USE OF HERBS AND SPICES AND THEIR EXTRACTS IN ANIMAL NUTRITION

Tamara FRANKIČ1, Mojca VOLJČ2, Janez SALOBIR3, Vida REZAR4


Received May 24, 2009; accepted November 17, 2009.

1 INTRODUCTION

Only quality feed together with proper hygiene, potable water and management can ensure the production of nutritious animal products with desired organoleptic properties (Saxena, 2008). Keeping farm animals healthy is necessary to obtain healthy animal products. For the last decade the use of additives of natural origin in animal and human nutrition has been encouraged. Numerous researches focused on the clarification of the biochemical structures and physiological functions of various feed additives like probiotics, prebiotics, organic acids and plant extracts.

Herbs, spices and their extracts were already used thousands of years ago in Mesopotamia, Egypt, India, China and old Greece, where they were appreciated for their specific aroma and various medicinal properties (Greathed, 2003). When discussing the use of herbs and spices as feed additives, we can hardly rely only on old believes about health impact of certain herbs and spices or their active components. We need a scientific proof of their beneficial effect on health and performance of the animals to justify their use. The technological progress enables us to more easily determine the structure and function of yet unidentified active molecules of plant origin.

To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts. The composition of extracts from the same plant depends on the method of extraction and

---

1 Univ. of Ljubljana, Biotechnical Fac., Zootechnical Dep., Groblje 3, SI-1230 Domžale, Slovenia, Ph.D., e-mail: tamara.frankic@bfro.uni-lj.si
2 Same address, e-mail: mojca.voljc@bfro.uni-lj.si
3 Same address, Assoc. Prof., Ph.D., e-mail: janez.salobir@bfro.uni-lj.si
4 Same address, Ph.D., e-mail: vida.rezar@bfro.uni-lj.si
the properties of the extraction solvent used. Depending on the chemical characteristics of extraction solvents, we can extract only certain molecules. There is also a difference between purified and unpurified extracts. Unpurified extracts contain a number of different molecules extracted with certain solvent, which can affect the action of each other, while purified extracts contain only one active component. The purified active molecules extracted from plants can be sometimes substituted by synthetic, naturally identical molecules. Plants mainly contain one or some predominant active molecules (secondary metabolites), which are responsible for certain biological effects. The amount of these molecules varies depending on the variety of plant, growing conditions, harvest time, etc. When we need the effect of a specific active component, it is more efficient to use a purified molecule alone than a dried plant or unpurified extract. But we have to be aware that the potency of an unpurified extract often exceeds the potency of a purified one because of synergistic effect among the molecules in it.

When talking about plant extracts, we must mention also essential oils. These are extracts of vaporous oils of strong taste and smell, which are still usually extracted by distillation with steam. Essential oils are very potent molecules and must be used in small quantities. Adversely, they can affect the function of intestinal microflora, cause allergies, suppress feed intake and can be stored in tissues. With the proper usage, most of essential oils are recognized as GRAS (generally recognized as safe). Today’s market offers different extracts of certain aromatic plants, combinations of extracts of different plants, purified active components, or combinations of purified active components and synthesized active molecules (naturally identical) (Indresh, 2007).

The effect of active components from herbs and spices depends largely on the dosage used. No effect

<table>
<thead>
<tr>
<th>Plant</th>
<th>Used parts</th>
<th>Mayor active component</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aromatic spices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutmeg</td>
<td>Seed</td>
<td>Sabinene</td>
<td>Digestion stimulant, antidiarrhoeic</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>Bark</td>
<td>Cimetaldehyde</td>
<td>Appetite and digestion stimulant, antiseptic</td>
</tr>
<tr>
<td>Cloves</td>
<td>Cloves</td>
<td>Eugenol</td>
<td>Appetite and digestion stimulant, antiseptic</td>
</tr>
<tr>
<td>Cardamom</td>
<td>Seed</td>
<td>Cineol</td>
<td>Appetite and digestion stimulant</td>
</tr>
<tr>
<td>Coriander</td>
<td>Leaves, Seed</td>
<td>Linalol</td>
<td>Digestion stimulant</td>
</tr>
<tr>
<td>Cumin</td>
<td>Seed</td>
<td>Cuminaldehyde</td>
<td>Digestive, carminative, galactagogue</td>
</tr>
<tr>
<td>Anise</td>
<td>Fruit</td>
<td>Anethol</td>
<td>Digestion stimulant, galactagogue</td>
</tr>
<tr>
<td>Celery</td>
<td>Fruit, Leaves</td>
<td>Phtalides</td>
<td>Appetite and digestion stimulant</td>
</tr>
<tr>
<td>Parsley</td>
<td>Leaves</td>
<td>Apio1</td>
<td>Appetite and digestion stimulant, antiseptic</td>
</tr>
<tr>
<td>Fenugreek</td>
<td>Seed</td>
<td>Trigonelline</td>
<td>Appetite stimulant</td>
</tr>
<tr>
<td>Pungent spices</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capsicum</td>
<td>Fruit</td>
<td>Capsaicin</td>
<td>Digestion stimulant</td>
</tr>
<tr>
<td>Pepperr</td>
<td>Fruit</td>
<td>Piperine</td>
<td>Digestion stimulant</td>
</tr>
<tr>
<td>Horsradish</td>
<td>Root</td>
<td>Allyl izoticianat</td>
<td>Appetite stimulant</td>
</tr>
<tr>
<td>Mustard</td>
<td>Seed</td>
<td>Allyl izoticianat</td>
<td>Digestion stimulant</td>
</tr>
<tr>
<td>Ginger</td>
<td>Rizom</td>
<td>Zingerone</td>
<td>Gastric stimulant</td>
</tr>
<tr>
<td>Garlic</td>
<td>Bulb</td>
<td>Allicin</td>
<td>Digestion stimulant, antiseptic</td>
</tr>
<tr>
<td>Herbs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosemary</td>
<td>Leaves</td>
<td>Cineol</td>
<td>Digestion stimulant, antiseptic, antioxidant</td>
</tr>
<tr>
<td>Thyme</td>
<td>Whole plant</td>
<td>Thymol</td>
<td>Digestion stimulant, antiseptic, antioxidant</td>
</tr>
<tr>
<td>Sage</td>
<td>Leaves</td>
<td>Cineol</td>
<td>Digestion stimulant, antiseptic, carminatif</td>
</tr>
<tr>
<td>Laurel</td>
<td>Leaves</td>
<td>Cineol</td>
<td>Appetite and digestion stimulant, antiseptic</td>
</tr>
<tr>
<td>Mint</td>
<td>Leaves</td>
<td>Menthol</td>
<td>Appetite and digestion stimulant, antiseptic</td>
</tr>
</tbody>
</table>
whatever can be observed at small doses; on the other hand, large amounts can be even toxic.

The search for nutritive antibiotic alternatives in EU and increased awareness and concern of the consumers, further encouraged the precise researches on the possibilities of plant extract use in animal nutrition. The main scope in animal husbandry – to ensure good performance of farm animals and get quality animal products, can be achieved only with the effort to keep the animals healthy. In this aspect, herbs and spices are not just appetite and digestion stimulants, but can, with impact on other physiological functions, help to ensure good health and welfare of the animals, what can positively affect their performance.

2 POSSIBLE USE OF HERBS AND SPICES

2.1 HERBS AND SPICES AS APPETITE AND DIGESTION STIMULANTS

When considering supplementing the feed with herbs and spices or their extracts to stimulate the appetite, we have to know the taste preferences of different animal species. Janz et al. (2007) found that pigs preferred the feed supplemented with garlic or rosemary over the feed supplemented with oregano or ginger. Furthermore, Jugl-Chizzola et al. (2006) noticed that weaned pigs consumed significantly less feed if it was supplemented with thyme or oregano. If pigs in this experiment had the possibility to choose among feed with or without above mentioned spices, they had chosen the unsupplemented feed. The spices known for their appetite stimulant effect are cinnamon, cloves, cardamom, laurel and mint (Loo and Richard, 1992).

Due to the wide variety of active components, different herbs and spices affect digestion processes differently. Most of them stimulate the secretion of saliva. Curcuma, cayenne pepper, ginger, anis, mint, onions, fenugreek, and cumin enhance the synthesis of bile acids in the liver and their excretion in bile, what beneficially affects the digestion and absorption of lipids. Most of the prelisted spices stimulate the function of pancreatic enzymes (lipases, amylases an proteases), some also increase the activity of digestive enzymes of gastric mucosa (Srinivasan, 2005). Besides the effect on bile synthesis and enzyme activity, extracts from herbs and spices accelerate the digestion and shorten the time of feed/food passage through the digestive tract (Platel and Srinivasan, 2001; Suresh and Srinivasan, 2007).

2.2 ANTIMICROBIAL ACTION OF HERBS AND SPICES

Feed supplements with growth promoting activity increase stability of feed and beneficially influence the gastrointestinal ecosystem mostly through growth inhibition of pathogenic microorganism’s growth. Due to improved health status of digestive system, animals are less exposed to the toxins of microbiological origin. Consequently herbs and spices help to increase the resistance of the animals exposed to different stress situations and increase the absorption of essential nutrients, thus improving the growth of the animals (Windisch et al., 2008).

Numerous secondary metabolites formed by plants serve as defence agents against physiological and environmental stressors, predators and pathogenic microorganisms. Several in vitro studies showed strong antimicrobial activity of certain plant extracts against Gram− and Gram+ bacteria. Pasqa et al. (2006) found a change in long chain fatty acid profile in the membranes of E. coli grown in the presence of limonene or cinnamaldehyde. Similar observations were made with Salomonella enterica grown in the presence of carvacrol or eugenol and with Bronchotrix thermophacta grown in the presence of either limonene, cinnamaldehyde, carvacrol or eugenol. In the case of Pseudomonas fluorescens in Staphylococcus aureus none of the tested phytochemicals changed the fatty acid profile. The changes in fatty acid composition can affect surviving ability of microorganisms.

The studies measuring hydrophobicity of E. coli (test for measuring the ability of microbial attachment) showed a large increase of hydrophobicity of E. coli grown in the presence of St. John’s wort or Chinese cinnamon and a moderate increase when medium was supplemented with thyme or Ceylon cinnamon. The differences in hydrophobicity were in good correlation with MIC50 values (minimal inhibitory concentration). This confirms the fact that herbs and spices act as antimicrobial agents by changing the characteristics of cell membranes, and causing ion leakage, thus making microbes less virulent (Windisch et al., 2008). The exact antimicrobial action of herbs and spices in in vivo situations is hard to evaluate, because of the very complex and balanced microbial populations in gastrointestinal tract and the interaction of active components from herbs and spices with other nutrients. Castillo et al. (2006) reported that the mixture of cinnamaldehyde, capsicum oleoresin and carvacrol enhances the growth of lactobacilli, and so increases the ratio of lactobacilli to enterobacteria. So herbs and spices do not posses only the antimicrobial activity, but also modulate the composition of microbial population by prebiotic activity.
2.3 ANTI-INFLAMMATORY ACTION

Extracts of curcuma, red pepper, black pepper, cumin, cloves, nutmeg, cinnamon, mint and ginger showed anti-inflammatory effect in the studies on rats (Srinivasan, 2005; Manjunatha in Srinivasan, 2006). The major active molecules with anti-inflammatory action are terpenoids and flavonoids. These molecules suppress the metabolism of inflammatory prostaglandins. The most known herbs and spices with anti-inflammatory potential in our area are chamomile, marigold, liquorice and anis (Craig, 2001).

2.4 ANTIOXIDATIVE ACTION

Many active components of herbs and spices can prevent lipid peroxidation through quenching free radicals or through activation of antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase and glutathione reductase. Main molecules responsible for the antioxidative properties of herbs and spices are phenolic substances (flavonoids, hydrolysable tannins, proanthocyanidins, phenolic acids, phenolic terpenes) and some vitamins (E, C and A). Often used herbs rich in phenolics are: rosemary, thyme, oregano, sage, green tea, chamomile, ginko, dandelion and marigold (Halliwell et al., 1995; Craig, 2001; Ćetković et al., 2004; Škerget et al., 2005; Baklrel et al., 2008; Fasseas et al., 2008).

Herbs and spices can protect the feed against oxidative deterioration during storage. This is a widely used practice in pet food and human food industry. The herb commonly used for feed/food preservation is rosemary (Rosmarinus officinalis). It can be used alone or in combination with tocopherols or synthetic antioxidants (Jacobson et al., 2008).

2.5 IMMUNOSTIMULANT FUNCTION

The immune system generally benefits from the herbs and spices rich in flavonoids, vitamin C and carotenoids. The plants containing molecules which possess immunostimulatory properties are echinacea, liquorice, garlic and cat’s claw. These plants can improve the activity of lymphocytes, macrophages and NK cells, they increase phagocytosis or stimulate the interpheron synthesis (Craig, 1999).

3 THE USE OF HERBS AND SPICES IN NUTRITION OF DIFFERENT ANIMAL SPECIES

3.1 POULTRY

How to replace antibiotic growth promoters is also a question for the poultry industry. Some studies on plant extracts are showing promising results. Çabuk et al. (2006) measured production parameters of broilers which were supplemented by a mixture of oregano, laurel, sage, anis and citrus essential oils. The mixture of essential oils significantly improved feed conversion, what can be attributed to more effective availability of nutrients due to the changes in intestinal ecosystem.

Lippens et al. (2005) tested the efficacy of a mixture of cinnamon, oregano, thyme, cayenne pepper and citrus extracts and a mixture of plant extracts and organic acids in comparison to nutritive antibiotic avilamicin in broiler chickens. Chickens supplemented with plant extracts reached significantly higher body weight than the ones in the control or avilamicin group. Higher body weight was a consequence of increased feed consumption. Feed conversion in group fed plant extracts was 0.4% better than in the group with avilamicin and 2.9% better than in the control group. The authors noticed no synergistic effect between plant extracts and organic acids.

Resistance of coccidia to currently used coccidiostatics to treat coccidiosis represents a serious problem in poultry industry. The use of plant extracts to treat coccidiosis is not a new approach. When searching for the best natural extract to treat coccidiosis, we have to take into account that the extract needs to be at least partially soluble in lipids to penetrate the cellular membrane, because coccidia are located inside the cells. Two Chinese plants, Dichroa febrifuga and Sophora flavescens are rich in alkaloids which are effective in treating coccidiosis (Youn in Noh, 2001). As infections with Emeria tenela include also lipid peroxidation in the intestine, herbs and spices with strong antioxidant potency may represent a good supportive treatment. In one of the latest studies Naidoo et al. (2008) studied the capacity of four African plants which would be appropriate to treat coccidiosis: leaves of Combretum woodii, leaves and stem of Artemisia afra, a whole plant and seeds of Vitis vinifera. Extracts of all chosen plants improved the feed conversion to the same extent as coccidiostatic toltrazuril. The best effect was seen with Tulbaghia violacea, which also partially lowered the shedding of oocysts.

The use of herbs and spices as antioxidants is not important only for the health of the animals, but also for the oxidative stability of their products. The effect of oregano essential oil on oxidative stability of chicken and
turkey meat was well studied in the past. Supplementation of turkeys with 200 mg/kg of oregano essential oil significantly decreased lipid peroxidation of cooked and fresh meat during refrigerated storage (Botsoglou et al., 2003b). Essential oil of oregano also efficiently preserved the quality of chicken meat during frozen storage (Botsoglou et al., 2003a). Extracts from herbs and spices in combination with vitamins C and E even more effectively prevent lipid peroxidation in tissues, what was shown in the studies on chickens and turkeys (Papageorgiou et al., 2003; Young et al., 2003). At this time the use of plant extracts instead synthetic or semi-synthetic antioxidants represents higher economical costs, however, this could be avoided with systematic intensified growing of needed plants and new technological processes of extraction.

The colorants for increasing yolk colour in laying hens or skin colour in broilers in intensive production can be of natural (carotenoids) or synthetic origin. Often used forage plants rich in carotenoids are maize and alfalfa. Besides these there are several other plants used for isolation of natural pigments like tagetes and red pepper. The main yellow pigments in tagetes are zeaxantin and lutein, while red pepper contains two important red pigments – capsantin and capsorubin. The extract from tagetes colours the yolk three times less effectively in comparison with the synthetic apo-ester of carotenic acid. Pigments from natural origin also degrade during the feed storage up to 30% (Sirri et al., 2007). Nevertheless, pigments obtained from tagetes or calendula species and red pepper are very suitable as yolk colorants in organic farming.

3.2 PIGS

In the pig production, most problems can be expected in the time of weaning. Weaning can be accompanied by infections, especially with enterotoxic Escherichia coli. The use of herbs and spices in piglet nutrition can reduce the incidence of infections. Results from Roselli et al. (2007) showed that alcin from garlic protects intestinal cells from increased permeability of membrane in pigs infected with E. coli. Garlic also contains active substances which suppress the action of fungi and viruses (Zigger, 2001) and improve the feed intake and daily weight gain of piglets (Janz et al., 2007). Cinnamaldehyde, an active component of cinnamon, possesses antibacterial properties. Zigger (2001) observed larger feed intake and live weight gain of weaned pigs fed feed supplemented with garlic and cinnamon extracts. The mortality due to intestinal disorders dropped from 3.9 to 1.2%. Namkung et al. (2004) found that a mixture of cinnamon, thyme and oregano extracts inhibited the growth of coliform bacte-

<table>
<thead>
<tr>
<th>Group</th>
<th>% DNA in the tail of the comet</th>
<th>OTM</th>
<th>8-OHdG (µg/24 h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.8a</td>
<td>1.74a</td>
<td>149.9±a</td>
</tr>
<tr>
<td>Oil</td>
<td>12.0b</td>
<td>4.68b</td>
<td>269.4±b</td>
</tr>
<tr>
<td>Calendula off. 1</td>
<td>6.8a</td>
<td>1.46b</td>
<td>138.9±b</td>
</tr>
<tr>
<td>Calendula off. 2</td>
<td>8.2a</td>
<td>2.05b</td>
<td>150.6±b</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>6.6a</td>
<td>1.54a</td>
<td>216.5±b</td>
</tr>
<tr>
<td>SEM</td>
<td>0.65</td>
<td>0.372</td>
<td>31.44</td>
</tr>
<tr>
<td>P-value</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>0.02</td>
</tr>
</tbody>
</table>

P-value < 0.01 < 0.01 0.02
SEM 0.65 0.372 31.44

A brown algae Ascosphyllum nodosum could be a good feed supplement with growth promoting activity of pigs infected with E. coli (Turner et al., 2002).

Combination of carvacrol, cinnamaldehyde and capsicum oleoresin beneficially effected gastrointestinal ecosystem and gastric emptying of weaned pigs (Manzanilla et al., 2004). The same mixture was tested for its antioxidative properties in our laboratory. The mixture effectively protected pig’s blood lymphocytes against oxidative DNA damage at the concentration of 271.2 mg/kg of feed. Its effect was comparable to that of 90.4 mg/kg of vitamin E. The concentration of spice mixture supplemented to pigs in this study was not sufficient to fully prevent lipid peroxidation induced by high intake of lightly oxidizable PUFA.

Frankič et al. (in press) studied antioxidant capacity of propylene glycol extracts of Calendula officinalis (Calendula officinalis 1 – extract from petals, 3 ml/day; Calendula officinalis 2 – extract from whole flowers tops, 3 ml/day) and vitamin E (38.4 mg/day) in the case of oxidative stress induced by high PUFA intake in pigs. The extracts effectively prevented oxidative DNA damage in peripheral lymphocytes (measured as % DNA in the tail of the comet and OTM (Olive tail moment), but did not prevent lipid peroxidation, measured by 8-OHdG (8-hidroxy-deoxyguanosine).

Although most studies concerning the effect of herbs and spices in pig production have been conducted on piglets, Allan et al. (2005) carried out an experiment on swine. Swine were fed 1000 ppm of dried oregano leaves and flowers enriched with 500 g/kg of oregano essential oil. Observed beneficial effects of oregano supplementation were: lower mortality rate, less culling during
lactation period, shorter service interval, more live born and less stillborn piglets.

3.3 RUMINANTS

Herbs and spices have been introduced also to ruminant nutrition. Microbial ecosystem in the rumen is composed from complex anaerobic microbial population of bacteria, fungi, protozoa, methanogeneous archea and bacterifagi. Numerous metabolites produced in rumen during microbial fermentation affect the basic digestive and metabolic functions and productivity of the host. Researchers have been searching for new possibilities to modulate the microbial fermentation in the rumen. The main goal of manipulating the rumen fermentation is to increase the effectiveness of digestion and metabolism of nutrients, to increase the productivity of the animals and to suppress the undesirable processes as methanogenesis. In intensive farming systems the feed additives, including antibiotics, were used to increase the production of milk, meat and wool. The ban on antibiotic use in Europe increases the production costs what triggered the need to search for antibiotic alternatives also in ruminant nutrition.

There are numerous studies showing beneficial effects of herbs and spices on feed intake, immune functions and health, rumen fermentation and productivity of calves, dairy cows, heifers and also beef cattle (Kraszewski et al., 2002; Greathed, 2003; Wawrzynczak et al. 2000; Cardozo et al. 2006). There are some data of the positive effect of plant supplements in nutrition of sheep and goats (Butter et al., 1999). Extracts of yucca plant contain saponnins and glico-components which are responsible for the increase of rumen fermentation and in some cases for reduction of ammonium synthesis (Ryan, P. and Quinn, T.: http://www.irishscientist.ie/P175.htm). Kudke et al. (1999) supplemented calves with powder of Azadirachta indica tree. Supplemented calves had higher weight gain than unsupplemented ones. The unsupplemented group had much higher incidence of parasite infections.

Gladine et al. (2007) tested the antioxidant effect of marigold, grape, rosemary and citrus extracts in sheep. Lipid peroxidation was induced by continuous infusion of linseed oil into the duodenum. The extracts were applied directly into rumen through the rumen cannula. The results showed that all tested plant extracts kept their antioxidant capacity in vivo in sheep. The most bioefficient in limiting lipid peroxidation was marigold extract.

Cardozo et al. (2006) studied the effect of alfalfa extract, anise, capsicum, and a mixture of cinnamaldehyde and eugenol on ruminal fermentation in beef heifers. The results indicated that tested concentrations of cinnamaldehyde and eugenol mixture, anise oil and capsicum oil may be used as modifiers of rumen fermentation in beef production systems. Same authors tested six natural plant extracts (garlic, cinnamon, anise, yucca, oregano and capsicum extract) and three secondary plant metabolites (cinnamaldehyde, eugenol, anethole) at five doses and two different pH (7.0 and 5.5) to determine their effect on in vitro microbial fermentation using ruminal fluid of heifers (Cardozo et al., 2005). Results demonstrated that the effect of herbs and spices on ruminal fermentation in beef cattle may differ depending on ruminal pH. At pH 5.5, garlic, capsicum, yucca and cinnamaldehyde altered ruminal fermentation in favour of propionate, which is more energetically efficient.

Results obtained in the research of Benchaar et al. (2007) showed limited effects of 750 mg/day of essential oil mixture (thymol, eugenol, vanillin, guaiacol and limonene) on nutrient utilization, ruminal fermentation, and milk performance of cows fed diets containing alfalfa or corn silage as a sole forage source. Polish researchers showed that 2% of mixture of Urtica dioica, Pradix teracxzi, Agrimonia eupatoria, Fructus carvi and Matrica Chamomilla improves the quality of milk (Kraszewski et al., 2002).

Tannins, the secondary plant metabolites found in stem, wood, leaves, fruits and seeds of many plant species can positively affect the protein digestion in ruminants. Tannins bind to proteins and form complexes which pass through the rumen undegraded. These proteins which pass the microbial degradation in the rumen are then successfully utilized by the animal and provide the proteins necessary especially in the special physiological states (like early lactation) and in the cases when feed is not of the best quality (Waghorn et al., 1990). Tannins also prevent bloat of the rumen (Butter et al., 1999) and possess antihelmic properties (Barry and McNabb, 1999).

Extracts from herbs and spices help to prevent and alleviate different kinds of health problems. They are effective in treatment of endometritis (inflammation of the endometrium) in cows. Esparza-Borges and Ortiz-Márquez (1996) evaluated the effect of extrats of garlic (Allium sativum, L), eucalypt (Eucalyptus globulus, Labill.) and Gnaphalium conoideum on acute endometritis of Holstein cows. The most effective of all extracts was the garlic extract, however, also eucalypt worked beneficially.

4 CONCLUSIONS

The main scope of animal production is to ensure the high productivity, healthy animals and quality animal products, which are stable and appropriate for fur-
ther processing. In this aspect, herbs and spices are not just appetite and digestion stimulants, but can, with impact on other physiological functions, help to sustain good health and welfare of the animals and improve their performance. Current studies show promising results regarding the use of phytochemicals as growth and production promoters. There is still a need to clarify the phytochemical composition and the mechanisms of action for many herbs, spices and their extracts and furthermore, to assess the appropriate dose that should be safely used in specific circumstances and animal species.

5 REFERENCES


Indresh H.C. 2007. Organic acids and plant extracts can be effective antibiotic alternatives. Feed International, 28, 8: 10–12


As flavouring feed additive for weaner pigs on the basis of a choice experiment. Berliner und Münchener Tierärztliche Wochenschrift, 119: 238–243