este de a descrie modul in care evolutia noilor alimente proteice are impact asupra mediului in regiunea Serbiei.*

Keywords*: sustainable technology development, novel proteins foods, environmental protection*
Cuvinte cheie: *dezvoltarea tehnologiilor sustenabile, noi alimente proteice, protectia mediului*

INTRODUCTION

Food production from animal and plant sources has increased steadily during the past century, keeping pace with population growth. Per capita consumption of animal products is much higher in developed countries than in developing countries. It is estimated that in developed countries 70% of dietary protein is of animal origin (CAST, 1999). Intensive animal production in the region is resulted environmental problems.

By the end of the 1980s "sustainable development" was alredy emerging as a leading principle for the future. In the field of production and human nutrition, the major problems arise from use of eco-capacity for arable farming and intensive livestock production.

The aims of the World Health Organisation (WHO), the UN Food and Agriculture Organisation (FAO), and the Organisation for Economic Cooperation and Development (OECD) are:

- the highest possible standard of health for all,
- the provision of safe food for all and

- the development of the world economy.

The increased interest in novel technologies without addition of chemicals, are very much in demand. The frequently used concept of “minimal processing” actually meet the principle “as little as possible, but as much as necessary”. These newly developed non-thermal food processing technologies usually focus on preservation and modification of functional properties of food components while keeping food quality attributes (DUNNE AND KLUTER, 2001).

The aim of this paper is to describe how development of novel protein foods in the region of Serbia have impact on environment.

Sustainable development had been adopted as a policy goal of the many countries in the region. The Serbian Sustainable Development Strategy should provide a framework for sustainable economic development of Serbia, by using the experience and findings arrived at through the implementation of the Poverty Reduction Strategy and the Strategy of the Accession of Serbia to the European Union and by identifying specific measures for the preservation of resources along with an accelerated progress in the relevant segments of Serbia's accession to the EU.

The technology could play in achieving environmental protection. Sustainable technology development (STD) studies revealed an important gap in policy efforts.

During the 1970s, the pace of advances in food technology increased rapidly. New products and processes were developed, especially in response to a perceived shortage of food, and particularly animal protein. Developments included methods to produce protein foods from new plant and microbial sources and to use textured plant proteins as meat analogues and extenders (WEAVER ET AL., 2000).

One area of future Sustainable Technology Development is nutrition. Possible model of Duch Sustainable technology development case studies and ilustrations is nutrition (novel protein foods, high-technology closed-system horticulture, integral crop conversion, mixed land uce systems). The production of a single kilogram of pork takes 4-5 kg of feedstock. Energy, materials and land are wasted on a large scale. Also, the production of other foodstuffs is inffficient. The more months there are to feed and the wealthier the world's population, the more food will be required and the higher will be the quality demand in terms of variety, taste, freshness and nutritional value (WEAVER ET AL., 2000).

The Republic of Serbia must find ways of supplynig and distributing food that are more efficient and less damaginig to the environment than today's production routes. Also the Republic of Serbia must premt the implications of restructuring for the agricultural sector.

DISCUSSION

THE DEVELOPMENT OF NOVEL PROTEIN FOODS

DELGADO ET AL. (1999) represented that the growing, increasingly urban and more affluent population in the developing world will most likely demand a richer, more diverse diet, with more meat and milk products. It is projected that there will be a ‘livestock revolution’ (or ‘livestock boom’) in the next two decades.

Nutritional standards have shown positive long-term trends with worldwide increases in the average global calorie supply per person (a rise of 16 percent since 1969–71 to reach 2 795 kcal/person/day in 2000-02, with the developing country average expanding by more than 25 percent) and in the quantity of proteins per person (from 65.1 g in 1970 to 76.3 g in 2003). Yet distributional disparities continue to exist. According to FAO estimates, in 2001-03, 856 million people in the world were undernourished, 61 percent of whom were living in Asia and the Pacific and 820 million in the developing countries overall. The highest prevalence of

undernourishment is found in sub-Saharan Africa, where 32 percent of the population was undernourished, while an estimated 16 percent of the population was estimated to be undernourished in Asia and the Pacific.

Corresponding figures for the world, excluding China, show an increase from 12.9 percent in 1961 to 15.4 percent in 1989, slightly declining since then to 14.6 percent in 2003. Figure 1 shows the contributions of major food groups to total protein supplies (http://www.fao.org/docrep/009/a0699e/A0699E05.htm).

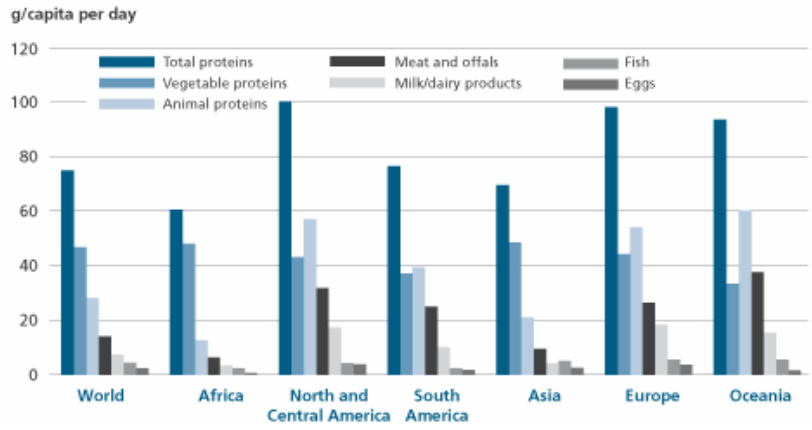

Figure 1. The contributions of major food groups to total protein supplies in the world (www.fao.org/docrep/009/a0699e/A0699E23.gif)

Animal protein production, in particular pork production, has high environmental impacts. Novel Protein Foods (NPFs) are modern plant-protein based food products, designed to have desirable flavor and texture. Technically, NPFs can be made of peas, soybeans, other protein crops and even grass (LINNEMANN AND DIJKSTRA, 2000). BAGGERMAN AND HAMSTRA (1995) suggested that NPFs can reduce environmental pressures because the conversion from plant proteins into meat proteins is biochemical and environmentally inefficient.

The STD research on nutrition makes a particularly useful methodological perspective.

The work on nutrition was organised in series of seven steps. These steps can be grouped in three phases (QUIST ET AL., 1996):

1. "orientation" phase aimed at defining problems, opporuinties and possible solutions, identifying stakeholders and pinpointing evaluation criteria,
2. "definition" phase focused on refining and selecting among ideas,
3. "implementation" phase focused on the organisation of work carry forward a preferred idea or set of ideas.

The production process for novel proteins of any sort has three steps (Figure 2). The first is to grow the protein substrate, such as soy, wheat or bacteria. The second step is to extract and refine the protein. The last step is to texturise proteins (WEAVER ET AL., 2000).Table 2 has shown balance of the livestock and poultry in the Republic of Serbia.

Possible way to reducing this environmental burden and dependency is to develop substitute products that might fulfil the function of meat but which are produced through more eco-efficient routes in The Republic of Serbia. Figure 3 has shown meat production in the Republic of Serbia.

Table 2

Balance of the livestock and poultry (number at the end of year)(Statistical office of the Republic of Serbia)

	thausand heads			
Year	**Cattle**	**Pork**	**Sheep**	**Poultry**
2006	1106	3999	1556	16595
2005	1096	3212	1609	17905
2004	1079	3165	1576	16631
2003	1102	3439	1586	16280
2002	1112	3634	1516	17677

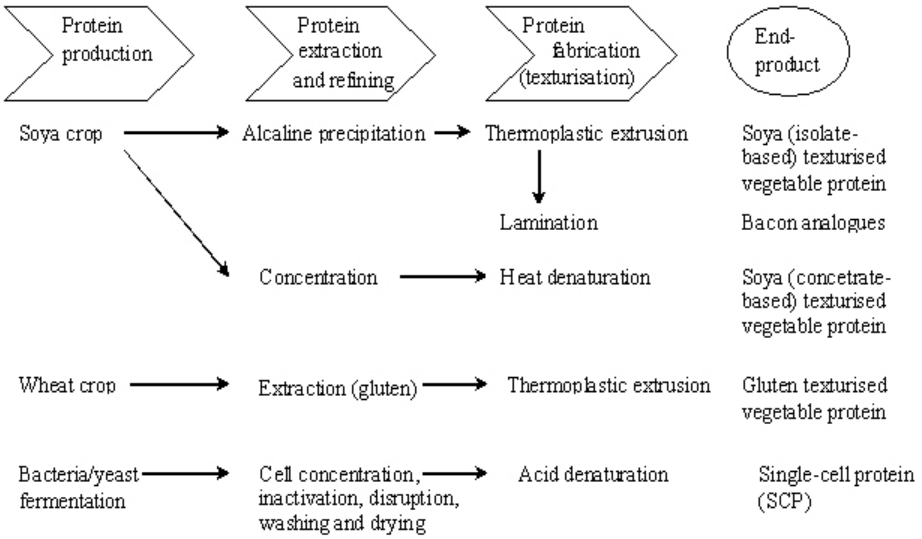

Figure 2 The production process for novel proteins(WEAVER ET AL., 2000)

According to results represented in Table 2 and 3 the research on nutrition foolowed several lines of innovation and offers a useful illustration of the learnig-by-doing approach.

Using animals to convert grain feedstock to animal protein involves the loss of 80%-90% of the contained nutritional value of feedstock, which introduces a substantial eco-inefficiency. It also leads to a large and often concetrated production of organic waste. A 10%-20% in acidifying and eutrophying emissions from animal husbandryis estimatedto be possible over the next ten years through manure treatment.

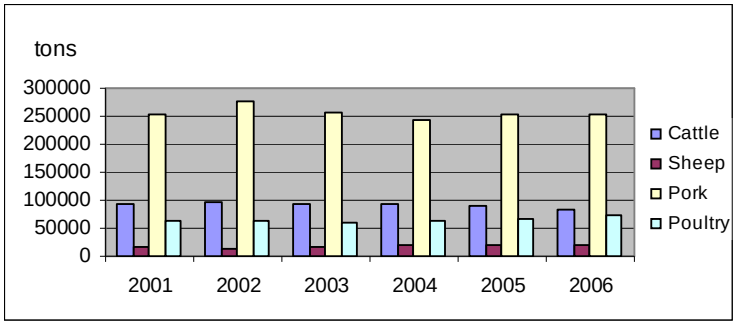

Figure 3. Meat production in the Republic of Serbia(Statistical office of the Republic of Serbia)

Table 3 represents crop production in Serbia (Statistical office of the Republic of Serbia).

Table 3

Crop production in Serbia(Statistical office of the Republic of Serbia)

Year	Wheat		
	Harvested area, ha	yield	
		Total, tons	Per ha, kg
2007	55925	1863811	3332.65564
Year	Barley		
	Harvested area, ha	yield	
		Total, tons	Per ha, kg
2007	93844	258998	2759.87809
Year	Maize		
	Harvested area, ha	yield	
		Total, tons	Per ha, kg
2007	12018	3904825	3249.06060
Year	Oats		
	Harvested area, ha	yield	
		Total, tons	Per ha, kg
2007	39724	76880	1935.35394
Year	Rye		
	Harvested area, ha	yield	
		Total, tons	Per ha, kg
2007	5548	10902	1965.03244

Further reductions will become increasingly more difficult and expensive to achive and, because of the energy requirement of manure treatment, will come only at expense and fossil fuel depletion (WEAVER ET AL., 2000).

Depletion of fossil fuels in meat production (per kilogram of pork) is 39.8 MJ and in production of novel protein foods is 7.4 MJ (EERDT ET AL., 1993). Comparing meat production and production of novel protein foods, production of NPFs is more eco-efficient on a product-equivalent basis (Table 4).

Table 4

Depletion of fosill fuels in meat production and in production of novel protein foods

	Depletion of fossil fuels
Meat production (per 1kg pork)	39.8 MJ
Per 1 kg meat analogue (15% protein)	7.4 MJ
Pork production in Serbia (2006)	$9.95*10^9$ MJ

According this results using novel protein foods technologies depletion of fossil fuels can be reduced to $1.6*10^9$ MJ.

CONCLUSION

Novel protein foods indeed help to reduce environmental pressure if consumers change their lifestyle by consuming more NPFs and reducing meat consumption.

Based on the development of novel protein foods we could make the policy recommendations for The Serbian Sustainable Development Strategy. Through these recommendations about establishing novel proteins food development strategy it is possible that The Republic of Serbia could reduce CH_4, N_2O and NH_3 emissions at global level, because novel protein foods are environmentally more friendly. The available technologies for novel protein food production could reduce environmental stress significantly. Using NPFs emitted pollutants to the water, soil and air will be decreased; and local environmental problems could be particularly solved. NPFs can reduce fossil fuels depletion for 84%.

According this results and paper the development of novel protein foods should be interesting for future agriculture regional needs.

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