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FEEDINGSTUFFS AND HUMAN HEALTH

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The paper shows the selected factors that are produced by men and that influence health quality of animal feeding stuffs, food safety and environment protection. It also presents hazards that arise as a result of faulty or incorrect use of legal acts or therapeutic premixes; a lack of knowledge about the interaction between therapeutic products and feed, the problem of the influence of genetically modified organisms on animals or antibiotics themselves on the environment. The effects of the described substances, that enter animal organism at very low doses that evoke subclinical picture of diseases and / or that cumulate in them, were underlined. Aberration of homeostasis in three principal systems in the organism (hormonal, immunological and nervous systems) may be the subsequent consequence. This condition can lead to the prevalence of a particular disease evoked by the mentioned factor or it can provoke the virulence of the pathogen that is present in the organism as saprophyte or as a result of the contact with exogenous pathogen. The summary suggests executing the binding law regarding particular feed additives (*e.g.* antibiotics) more effectively and considering the results of scientific research. The materials admitted to use and feed additives in feeding of farm animals should be evaluated more perspectively and multidirectionally. This estimation ought to be carried out regarding also all the consequences of the influence of these substances on health of animals and consumers of food of animal origin and the influence of wastes of animal or feed origin on the environment.

INTRODUCTION

Nowadays much more attention is being paid to decisions and suggestions of veterinary doctors taken as a whole that are directed to support the so-called animal welfare and the quality of a completed product of animal origin. The maintenance of animal welfare at a high level as well as the high quality of animal-based foodstuffs may be achieved through precise preventive activities, which means "following the rules of animal and animal feeding stuffs hygiene and providing detailed programmes of specific and non-specific prophylaxis for herd or group of animals regardless of their number" [McEvoy, 2002]. However we encounter some significant difficulties while trying to fulfil the rules mentioned above. The failures in maintaining high productivity of animals in commercial breeding and ineffectiveness of preventive or therapeutic activities are frequently caused by the presence of subclinical conditions that are diseases or productive disabilities which are very difficult or even impossible to diagnose through routine diagnostic measures or laboratory analysis. The reason for these conditions may lie in improper health quality of animal feeding stuff.

Modern animal feeding stuff should allow for manufacturing animal-based food of high health quality [Eissen *et al.,* 2000; Aguzzi *et al.*, 2004]. And at the same time they should be environmental and animal friendly [Ellsmere, 1999]. These needs prompt us to widen subjects of research and studies. In recent years, a significant challenge has been to change the traditional carriers of nitrogen and phosphorus (meat/bone meals) [Bakuła *et al.*, 2004] into new, underestimated until recently, resources. Too careless use of feed material and additives has led to many dangerous environmental changes (antibiotics, dioxins, nitrofens) [Martin *et al*., 1999] and what is worse as a result of using them some dangers are posed to human health (steroid hormones, BSE – vCJD) [Polak & Żmudziński, 2001; Schaefer *et al*., 2000].

In pursuit of increasing productivity no attention has been paid to conditions of animals (welfare) [Aguzzi *et al.*, 2004] and nowadays, as a result of long-standing genetic research, farm animal, pigs, poultry and companion animals in particular [McEvoy, 2002], are oversensitive [Eissen *et al*., 2000] and vulnerable to health quality of animal feeding stuff [Aguzzi *et al.*, 2004], environmental conditions and reproductive techniques [Harlow & Hillier, 2002]. The use of feeding stuffs prepared according to modern formulas (much more sophisticated), but in wrong proportions and without following health quality while choosing feeding materials and additives [Eissen *et al*., 2000], may easily lead to: (i) unexpected pathological conditions in animals [Gajęcki, 2002; Aguzzi *et al.*, 2004]; (ii) undesired emission of unused components [Opaliński, 2003; Szprengier-Juszkiewicz, 2002]; (iii) wastage of valuable animal feeding stuffs. The presented situation is very dangerous for a man as the last link in the food chain and as an organism that exists in the environment for a much longer period of time [Opaliński, 2003].

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In our country, the manufacturer bears the responsibility for proper health and commercial quality of food and animal feeding stuff. It is true, however, that in the case of food and animal feed most of quality defects are hidden ones. They manifest themselves during consumption or even later when a poor quality product does not exist whereas subclinical conditions occur in animals and what is worse in humans, but we cannot diagnose that [Gajęcki, 2002]. It is in people's, animals', environment and salesman's interest to assure that foodstuffs as well as animal feeding stuffs have a well known history "from stable to table" because it provides a quick access to a real manufacturer of poor quality food or animal feeding stuff.

In EU, according to Directive 85/374, a manufacturer is responsible for a product's defects. Only in cases where the manufacturer cannot be identified, the supplier bears the responsibility. In this Directive agricultural material and venison are excluded from responsibility. The legislative procedure is being held in order to extend the effects of regulation concerning responsibility of manufacturers of agricultural materials. After the scandal over the association of the incidence of Creutzfeld-Jacob disease in people or later statement that prion (infectious factor) is a danger for people causing the new variant of Creutzfeld-Jacob disease (nvCJD) [Larska & Polak, 2003; Polak & Żmudziński, 2001] with the consumption of meet derived from animals affected with bovine spongiform encephalopathy (BSE) or the fact of using improper fat-like substances in order to improve the energy value of animal feeding stuffs (the animals were treated like "recycling plants" – dioxins scandal), vigorous efforts started to be made in order to identify the sources of meet and as a whole the materials used for the production of animal-based foodstuff or animal feeding stuff.

The aim of the study was to present the selected factors (legal and biological ones) that are important from the veterinary inspection's point of view and that may influence health quality of animal feeding stuffs, food safety and environment protection.

JURISDICTION IN FORCE

A specific supervised manufacturing system and documented origin of materials are important attributes of health quality of food and animal feeding stuff. It is in the interest of consumers that information given simplifying the selection of a product were reliable and confirmed by the authority of the institutions obligated to provide control over the production and the trade of food and animal feeding stuff. On the other hand, it is in the manufacturer's and salesmen' interest that information about the origin and the method of production was accepted by consumers and promoted sales [Bakuła *et al.*, 2004]. This specific way of manufacturing applies to agricultural materials and "biological" foodstuff produced on the area of ecologic farms (Opinion – 2005/C 71/04). In this case, the problems in EU are solved by the rules defined in Regulation No 2092/91. The European Commission (EC) Regulation No 820/97 was a novelty as it introduced the identification and registration system of cattle in order to mark the source of meet and its products. It is also known that some measures will be taken in order to extend the system of identification of the source of raw materials used in the food production to plant materials (used in the food production as well as animal feeding stuff, for example European Commission (EC) Regulation No 382/2005) which until now are found in turnover mostly anonymously and thus are very difficult to be excluded from the market in the case of detecting contamination that poses a risk to human health (food) or animal health (animal feeding stuff) [Bakuła *et al*., 2004].

Following a momentary need, a detailed outline of administrative control of animal feeding and animal feeding stuff should be presented in executory provisions resulting from the act of animal feeding stuff. The following acts present a good pattern: Directives No 95/11, 95/53, 95/69, 96/23, 96/25, 1999/29, 2005/7 or 2005/8 and Council Regulations (EC) No 2092/91, 2078/92, 1774/2002 and 1831/2003 or the new acts that are being published but they will have been in effect by January 2006, *e.g.* EC Regulation No 183/2005, 255/2005 or 382/2005. Based on all these presented documents, it appears that the controls of animal feeding must be performed by competent authorities of the membership countries. Nowadays in the EU countries, and soon in our one, The European Commission will not perform any specific administrative control actions. However, as the result of BSE, "dioxin" or "nitrofen" crisis, the pressure has arisen in order to make the European Commission assure the efficiency of the controls performed by the membership countries and also that the quality standards are the same in the EU [Bakuła *et al.,* 2004]. In other words, The Commission has a "monitoring" role with reference to the way the national controls are performed. From the documents mentioned above it appears that "competent authorities" of the membership countries are different. Every membership country independently appoints the bodies responsible for controlling animal feeding stuff. It may be the ministry of agriculture or some institution responsible for animal health and consequently for human health and the environment. It depends on the structure of the administration and on the history of every country [Polak & Żmudziński, 2001]. It is not necessary that only one institution is responsible for the entire control of animal feeding stuff in a particular country. However it is important to avoid duplicating or multiplying controls. Their competence should be strictly defined. Yet in critical situations the Commission may take initiative and appoint a special control body, as it took place in September 1997 when as a result of the crisis over BSE The European Union created The Food and Veterinary Office with the registered office in Dublin, Ireland. This Office directly comes under the authority of XXIV Directorate General of the European Commission whose role addresses "Health and Consumer Protection" and whose competence has recently been largely extended covering the scientific aspects of legislation concerning food and animal feeding stuff, controlling and testing these products and prophylaxis of zoonosis. The main task of this Office is to monitor keeping to the rules of food hygiene, animal feeding stuff hygiene and the veterinary laws, which also applies to phytosanitary aspects in and outside the EU, in order to support and maintain the

trust for food safety, particularly of animal origin, offered to European consumers [Tyszkiewicz, 2000].

Coming back to our domestic needs and referring to the existing acts as well as to the ones to be established in order to fulfil the European requirements, some suggestions should be developed: what kinds and means of the control over animal feeding stuff are to be performed. Even now it is possible to determine that the final products in feed manufacturers and also feeding materials and additives at the time of acquiring should or must come under control [Janczyk, 2002]. The way, the conditions and the health quality of acquired feeding materials and additives should be taken into account.

The threat of pathogenic microorganisms connected with for example animal meals justifies the production of pelleted feed proceeded by expanding, extruding or micronisation. It is unacceptable to produce feeding stuff through mixing ingredients (feeding materials) and later pelleting or mixing only. Unfortunately the majority of feeding stuff is feed blends which are, from the veterinary and sanitary point of view, very dangerous. On the other hand, the most modern manufacturing techniques, which are pelleting proceeded by preliminary preparations through expanding or micronisation, force the feed producers to keep to expiry dates of feeding materials and feeding stuffs. The breeder should also use this method of feed analysis. Exceeding an expiry date entitles a consumer to return a product and the producer is obliged to withdraw such a product. Unofficially we are aware that feeding materials or feeding stuffs do not lose their properties from one day to the next. The process of "aging" takes place gradually depending on the type of a product.

Premixes and medicated feed

The problem of drug residues in animal-based food is being discussed. Under the term residue we understand the presence of a parent active compound of a drug or its metabolites and contamination that results from the administration of this drug to animals according to the rules of good medical practice. While discussing the problem of residues, we should also take into account the possibility of the presence of the so-called residues connected with macromolecular proteins. The most frequent reasons for drug residues in food are the mistakes made by man during the production and use of medicated feed (*e.g.* inappropriate blending, introduction of another material by mistake or contaminated equipment). The reason for this may lie in conscious or unconscious overdosing, not keeping to withdrawal period or using a drug for another target species. In order to maximally eliminate veterinary drug residues from food of animal origin the withdrawal periods were established for every drug. This is the period which must pass from the last application of a drug until obtaining animal based material. The toxicological indices are the basis for determination of withdrawal periods describing a particular drug. As an example: for sulphonamides the withdrawal period stands at 7 days and in addition the maximum allowed concentration in food is 0.1 mg/kg, for neuroleptics and beta-blockers the withdrawal period stands at 3 days. The separate matter is keeping to a withdrawal period while using different medicaments or feed additives by breeders. Coccidiostatics are the best example. In the majority they are chemotherapeutics which in Poland and many other countries are registered in a way similar to other drugs. However due to their application they are included in the group of feed additives. They vary in terms of chemical structure and should be chosen according to particular species and environmental conditions. The most important is keeping to the withdrawal period that stands at 14-10 days before the end of fattening. In reality only a few poultry producers obey this. Therefore it means that the legally binding acts are right, but not fulfilled, so in other words the controlling process is too ineffectual.

Bearing animal health in mind, and consequently the human population and the environment, it is essential to be able to competently use different therapeutics that at low doses may be very helpful in animal production. When used in a suitable way, they are absolutely harmless to animals, people and the environment. "Medicated premixes" may be listed as an example. They must be prepared according to the prescription, not carelessly, and used according to recommendation.

According to the EU Directives (90/167 and 96/23), "a medicated premix" means any substance or a combination of ingredients blended with a suitable feed carrier prepared in order to make "a medicated feed". For the veterinary pharmacotherapy the premix is a specific form of drugs for animals. This is a very comfortable form of medicament particularly for a therapy of a large herd. "The medicated premix" must be registered like every drug and the preparation of "medicated feed" requires a specific veterinary supervision. The use of "medicated feed" should be performed in accordance with recommendations and under veterinary supervision.

The efficacy and safety of using premixes depends on proper preparation. The amount of drugs in premixes and feeding stuff is determined in prescriptions. Lowering the amount of an active substance may lead to a decrease in drug efficacy and to an increase in microorganisms' or parasites' resistance to this drug whereas overdosing may cause acute or chronic intoxications in animals. Overdosing is also connected with a risk of maintenance of drug residues in animal-based food (in the case of treatment of farm animals). It also leads to a situation when a drug penetrates the environment at doses higher than expected (together with faeces and pollution) [Opaliński, 2003]. The risks to public health resulting from the pollution of the environment with the drugs used in animals are rarely determined, but we cannot assume that they do not exist.

Hence there is a necessity for controlling the content of therapeutic substances in premixes and feeding stuff and in the case of existing productive failures (probable intoxications) for possessing the methods for identification and determination of an infectious factor. The confirmation of exceeding the maximum residue level (MRL) in animal-based products imposes a duty to search for the causes. This was the main reason for introducing a prohibition on retail sales of premixes in accordance with the law.

All these directly and indirectly proves the significance of the subject of controlling the production and distribution of medicated premixes and feeding stuff with reference to health quality of animal feeding stuff compared with human and animal health as well as the environment.

Interaction between medical products or specific feed additives and animal feeding stuff

The administration of medical products or specific feed additives is directed at rebuilding the disturbed homeostasis of an organism or stimulating a particular productive effect. The medical products used in the treatment of diseases must reach a proper therapeutic concentration in an organism of a treated animal. Under dosing is ineffective whereas overdosing produces undesired side effects. All authorised medicinal products have determined posology. However, even when administered at optimal doses, medicinal products may cause side effects after application. Such a condition may occur after simultaneous administration of several drugs interacting with each other, which may lead to severe disorders. Similar clinical consequences or a decrease in a therapeutic effect may result from interactions between medicinal products and animal feeding stuff. This problem has not been recognised yet, however in recent years there have been more and more publications describing these kinds of interactions and their consequences. The mechanisms of interactions between medicinal products and animal feeding stuff are very complex and may occur at a level of releasing from prescription form while introducing into feed as feed additives or during the production of medicated feed (premixes), biochemical transformation of a drug in the gastrointestinal tract and its elimination from an organism [McEvoy, 2002].

The interaction means an impact of one substance on the content, metabolism and activity of the other one. The interaction may take place between drugs used simultaneously or between medicinal products and animal feeding stuff. From the pharmacological point of view, we determine three kinds of interaction: pharmaceutical, pharmacodynamic and pharmacokinetic ones.

The pharmacological incompatibility of a drug may lead not only to the modification of the physical form of medicinal products or specific feed additives, but also to the modification of pharmacological properties. The interaction may as well occur between medicinal product or specific feed additives and the ingredients of animal feeding stuff, *e.g.* after simultaneous use of tetracycline and dairy products. Tetracycline forms chelate complex with Ca^{2+}, non-absorbent from the gastrointestinal tract, which consequently leads to a decrease in drug concentration in blood and to a reduction of its antibacterial activity [Bakuła *et al*., 2004].

The pharmacodynamic interaction is a mutual modification of pharmacological activity through simultaneous administration of medicinal products or medicinal products and substances found in animal feeding stuff at a receptor and effector level. Consequently, the effect of such an interaction may be a one-way activity that results in an increase in the pharmacological action (synergic activity) or conversely in the diverse interaction causing a reduction or complete elimination of drug activity (antagonistic activity).

A similar situation may be observed in the case of products with an antagonistic mode of action. Competitive antagonism applies to drugs reacting with the same receptors whereas non-competitive antagonism takes place while using medicaments with different points of action, *e.g.* acetylcholine and papaverine. Some medicinal products or specific feed additives may show an agonistic and antagonistic mode of action. Phytoestrogens found in food show a similar and diverse impact on an organism – they react antagonistically during the follicular phase and ovulation whereas agonistically in the luteal phase and early pregnancy [Gajęcki, 2002; McEvoy, 2002].

Genetically modified organisms

The Act on genetically modified organisms (GMO) passed on the 22nd of June 2001 (Law Gazette, 2001, No 76, item 811) is another proof of fears of uncertainty and ambiguity of the situation. From the very beginning this act was given a nickname "over restrictive" due to the strict regulations imposing some discipline on administrative organs competent to GMO, closed use of GMO, deliberate release of GMO into the environment with the aim different than introducing into turnover, introducing GMO products into turnover and taking GMO product out of the country as well as transiting GMO products. The majority of the decisions are made by the Minister of the Environment or by the departmental Commission competent to GMO.

The genetically modified organisms include plants, animals and microorganisms whose DNA was deliberately modified by a man with the use of genetic engineering methods. Such creations are called transgenic organisms or GMO. This short definition hides a lot of doubts and disputes concerning the use of genetic engineering. The supporters think that in this way it is possible to improve for example the properties of plants, animals and produced food. With the use of genetically modified organisms it is also possible to manufacture drugs and destroy harmful wastes. The opponents are of the opinion that without the knowledge of the consequences of genetic manipulations future generations are at risk. People may lose control over GMO introduced into the environment. There is a fear that genetically modified food may induce allergies and other yet unknown consequences for human health [Kossobudzki, 2004].

The other point of view is caused by economic, environmental and technological factors. The economic benefits are as follows: 5% higher efficacy per ha, the possibility to reduce the use of herbicides by 30% or 20% reduction of the production costs. The benefits for the environment mean: less "chemicals", lower consumption of energy or decreased amount of undesired substances in grain, *e.g.* mycotoxins. The technological benefits are: easy harvest, a lack of quarantine weeds such as fungal ambrosia in maize grain, the improvement of storage properties and the improved quality for processing.

On the other hand, it is estimated that app. 75-80% of genetically modified plants is used in feed production [after Zduńczyk, 2004]. The genetic engineering techniques allows for the modification of chemical composition of plants, which consequently leads to the change of qualitative properties and nutritional value. The modification of amino acid profile of seeds and grain affords the possibility to balance feeding amounts without using synthetic amino acids and to eliminate animal-based meals out of diets. It is assumed that the use of genetically modified plants in animal feeding will improve their nutritional value. In plants, the presence

of compounds modifying digestion or animals' metabolism may lead to a decrease in the amount of drugs used for treatment and prophylaxis. We should remember, however, that the interference in genetic material means introducing a new determined feature which may be connected with a certain risk of introducing other undesired characteristics. It is also possible to increase the expression of a lethal gene or a group of inactive plant genes, which is the result of the unintentional introduction of a new feature into DNA of a modified plant or of the deletion of DNA fragment encoding the desired feature. The modifications of macromolecules being the part of genetically modified plants, which are dangerous for an organism, may also be caused by the impact of specific physical factors during biotechnological processing of plants assigned for consumption or animal feeding.

The presented suggestions raise some doubts that the modification of genetic structure of plants may have a negative impact on animals and consequently on consumers in an unpredictable way. The creation of entirely new proteins or the introduction of changes in chemical structure of particular nutritive compounds may pose a certain risk due to properties of products (unknown activity or allergenic or immunomodulating properties). It may be assumed that the modification of genetic characteristics of plants may change the functions of individual tissues or whole animal organism and in turn human who is the last link of the food chain.

According to some authors [after Zduńczyk, 2004], ethical doubts questioning the right of biotechnologists to correct nature are axiomatic and should not be discussed as far as natural sciences are concerned. In comparison with other ethical values, it is the responsibility of the state to guarantee the right to choose goods according to consumers' needs. This postulate is fulfilled by the producers and distributors who must label the products containing GMO. The gradual reinforcement of the systems directed at controlling the production and distribution of food with GMO should be based on the consumers' right to have reliable information about products. However it should not be used as an opportunity to discriminate products regardless of a real risk of decreased nutritional or health value of food. It may be assumed that in many cases consumers' reluctance to products of modern biotechnology results from the fear of the undesired impact of GMO on human organism.

Negative impact of feeding stuff on the environment

From self observation as well as from other publications it appears that slurry derived from animals fed with commercial feeding stuff causes significant changes in the environment (too much nitrogen and soil erosion, degradation of surface freshwater, decrease in grazing lands quality through changing botanical composition, *etc.*). Until now there is little knowledge about interaction of individual animal feeding stuff between one another. This is not the most important problem which agriculture has to face, but surely it is for veterinary medicine. Thus it is supposed that some side effects will arise soon, *e.g.* unclear or ambiguous clinical conditions on commercial farms.

As far as animal feeding is concerned, the aim of using feeding stuff, feeding materials or premixes is to optimize digestion and absorption of individual nutrients. The mode of action of premixes (specific feed additives) lies in stimulating the absorption of nutrients and in suppressing the growth of conditionally pathogenic and pathogenic microorganisms. These microorganisms are the main factor that stimulates the activity of the local immune system. Their elimination leads to oversensitivity of the membranes of the intestines and to a decrease in energy needs essential for their protection or regeneration. Hence some "saved" or unused nutrients are incorporated into other tissues. From the veterinary point of view, we should be mostly interested in "parenteral" transformation of bacteriostatic or bactericidal additives.

After the discovery of antibiotics in 1940s, it appeared that they might be helpful to people as well as to animals and not only therapeutically. They started to be used as specific feed additives first in the USA, in 1949 for swine feeding, and in 1953 in Europe [Jonson & Jacobson, 1973].

The impact of antibiotics on animal health and development was determined much earlier. Nowadays adding antibiotics to animal feeding stuff is a common practice all around the world. In EU it is regulated in the Directive No 70/524/EEC.

Tonnes of "feed" antibiotics after passing the gastrointestinal tract end in the environment. The attention of the producers paid to antibiotics growth promoters was due to the economic situation – not to the ecological effect or environmental hygiene of animals or people. There was a lack of awareness, but also a lack of good will of authorities. The course of action during implementation of such a kind of substances was and still is similar to other products. The positive side is always presented, not the negative one. Such oblique statements should be avoided considering these kinds of "additives" which have a significant impact on animals' health condition.

From the article published by Opaliński [2003] it appears that the use of antibiotics growth promoters in animal feeding causes many changes in the environment: the disruption of the ecological balance in soil, which means disrupting the balance between bacteria and moulds and the elimination of nitrogen from soil. Further changes in the environment may only be predicted as the consequences of the processes mentioned above – they result in barren soil, escape of mineral compounds into underground water (eutrofication) and in the decrease in primary production [Opaliński *et al.,* 1998].

The presented publication [after Opaliński, 2003] indicates also that the use of antibiotics growth promoters in commercial feeding stuff for farm animals and consequently their presence in slurry causes: (1) the qualitative and quantitative impoverishment of soil and water biocoenosis of the environment; (2) triggering the process that becomes apparent after three weeks but the results are seen even for forty weeks and consist in disrupting the balance between moulds and soil bacteria in favour of moulds (the decease in the processes of cellulose decomposition and soil nitrification); and (3) the significant increase in the biomass of monocotyledons which is very dangerous for the botanic composition of grazing lands and meadows in large area agriculture.

In conclusion the author mentioned [Opaliński, 2003] discussed the fact that in the EU, and now in our country, the

ban on using antibiotic growth promoters was introduced as far as pig production is concerned, but they may be added to feeding stuff for poultry and milk or beef cattle. The use of coccidiostatics is left unsaid. But all these antibiotics pass into manure or slurry and are distributed over fields as natural fertilizer!?!

SUMMARY

We should be very firm to enforce the law on the health quality of animal feeding stuff and particularly specific feed additives (antibiotics) while used for therapeutic as well as preventive purposes.

We try very hard to improve nature by interfering or even destroying its form established many years ago. The results obtained we present tendentiously and unilaterally leaving unsaid the ambiguous situations which we cannot explain or, what is worse, predict (*e.g.* BSE crisis).

We should perceive health problems - at the time of introducing new or modern feed additives or while interfering in the structure of animals or plants - more horizontally now and in the future.

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PASZE DLA ZWIERZĄT A ZDROWIE LUDZI

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W przedstawionym opracowaniu zostały przedłożone wybrane czynniki prowokowane i produkowane przez człowieka a mające wpływ na jakość zdrowotną środków żywienia zwierząt, bezpieczeństwo żywnościowe oraz ochronę środowiska. Przedstawiono ewentualnie występujące zagrożenia w wyniku błędnego lub nieprawidłowego stosowania aktów prawnych, premiksów leczniczych, antybiotykowych stymulatorów wzrostu, organizmów genetycznie modyfikowanych czy antybiotyków jako takich w środowisku. Należy podkreślić, że efektem działania tych substancji w małych dawkach jest wywoływanie stanów subklinicznych i/lub kumulowanie się ich. Konsekwencją dalszą może być zachwianie homeostazy na poziomie trzech podstawowych układów w organizmie (hormonalny, immunologiczny i nerwowy).Taki stan rzeczy może być przyczynkiem stanów chorobowych wywołanych na przykład, przez ten określony czynnik, mogą być sprowokowane uzjadliwieniem się saprofitycznych patogenów obecnych w organizmie lub wynikiem bezpośredniego kontaktu z zewnętrznym patogenem. W podsumowaniu zasugerowano by skuteczniej egzekwowano obowiązujące prawo w odniesieniu do określonych dodatków paszowych (np. antybiotyków), bardziej wsłuchiwano się w wyniki badań pracowników nauki. Bardziej perspektywicznie i wielokierunkowo powinniśmy oceniać dopuszczone do stosowania materiały i dodatki paszowe w żywieniu zwierząt gospodarskich wraz z wszystkimi konsekwencjami wpływu na stan zdrowia zwierzęcia, konsumenta spożywającego pokarm pochodzenia zwierzęcego oraz wpływ odpadów pochodzenia zwierzęcego czy paszowego na środowisko.