

# PROCEDURES IN IMPROVEMENT OF THE CONTROL OF THE QUALITY OF MEAT PRODUCTS – CONSUMER PROTECTION STRATEGY\*

Matekalo-Sverak Vesna, Turubatović L., Petronijević R.

*A b s t r a c t:* Introduction of new parameters of control of the quality of meat products, as well as constant improvement of analytical methods used for examination of all major components of the meat products, would considerably contribute primarily to the improvement of the consumer health, as well as protection of their economical, ethical and religious interests. Identification of the main raw material in meat products, certain additives of which some can have detrimental effect on health safety of certain consumers, as well as control of type and quantity of certain additives would greatly contribute to the development of consumer protection strategy and strengthen the confidence of consumers in quality and safety of meat products on domestic market.

**Key words:** quality of meat products, consumer protection strategy, control of the quality of meat products

## Postupci unapređenja kontrole kvaliteta proizvoda od mesa – strategija zaštite potrošača

*S a d r ž a j:* Uvođenjem novih parametara kontrole kvaliteta proizvoda od mesa, kao i stalnim unapređenjem analitičkih metoda kojima bi se svi važni sastojci koji čine proizvod od mesa, mogli ispitati, značajno bi se uticalo, pre svega na unapređenje zaštite zdravlja potrošača, kao i na zaštitu njihovih ekonomskih, etičkih i religioznih interesa. Identifikacija osnovne sirovine u proizvodima od mesa, određenih dodataka od kojih neki mogu imati negativan uticaj na zdravstvenu bezbednost pojedinih potrošača, kao i kontrola vrste i količine pojedinih aditiva znatno bi doprinela u razvoju strategije zaštite potrošača i pojačala poverenje potrošača u kvalitet i ispravnost proizvoda od mesa na domaćem tržištu.

**Ključne reči:** kvalitet proizvoda od mesa, strategija zaštite potrošača, kontrola kvaliteta proizvoda od mesa

## Introduction

In the World, special attention is directed to protection and safety of consumers in all branches of production. Consumer must not be deceived, and product he is purchasing must be completely safe and cannot endanger human health in the lowest degree (Turubatović *et al.*, 2005).. In European Union countries, Canada and USA, consumer protection strategies are being developed mainly directed to production and marketing/ trade of food products, and in this way not only the health of consumers is protected but also their economical, ethical and religious interests. In developed countries, and in Serbia, consumers are protected by laws when the food is concerned. However, regardless of this fact, recently, food producers, and especially food producers in the meat industry –numerous incidents

(BSE, *E. coli*, utilization of not allowed meat species in meat products, genetically modified organisms, dyoxine, melamine, and in our country, utilization of prohibited additive potassium meta bisulphate in chopped meat for forming, so called čevapčići and pljeskavice/hamburgers, etc.) have contributed to lack of trust and confidence of consumers towards food producers – have increased the measures aimed at protection of consumers and developed strategy for improvement and implementation of these measures.

Since year 1998, it has become clear that consumers are concerned about the use of genetically modified food and they demanded that food products to which genetically modified ingredients have been added be labeled accordingly, (Joop de Boer *et al.*, 2007) i.e. on labels within the declaration of the product, it has to be declared that products has been

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AUTHORS: Vesna Matekalo-Sverak PhD, [vesna@inmesbgd.com](mailto:vesna@inmesbgd.com), Lazar Turubatović PhD, Radivoj Petronijević MSc, Institute of Meat Hygiene and Technology, Belgrade

AUTORI: dr Vesna Matekalo-Sverak, [vesna@inmesbgd.com](mailto:vesna@inmesbgd.com), dr Lazar Turubatović, mr Radivoj Petronijević, Institut za higijenu i tehnologiju mesa, Beograd

manufactured with addition of genetically modified food. In Great Britain, consumers even demanded that also restaurants serving food consisting of genetically modified food stuffs should be visibly marked. Consumer panic is completely understandable because of the suspicion that genetically modified organisms (GMO) are responsible for more frequent incidence of allergies occurring subsequent to consumption of certain types of food products and meat products (*Jamenez-Colmenero et al*, 2001). About the same time, a currently very modern term “safe food” was created, and in accordance to that term “safe meat products”. However, the difference between hygienically safe/correct meat product and safe meat product must be underlined. Meat product, which is correct, from the aspect of hygiene and health doesn't have to be safe at the same time. Certain ingredients used in manufacturing of different types of meat products, as well as certain meat species, can cause in specific group of consumers, due to allergic reactions or reactions due to intolerance to certain specific ingredient, more or less severe health problems, and consequences for consumer, when allergic reaction is in question, can sometimes be even lethal (*Giese*, 2003). Therefore, food producer is obligated to declare on the label of the product all information of significance to the consumer (*FDA*, 1999). Expanded content of declaration of food products and meat products compared to previous declarations/labels which only had some main parameters of the product composition presented, are result of this consumer protection strategy and have been adopted in the majority of world countries and also in Serbia. In any case, this is an excellent measure for maintaining of insight into the quality of meat product, but it is not sufficient and it is not the only measure. The most important issue is that the declaration reflects the true situation and that the food producer is manufacturing meat product from raw material, supplements and additives which have been declared, as well as that the name of the product is not misleading in any way. Following measure in implementation of the consumer protection strategy are inspection in production and trade, and education of consumers. One of unavoidable measures is also upgrading of analytical methods in the control of the quality of meat products and learning how to use modern methods.

### Quality of meat product

In our society, the concept of quality of meat product mainly includes product composition and its sensory properties. Quality of meat product es-

entially, beside sensory properties, includes also its microbiological and health status, i.e. presence or absence of environment contaminants, heavy metals and pesticides, and residues of veterinary drugs. However, regardless of this fact, inspection examination of meat products, in our country, includes in inspection of the quality of meat products, beside sensory properties and declaration control, determination of main chemical parameters and, in regard to additives, determination of the residual nitrite, total phosphorus and nitrate in fermented sausages. Health correctness of meat product includes microbiological correctness, control of residues, examination of the radio activity and sensory examination, although, Law on health adequacy of food stuffs and objects of general use clearly defines that food stuff has to have issued quality – composition in order to be deemed adequate from the aspect of health.

Quality, composition of meat product in all organized countries is regulated by regulations adjusted to consumer habits, technological capability and development of the country, control possibilities, religious demands, etc (*Arihara Keizo*, 2006.) Some countries, for instance Australia and New Zealand, in their regulations and provisions for different meat products, issue different minimum quantities and species of meat, which have to be complied to. In certain countries, the content of water or lipids is limited, or the minimum content of protein for certain products is issued (which is case in our country). However, for almost all countries it is characteristic that there is a group of product of high quality or products of protected origin which are manufactured according to protected procedures and which often have better price than remaining meat products. Serbian Regulation on quality and other requirements regarding meat products issues for certain products possibility or impossibility for use of different additives of food stuffs. Regulation on quality and other requirements for additives used in food products, determines conditions for use of additives in meat products. So, it is evident that in our regulations the quality of each product is unambiguously determined and with compulsory declaration represents significant contribution to the consumer protection strategy.

In our country, control of the technological process is carried out in production facilities where meat products are manufactured, also production specifications and declarations are controlled, as well as main chemical investigations, such as protein content, relative content of protein of binding tissue, content of total phosphates, nitrites and nitrates, etc. Establishment of the presence of proteins ori-

ginating from different meat species is done only in meat products intended for export and specifically the presence of bovine protein is compulsory. Determination of the content of soy protein, gluten, supplements obtained from milk, carrageenens and colors in meat products, as far as we know, is not done on national level.

The most important issue relating to the part of the strategy determining that meat products manufactured according to precisely defined procedure and technology (defined production specification), are marketed with full declaration – information presented on the label where it is unambiguously stated which raw material was used for manufacturing of that product and which supplements and additives have been used. The accuracy of information on declaration is checked by the inspection at the production facility as well as by analysis of meat product, by applying acknowledged analytical methods. Such control of the quality of meat product is sufficient for large production facilities of the meat industry where an experienced team of experts are working and where inspection authorities are present on regular basis. In smaller facilities for meat processing, which are present in our country in great number, usually only one technologist is employed, and inspection authorities are not present there on daily basis, declaration/statement on composition of the meat product must be controlled on broader basis, and same relates to imported meat products which are also present on our market in significant quantities. Also, it is necessary to intensify the control of meat products and dishes containing meat sold in fast food restaurants, since these products are mainly consumed by children and young people. From the intensified control also the regular food and dishes containing meat prepared and served in conventional, traditional restaurants should not be excluded.

There are cases known in practice and described in literature of allergies on meat, most of hypersensitive persons are allergic to red meat, and in some cases there are allergic manifestations occurring after consumption of poultry meat or mutton (Aoyama, et al, 2000; Davidson, 2002; Givens, et al, 2006). Apart from that, there are many other health reasons or conditions such as gout, hypertension, diabetes, increased cholesterol in blood plasma, which limit the consumption of certain species of meat in nutrition. It is very important to point out that certain religions prohibit the consumption of pork, and some of beef, therefore, strict control of meat products in regard to its main ingredient, raw material is necessary. The latest, current Regulation on quality and other requirements for meat products,

which has been harmonized with similar regulations of EU countries and adjusted to our conditions for certain types of meat products issue even the type of raw material, which is additional reason confirming the necessity for development and application of methods for identification of species of meat in meat products.

Regardless of many health benefits contributed to soy bean preparations, (Aoyama et al, 2000; Hoffman & Wiklund, 2006; Hoogenkamp, 2007; Pszczola, 2003) which was also confirmed by scientific results, utilization of soy protein in food products, also in meat products, has to be properly declared on the product label, and soy bean preparations have to be declared also on cosmetic products. Similar problems to different species of meat can also occur in cases when soy bean preparations are used in manufacturing of meat products, however, more people are allergic to soy protein than to protein originating from certain species of meat. It is not widely known that soy bean as food stuff is considered as one of the greatest allergens and is on the list consisting of nine food stuffs “severe allergens”, with strict control over their use in food products. Main instigators of allergy in soy bean are proteins glycinine and three units of BETA conglycinine, i.e. soy proteins which are carriers of the functionality and are present in all soy bean products used as food supplements. Problems with allergies on to soy bean are especially present in developed world countries where the use of industrial food and semi-finished finished dishes is mostly present. Canadians state that they have recorded significant increase of number of allergic incidents in humans, especially children, during the nineties of the last century which coincides with increased utilization of different protein products in food processing. Although it is regulated by legislation provisions that the use of soy bean in food products has to be declared, in this country by inspection and control products are registered for which the use of soy bean has not been declared. Such occurrences must not immediately be regarded as intentional mistakes by the food producer. Many spice mixtures, especially spice extracts, contain as carrier soy proteins, so food producers in meat industry are sometime unaware of the fact that they are using soy bean in the production and therefore not declaring it. If for this reason, or intentional deceit of consumers, but in Spain hams were discovered which were manufactures with soy bean, but manufacturer has not declared its presence on the label. In regard to increase of number of allergic reactions to soy bean, according to official data from New Zealand, of all severe allergic incidences in humans caused by food, soy bean was

the cause of allergy in 25% of cases. Also, in Great Britain, it was established that consumption of soy bean milk in childhood, as substitute for cow milk, causes occurrences of allergies to peanuts later on. Soy bean in nutrition is not recommended in certain physiological conditions, such as pregnancy and nursing, also it is not recommended for consumers with heart problems since it causes blowing up for which oligo saccharides contained in soy bean are responsible. Based on all stated it can be concluded that content of soy bean in meat products must be declared, however, regardless of that, experiences from other countries tell us that we cannot even rely on the declarations with high certainty and that it is necessary to develop methods for verification of its presence in meat products, since consequences can be fatal for some people. In spite of the fact of the detrimental effect of soy bean on health, it is used as way to substitute parts of high valuable and expensive meat by cheap supplement (*Hoogenkam, 2007; Tsumara et. al, 2005*). If we mention that by only one kilogram of soy bean isolate it is possible, with hydration in meat products, to substitute five to six kilograms of meat, and at the same time maintain the content of total protein in meat product, it is clear that by conventional analytical methods, and such substitution cannot be precisely detected.

Gluten, wheat protein (*Pietrasik et. al, 2007*), is very often used in food products and meat products since it is very good emulgator and stabilizer and influences good consistency of the product, it has no significant effect on taste, odor and color of meat product, so it can't be easily identified organoleptically. Gluten is known allergen and declaration of gluten is compulsory. However, gluten is often used in mixtures which are intended for use in meat products, such as emulgators and stabilizers, and meat industry is buying them according to different trade names, so it can easily be used in manufacturing of meat products, without it being declared, most often due to lack of information or poor knowledge or expertise of the person applying it.

Karagenan is hydrocolloid with exceptional ability of hydration (*CyberColloids, 2007*). Its ability to provide for meat, through brine injected into it, up to 100% of hydration, i.e. to double the mass of meat, influenced the decision of producers in meat industry to use it more than technologically justified. Apart from this, karagenan, which is functioning as condenser, stabilizer and gelling agent and is often found in composition of different mixtures intended for use in meat industry, similar to gluten, can also unintentionally be left out of the product declaration. Considering that many consumers wish to consume products free of this additive since it can cause dige-

stion disturbances of different intensity, and we are familiar with cases of the use of this additive without declaring it on the label, the development of the method for determination of the presence of karagenan in meat products is of exceptional importance.

Included in the list of additives used in meat industry, and for which in our country there is still no developed determination method, and therefore are not controlled, beside karagenan, are also colors used in food industry.

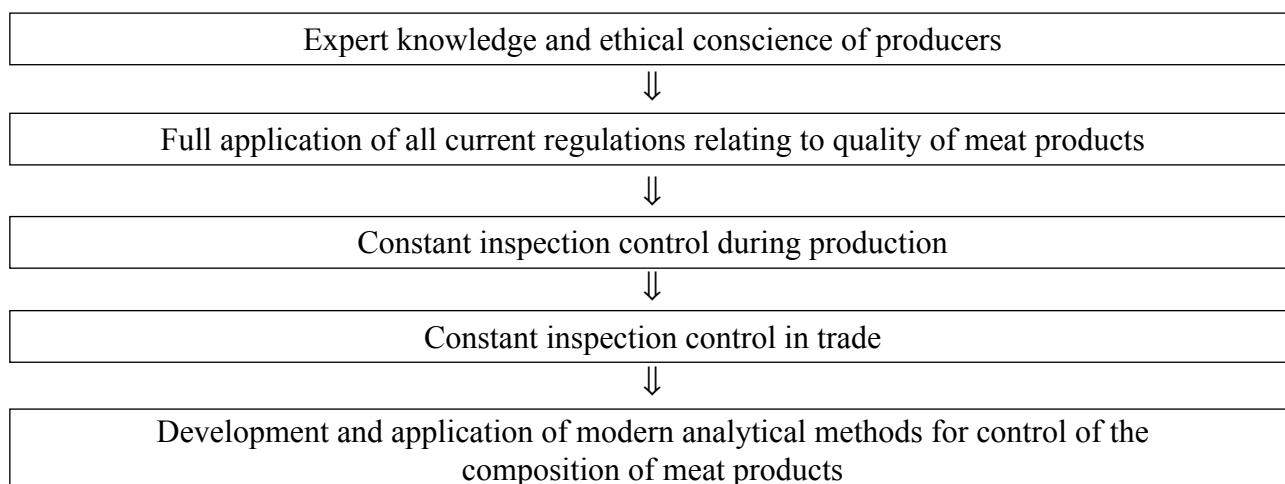
Certain colors have been allowed for use since December 2004 in meat products but only in certain products and in regulated quantities, so, it is understandable that in our country we still are not capable of using adequate analytical methodology for determination of their presence and quantity in meat products. Accordingly, of course, there are no requirements for their control. It has to be mentioned that Kosenilo is allowed for use in certain meat products, whereas Ponso 4P is not on the list of allowed additives for use in meat industry, but we suspect that because of its desired traits and effect on color quality of the product, in spite of ban, it is still used in processing, like some other additives which are not intended for use in meat products. Because of its property to affect positively the quality of color of certain meat products, food color Ponso is used also in manufacturing of some spice mixtures used all around the world in manufacturing of food products.

So, we think that beside conscience and expert knowledge of people working in the meat industry, obligation to comply with regulations relating to quality of meat products, use of additives and obligation to declare composition of products, inspection control during production and in trade, it is necessary to control the quality of meat product in more detailed manner and constantly develop and apply analytical modern analytical methods in assessment and control of meat products.

### **Selected analytical methods for more complete control of quality of meat products**

In laboratories of the Institute of meat Hygiene and Technology, high quality methods for determination of species of meat have been developed and validated; also for determination of quantity and quality of soy bean and gluten proteins in meat products; for determination of quantity and quality of carrageenans and determination of quantity of food colors Kosenilo and Ponso.

Identification of proteins of muscle tissue originating from different animals in developed countries is done using method ELISA. Method is based on enzyme immune reaction (ELISA). Contrary to

**Scheme 1.** Elements of development of consumer protection strategy**Shema 1.** Elementi razvoja strategije zaštite potrošača

other methods with same purpose, it takes very little time and it is very reliable and fast. Enzyme immune reaction is based on determination of presence of thermo-stable proteins which are characteristic/species specific. For detection and identification of different meat species in meat products also PCR technique is used which is also very fast and highly sensitive (Arslan Ali *et al.*, 2009; Ghovvati *et al.*, 2009; Gurdeep Rastogi *et al.*, 2007; Kesmen *et al.*, 2007; Weibin Bai *et al.*, 2009; Rea *et al.*, 2009). In this technique, gene targeted is cytochrome b coded by mitochondrial circular DNA molecule. This gene is highly preserved during evolution and can be found in numerous copies which enable its easy species specific identification.

Methods used for quantitative and qualitative determination of the content of soy protein in meat products are microscopy, SDS poly acryl amide gel electrophoresis and analysis of peptides, and all mentioned methods require lot of time and don't give sufficiently precise results (Tsumara *et al.*, 2005). Soy bean can be identified in meat products microscopically, but organoleptic/sensory evaluation is not neglected and represents the first step in further analytical procedure. ELISA method is also widely used all over the world and principles of enzyme immune reaction, as method sensitive and soy protein specific even in products where other proteins are present such as other proteins of plant or animal origin and other proteins. Presence of soy proteins in meat products, according to literature data, can also be established by reverse highly efficiency liquid chromatography. The latest literature data present fast/rapid, specific and sensitive method for determination of additional soy proteins in meat products which is also based on reverse-phase high efficiency liquid chromatography, but phytoestrogens are

detected, main isoflavones from soy bean - daidzein and genistein. Using this procedure it is possible to detect in meat products amounts of soy bean below 0.1%. However, we couldn't find data on if this procedure is used in regular inspection control.

Gluten, as well as dairy supplements, is easily and rapidly identified by analytical methods, primarily by ELISA technique, in meat products.

The most frequent methods for determination of karagenan stated in foreign literature and papers by different authors are chromatography methods (primarily methods of gas chromatography and high efficiency liquid chromatography) (Sebranek, & Bacus, 2007). Recently, there are methods presented which use infrared spectral-photometry with Fourier transformation. Advantage of spectral-photometry methods compared to chromatography is simpler preparation of samples for analysis and shorter time for carrying out of the analysis, whereas chromatography techniques have higher sensitivity and selectivity. All of these analytical methods and techniques are applied for determination of carrageenan and other hydrocolloid polysaccharides in products intended for human consumption.

Methods for determination of food colors in meat products, primarily those of interest to our market and products which can be found on our market, E 120 and E 124, are spectral-photometry methods, kinetic methods, and in more recent studies also liquid chromatography methods (high efficiency liquid chromatography) with different types of detectors (UV/VIS, PDA) are mentioned. Ponso 4R, as azo color, is frequently determined multi-residually with other azo colors, for instance together with Sunset yellow, Sudanese azo colors, etc (Straub, 2005).

Application of new methods and expanding of the list of parameters which are used within the

control of meat products, would greatly contribute to improvement of the efficiency of the consumer protection strategy, first of all of their health and of protection of their economical, ethical and religious interests. Identification of the main raw material in meat products is important because of the cases when during manufacturing process more expensive meat which is declared on the label, is partially substituted with cheaper meat species. This is not only economical and ethical violation, but it can seriously endanger health of those consumers who are intolerant or hypersensitive to certain types of meat proteins.

## Conclusion

Introduction of new parameters of control in assessment of the quality of meat products offers

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