16. BOKU-SYMPOSIUM TIERERNÄHRUNG

TAGUNGSBAND

Der gesunde Verdauungstrakt

27. April 2017 in Wien

TIERERNÄHRUNG
TIERISCHE LEBENSMITTEL
ERNÄHRUNGSPHYSIOLOGIE

Tagungsband

16. BOKU-Symposium TIERERNÄHRUNG

Der gesunde Verdauungstrakt

27. April 2017, Wien

Institut für Tierernährung, Tierische Lebensmittel und Ernährungsphysiologie

Department für Agrarbiotechnologie

BOKU – University of Natural Resources and Life Sciences, Vienna

Universität für Bodenkultur Wien

Tagungsband:

16. BOKU-Symposium TIERERNÄHRUNG

Der gesunde Verdauungstrakt

27. April 2017, Wien

Herausgeber:

Julia Braach, Martin Gierus

Institut für Tierernährung, Tierische Lebensmittel und Ernährungsphysiologie

Department für Agrarbiotechnologie

Universität für Bodenkultur Wien

Muthgasse 11, A-1190 Wien

www.boku.ac.at/tte-symposium

tte(at)boku.ac.at

Eigenverlag:

Institut für Tierernährung, Tierische Lebensmittel und Ernährungsphysiologie

978-3-900932-47-3

Inhaltsverzeichnis

Poster

Futterzusatzstoffe / Feed Additives

Antibiotikaresistenz – Auswirkungen auf die Tierernährung

Konrad J. Domig

Institut für Lebensmittelwissenschaften, Universität für Bodenkultur Wien, AT

Abstract

Based on the growing concern regarding the increasing level of antibiotic resistance in bacteria and the risk of transmission to humans via animals, food and the environment, various authorities worldwide have implemented measures for reduction and prudent use of antimicrobials. In contrast to human medicine, antibiotics are used in food producing animals also to control infection diseases which cause economic losses. The fight against the further development and spread of antibiotic resistance in animal husbandry is a very complex process and has to include all stakeholders. A solution will become possible by a broad concept. This step-wise procedure was summarized by EFSA by three bullet points: REDUCE – REPLACE – RETHINK.

Einleitung

Antibiotika werden seit ihrer Entdeckung in der Human und Tiermedizin breit eingesetzt. Die grundsätzliche Problematik der Antibiotikaresistenzentwicklung ist lange bekannt und ihr wurde zunächst mit der Entwicklung neuer Wirkstoffe begegnet. Nachdem die letzten beiden Jahrzehnte kaum neue Wirkstoffe zugelassen werden konnten, ist die grundsätzliche Problematik des breiten Einsatzes von antibiotischen Wirkstoffen akut geworden. Diese Herausforderung wurde von unterschiedlichen legislativen Einrichtungen aufgegriffen und endete in mitunter sehr unterschiedlichen Umsetzungen. Dies betrifft auch die Einsatzmöglichkeiten von antibiotischen Wirkstoffen in der Praxis der Nutztierhaltung. Parallel zur Resistenzherausforderung in der Nutztierhaltung sind jedoch auch weitere Treiber der Problematik zu definieren: Eine stark zunehmende Weltbevölkerung, welche parallel eine überproportionalen Bedarf nach tierischem Protein zur Ernährung entwickelt, sowie Herausforderungen in der Versorgung mit Trinkwasser und der Entsorgung von kommunalen Abwässern und Abfällen. Es gilt hervorzuheben, dass die aktuell in der Humanmedizin existierende Antibiotikaresistenzproblematiken sich bis auf wenige Ausnahmen auch in diesen Umfeld entwickelt haben – jedoch aktuelle Resistenzentwicklungen eine deutlich stärkere Vernetzung der Resistenzentwicklung in Human- und Veterinärmedizin aufzeigen.

Hintergrund

Es ist unbestritten, dass jedweder Einsatz von antimikrobiellen Substanzen zu Resistenzentwicklungen bei Mikroorganismen führt. Dies trifft nicht nur auf Antibiotika im engeren Sinn zu, sondern auch für andere antimikrobielle Substanzen wie Desinfektionsmittel und Schwermetalle. Die zugrundeliegenden resistenten Mikroorganismen bzw. Resistenzgene können inzwischen nicht nur im Anwendungsumfeld, sondern auch weit davon entfernt nachgewiesen werden. Die letztlich unmittelbare und direkte Gefahr für den Menschen liegt im Therapieversagen bei der Behandlung einer Infektion, d.h. es stehen gegen definierte multiresistente Erreger keine wirksamen Antibiotika mehr zur Verfügung. Die ökologischen Auswirkungen der Antibiotikarückstände und der sich ausbreitentenden Resistenzdeterminanten sind aktuell noch sehr wenig untersucht. Global ist eine große Anzahl von Monitoringsystemen im Human- und veterinärmedizinischen Bereich etabliert. Unabhängig von der Diskussion betreffend die lückenlose Erfassung der eingesetzten Antibiotikamengen und deren korrekte Umlegung auf die behandelten

Conclusion

The application of capsules containing Sacharomyces cerevisiae 30 Billions CFU and 6 g of niacin for dairy cows for three days after calving and one capsule on the 30th and 60th day repeatedly influenced positively the productivity of cows and their health state.

Sacharomyces cerevisiae and niacin supplement applied in cows' nutrition had no significant influence on fermentation of nitrogenous substances and carbohydrates in the rumen.

References

Erasmus L.J., Botha P.M., Kistner A. Effect of yeast culture supplement on production, rumen fermentation, and duodenal nitrogen flow in dairy cows. J. of Dairy Science. 1992. V. 75. P. 3056-3065.

Jeroch H., Šeškevičienė J., Kulpys J. Žemės ūkio gyvulių ir paukščių mitybos fiziologinės reikmės (Nutrient requirement for agricultural animals).Kaunas, 2004. S. 158.

Juozaitienė V., Kerzienė S. (2001): Biometrija ir kompiuterinė duomenų analizė (Biometric and computer data analyses). Kaunas. 114.

Pikelis V., Kulpys J., Paulauskas E. Mielių " Sacharomyces cerevisiae [1026]" priedo poveikio melžiamoms karvėms tyrimas. (The influence of weed spirulina platensis on production and profitability of milking cow). VeterinarijairZootechnika. (Veterinary and zootechnics). 2006. T.35 (57). P. 77-84.

Steiner T. Natural Growth Promoters as a Key to Animal Performance. 2006. UK. 100 p.

Tarvydas V., Uchockis V., Bliznikas S., Bendikas P. The effect of hydrolyzed beer yeast on the rumen fermentation of nitrogenous matter and carbohydrates and cow productivity. Gyvulininkystė. (J. Animal Husbandry). 2009. T.54. P. 51-61.

Žilaitis V., Kučinskienė J., Vorobjovas G., Japertas S., Žiogas V. Produktyvių karvių sergamumas subklinikine ketoze. Subklinikinės ketozės profilaktika propilenglikoliu ir niacinu. (Prevalence and treatment of subclinical ketosis in highly producting dairy cows in Lithuania). Veterinarija ir Zootechnika. (Veterinary and zootechnics). 2007. T.37 (59). P. 91-95.

Corresponding author

Dr. Andrejus Jerešiūnas
Marijampolės college
Technologies Department
P. Armino street 92, Marijampolė LT-68125
E-mail: andrejus_jeresiunas(at)yahoo.com

The effects of extruded peas (*Pisum sativum*) on the ruminal fluid parameters in dairy cows

Ieva Kudlinskiene[1], Qendrim Zebeli[2], Romas Gružauskas[1], Rolandas Stankevičius[1], Rasa Želvytė[1], Ingrida Monkevičienė[1], Jonė Kantautaitė[1], Jovita Lionikienė[1] and Gintarė Dovidaitienė[1]

[1] Lithuanian University of Health Sciences, Veterinary Academy, Kaunas, LT
[2] University of Veterinary Medicine in Vienna, AT

Abstract

The aim of our research was to determine the influence of extruded peas on fermentation processes in the rumen of dairy cows. For the trial 20 Lithuanian Black-and-White cows with analogous characteristics were selected and randomly allocated into 2 groups (control and experimental), 10 animals each. The control group was fed a conventional diet consisting mainly of grass silage, barley grain, enriched extruded full fat soybean flour, and mineral premix. The experimental groups was fed a similar diet, but instead of 1.5 kg of soybean meal, the cows were given the same amount of the extruded peas and 700 gr. extruded soybean. The rumen fluid samples were collected three times (once a month) in the experimental period. The samples were collected from three randomly selected animals of each group with a stomach tube 3 hours after the supplementary feeding with extruded peas. The rumen fluid was analyzed for the pH, total volatile fatty acid (VFA) content, total and ammonia nitrogen, reduction activity of bacteria and protozoa count. The results of this study shows that partial replacement of extruded soybean with extruded peas in dairy cows rations, had no negative influence on rumen's fermentative indexes and maintained its optimal activity.

Introduction

In many animal production systems feed is the biggest single cost and profitability can depend on the relative cost and nutritive value of the feeds available (McDonald et al., 2002). In pursuit of sustainable and economically-viable farming systems, there is a need for livestock farmers to reduce reliance on imported feedstuffs, such as soya bean, which are subject to world market price fluctuations and have a high environmental footprint. Therefore, most researches have focused on improving the status and utilization of different protein sources in order to reduce costs and maintain optimum performance of animals (Ružić-Muslić et al., 2014). The use of alternative plant proteins in place of the soybean meal protein in diets for producing animals aims to reduce the extra-EU soybean import and partially substitute the GMO in the food chain. Among possible alternatives, the heat-processed legume grains seem interesting for dairy cow diets (Volpelli et al., 2012). Grain legumes, such as soybean (*Glycine max L.*) Merr.), pea (*Pisum sativum L.*), faba bean (*Vicia faba L.*), lupins (*Lupinus spp.*), common vetch (*Vicia sativa L.*) and grass pea (*Lathyrus sativus L.*), represent one of the most quality and least expensive solutions for a long-term demand for plant protein in animal husbandry (Mikić et al., 2009). Peas have a number of characteristics that make them a desirable ingredient in dairy rations. Field peas are palatable, contain over 20% protein and also contain a substantial amount of starch. These are desirable characteristics for supplying available nutrients and they also support favorable rumen conditions for microbial growth and fermentation (Christensen, Mustafa, 2000). Many researches had been done in order to investigate peas and faba beans effects on dairy cows performance and milk composition (Corbett et al., 1995; Petit et al., 1997; Masoero et al., 2006; Martini et al., 2008), but there haven't been done many researches in pursuance to investigate its effects not fermentation processes in the rumen of dairy cows. **So the aim of our research** was to determine the influence of extruded peas on fermentation processes in the rumen of dairy cows.

Materials and methods

The research was carried out complying with the Law of the Republic of Lithuania on Animal Care, Housing and Use" (No. XI–2271) as well as complying with the amended Order of State Food and Veterinary Service "On Approval For Requirements For Housing, Care and Use of Animals for Experimental and Other Scientific Research" (No. B1-872 of 24-09-2015).

Dairy cows feeding trial. For the trial, 20 Lithuanian Black-and-White cows with analogous characteristics were selected. The animals selected were divided in 2 groups (control and experimental), 10 animals each. Feeding trial were divided in two periods - preparatory (14 days) and experimental (90 days). Feeding scheme in the experimental period is provided in Table 1. Raw material's for the trial was extruded by SC „Kauno Grūdai".

Table 1: Feeding scheme in the experimental period (90 days)

Group	Number of cows, n	Feeding characteristics		
Control	10	Diet	+1,5 kg extruded soybean, cow per day	-
Experimental	10	Diet	+1,5 kg extruded peas, cow per day	+700 gr. extr. soybean, cow per day

Table 2: Diets for control and experimental groups, their energy and nutritional values

Feedstuff	Units	Groups: Control (extruded soybeans)	Groups: Experimental (extr.peas+ soybeans)
Maize silage	kg	10,0	10,0
Perennial grass silage	kg	12,0	12,0
Grass silage	kg	12,0	12,0
Barley flour	kg	5,0	5,0
Straw	kg	2,0	2,0
Molasses	kg	1,0	1,0
Extruded soybeans	kg	1,5	0,7
Extruded peas	kg	-	1,5
Minerals and vitamins supplements	kg	0,83	0,83
1 kg diet DM contains:			
Net energy per lactation (NEL)	MJ	5,70	5,78
Crude protein	g	130	128
Crude fibre	g	196	191
Crude fat	g	39	33
Starch	g	190	211
Sugar	g	38	36

The control group was fed a conventional diet consisting mainly of grass silage, barley grain, enriched extruded full fat soybean flour, and mineral premix (Table 2). The experimental groups was fed a similar diet, but instead of 1.5 kg of soybean meal, the cows were given the same amount of the extruded

peas and 700 gr. extruded soybean (Table 2). Energy and nutritional values of the diets were calculated with the feeding software HYBRIMIN® Futter 2008.

Sampling and analyses of rumen fluid. The rumen fluid samples were collected three times (once a month) in the experimental period. The samples were collected from three randomly selected animals of each group with a stomach tube (Sederevičius, 2000) 3 hours after the supplementary feeding with lupins, faba beans and peas. The rumen fluid was analyzed for the pH, total volatile fatty acid (VFA) content, total and ammonia nitrogen, reduction activity of bacteria and protozoa count.

Ruminal pH was measured immediately after sampling, using a handheld pH-meter (Horiba - Twin pH, Spectrum Technologies). Total VFA was defined by rumen fluid distillation in a Marcgamus apparatus according to the method of Pustovoj (1978). Total nitrogen was analysed by Kjeldahl procedure (Behr system, Germany), ammonia nitrogen – by titrimetric method with the preliminary distillation (Behr steam distillation unit S1, Germany). Reduction activity of bacteria were evaluated according to the method described by Bakūnas (2004). Fuchs-Rosenthal counting chamber (Blaubrand, Wertheim, Germany) was used for enumeration of protozoa by Olympus microscope (BX43, Hamburg, Germany). The rumen fluid analyses were carried out at the Research Centre of Digestive Physiology and Pathology of the Department of Anatomy and Physiology, LHSU Veterinary Academy.

Statistical analysis. SPSS software, version 15.0 (Chicago, IL, USA, 2006) was used for the statistical analysis of the data.

Results

Rumen fluid's fermantation processes' activity is not permanent, it can depend on feeding time, ration, feed's quality, time that passed after feeding, rumen fluid's pass to other sections of digestive tract.

Table 3. Ruminal fluid parameters during experimental period

Parameter	After 30 days		After 60 days		After 90 days	
	Control	Experi-mental	Control	Experi-mental	Control	Experi-mental
pH	6.81	6.98	6.51	6.99	6.99	6.82
Reduction activity of bacteria, s	66.67	96.67	33.33	70.00	40.00	40.00
Protozoa count, x10^3/ml	258.59	262.50	303.65	219.79	195.84	196.35
VFA,mmol/l	91.33	78.00	83.33	80.00	77.33	80.00
Total nitrogen, mg/100 ml	81.43	68.60	129.03	71.17	77.93	52.03
Ammonia nitrogen, mg/100 ml	15.49	15.49	18.76	13.91	10.08	13.07

From the data given in Table 3, it can be observed that control and experimental group's rumen fluid's pH did not range significantly during all experimental period and matched physiological norms (Sederevičius, 2004) (P>0.05). After the research it was determined that using extruded peas in cow's ration had no statistically significant influence on rumen fluid's bacteria reduction activity (P>0.05). Observing range of protozoa quantity in rumen's fluid during experimental period, it was perceived that after first and third month of the experiment the quantity of protozoa between control and experimental groups was very similar. After analyzing 2nd experiment's month results, we observed that the quantity of protozoa in rumen fluid of experimental group decreases and is 66.15 x10^3/ml or 25.2 % lower (P>0.05). After analysing alterations of volatile fatty acids, Total and Ammonia nitrogen content during experimental period, we observed that these indexes during whole experimental period was physiologically within the mark in both control and experimental groups (P>0.05).

Conclusion

The results of this study shows that partial replacement of extruded soybean with extruded peas in dairy cows rations, had no negative influence on rumen's fermentative indexes and maintained its optimal activity.

References

Christensen D.A., Mustafa A. The Use of Peas in Dairy Rations. Advances in Dairy Technology . 2000. 12. P. 293-302

Corbett R., Okine E. K., Goonewardene L. A. Effects of feeding peas to high-producing dairy cows. Can. J. Anim. Sci. 1995. 75. P. 625-629.

Martini, A., Migliorini, P., Lorenzini, G., Lotti, C., Rosi Bellière, S., Squilloni, S., Riccio, F., Giorgetti, A., Casini, M., Production of grain legume crops alternative to soya bean and their use in organic dairy production. Proc. 16th IFOAM. Organic World Congr., Modena, Italy. 2008.

Masoero, F., Moschini, M., Fusconi, G., Piva, G., Raw, extruded and expanded pea (*Pisum sativum*) in dairy cows diets. Ital. J. Anim. Sci. 2006. 5. P. 237-247.

McDonald, P.; Edwards, R. A.; Greenhalgh, J. F. D., 2002. Animal Nutrition. 6th Edition. Longman, London and New York. 543 p.

Mikić A., Perić V., Đorđević V., Srebrić M., Mihailović V., Anti-nutritional factors in some grain legumes, Biotechnology in Animal Husbandry, 2009. 25(5-6) P. 1181-1188.

Petit, H.V., Rioux, R., Ouellet, D.R., 1997. Milk production and intake of lactating cows fed raw or extruded peas. J. Dairy Sci. 80:3377-3385.

Ružić-Muslić D., Petrović M.P., Petrović M.M., Bijelić Z., Caro-Petrović V., Maksimović N., Mandić V.. Protein source in diets for ruminant nutrition. Biotechnology in Animal Husbandry 2014. 30 (2), P. 175-184,

Sederevičius A. Diagnostiniai ir gydomieji zondai galvijams. Kaunas, 2000. P. 3–9.

Sederevičius A.: Gyvūnų organizmo skysčių fiziologiniai rodikliai. Lithuanian Vet. Acad., Kaunas 2004, 56-61 p.

Volpelli L. A., Comellini M., Gozzi M., Masoero F., Moschini M. Pea (*Pisum sativum*) and faba beans (Vicia faba) in dairy cow diet:effect on milk production and quality. Italian Journal of Animal Science. 2012. vol. 11:e40. P. 217-222

Corresponding author

Ieva Kudlinskiene
Lithuanian University of Health Sciences, Veterinary Academy
Kaunas, Lithuania
E-mail: ieva.kudlinskiene(at)lsmuni.lt

Improvement of milk quality and litter size at weaning by supplementation of a standardized blend of capsicum and turmeric oleoresins in late gestation sows

Clémentine Oguey[1], I. Riu[2], C. Quintilla[3] and S. Lopez[1]

[1] Pancosma S.A., Le Grand-Saconnex, CH
[2] Avena Nutrició, ES
[3] Copinsa Altorrican, ES

Abstract

Previous research demonstrated that standardized blend of capsicum and turmeric oleoresins (XT, XTRACT® Nature, Pancosma) had an immune-modulating effect and potentiates the effects of vaccines in poultry. The objective of this trial was to evaluate the effect of XT in late gestation on performance of sows vaccinated against *E. coli* during farrowing and lactation.

1531 sows vaccinated against *E. coli* at 80 days of gestation and regrouped in 3 successive bands were involved. Sows in phases 1 and 3 were fed an unsupplemented basal diet (CT, N = 529 and 329 respectively) whereas animals in the second phase were provided the same basal diet supplemented with 200 g/t XT (N = 673) from 80 until 110 days of gestation. Proportion of piglets born / litter was recorded at farrowing as well as piglets' mortality during lactation. Colostrum was collected (N = 14 and 16 respectively for XT and CT groups) for analysis. Data were analyzed by analysis of variance. XT enhanced the levels of total proteins +5.0% in colostrum ($P = 0.04$), driven by a +5.0% increase in globulins concentration ($P = 0.08$). XT enhanced the proportion of piglets born alive ($P < 0.01$). The treatment did not affect piglets' mortality during suckling, but this outcome had a treatment*parity effect: litters in parities 1 & 2 sows had reduced mortality when fed XT versus CT (10.1 vs 12.5%, P = 0.01). XT supplementation to vaccinated sows during gestation can improve litter performance at farrowing and litter size at weaning.

Introduction

Previous research projects have demonstrated that a standardized protected blend of capsicum and turmeric oleoresins (XT, XTRACT® Nature, Pancosma, Switzerland) had an immune-modulating effect and could potentiate and complement the effects of vaccines in poultry. However, no similar data was available in swine. The objective of this trial was to evaluate if the supplementation of XT in late gestation could improve performance of sows vaccinated against E. coli during farrowing and lactation.

Experimental procedure

The trial was set up in a commercial farm in Spain and consisted in 3 successive phases. Animals involved were highly prolific sows in 1st to 8th parity (52.1% of the herd composed of sows in parity 1 and 2), vaccinated against E. coli at 80th day of gestation, and given a feeding program consisting of standard commercial formulas including a specific diet from day 80 until the end of gestation.

During the first phase (60 days) and the third phase (30 days), respectively 529 and 329 sows were fed a basal control diet (CT) from 80 days of gestation until end of lactation. During the second phase of 60 days, 673 sows were fed the basal diet supplemented with 200 g/t XT from 80 until 110/112 days of gestation, then a basal diet until end of lactation (XT). The following parameters were assessed: total

Jerusalem artichoke tuber's powder influence on lambs weight, meat chemical composition and technological indexes

Guoda Stanyte[1], Jolita Klementaviciute[1], Vilija Buckiuniene[1], Vilma Valaitiene[1], Jovita Lionikienė [1], Rolandas Stankevičius[1] and Lina Asmenskaite[2]

[1] Lithuanian University of Health Sciences, Veterinary Academy, LT
[2] Lithuanian University of Health Sciences, Medicine Academy, LT

Abstract

In this research, effects of using Jerusalem artichoke tuber's flour in extruded compound feed on lamb's productivity and lamb's meat chemical composition were analysed. A total number of 24 Lithuanian blackhead breed sheep were divided into 2 groups (12 lambs in each group). I was control group, II experimental, where farm ratio was supplemented with 200 g/day of Jerusalem artichoke tuber's flour. Lambs were weighed after being born, 21st day of age, 2 months age, 3 months age, 4 months age and 6 months age, i.e. before slaughter. Weighings were performed before morning feeding. Lambs were slaughtered at 6 months of age. In the end of the trial, lamb's from experimental group had 5 percent bigger weight, comparing to control group. Jerusalem artichoke influenced meat's chemical composition, concentration of fat in experimental group's meat increased by 1.83 %(P<0.05) comparing to control group. Besides that, Jerusalem artichoke tuber's powder affected meat color, experimental group's lambs meat distinguished for being darker. The difference between groups was 3.4 %. (p<0.05). Though experimental group's meat was more red – by 2.62 % comparing to control group's meat.

Introduction

Jerusalem artichoke tuber's powder is a concentrated source of fructo-oligosaccharides and inulin that helps Bifidobacterium literally recolonize the colon. This product contains over 6 million Bifidobacterium per serving. Taking such natural FOS as found in Jerusalem artichoke tuber's powder increases the number of friendly Bifidobacteria and Lactobacillus bacteria in animal's intestine. Eventually these beneficial bacteria protect animals from a wide range of health problems by lining gastrointestinal system. This protective lining helps reduce the level of harmful bacteria and disease causing toxins within animal bodies (Loes M.D., 2000).
Jerusalem artichoke has been used for food or animal feed (Ma et al., 2011; Swanton and Hamill, 1994), and for the past two decades, alternative uses have been explored especially for the production of functional food ingredients such as inulin, oligofructose and fructose (Panchev et al., 2011; Praznik and Cieslik, 2002). Jerusalem artichoke tubers primarily contain two types of carbohydrates, inulin and sugars (fructose and glucose) (Gunnarsson et al., 2014; Baldini et al., 2004). Jerusalem artichoke (JA), from the Asteraceae family, contains high amounts of inulin and phenolic compounds. As one type of fructooligosaccharide (Rodriguez Furlan, Padilla, & Campderros, 2014), the inulin in JA is a prebiotic and a good source of low-calorie ingredient. It can increase faecal bulk, enhance bowel regularity and possesses characteristic properties comparable with other fibers. It also has the potential to influence gastrointestinal functions, which could be attributed to its bio-chemical and physiological properties (Roberfroid, 2005).

Moreover, by increasing animal health and wellness, probiotics as well increase animal production and it's quality. Therefore, the aim of this research was to evaluate the influence of jerusalem artichoke tuber's powder in extruded compound feed on lamb's productivity and lamb meat chemical composition.

Material and methods

The experiment was performed with 24 Lithuanian blackhead breed's lambs, which were divided into 2 groups (12 lambs in each group). First one was control group, where compound feed was supplemented with extruded compound feed and II experimental, where extruded compound feed supplemented with 200g/day of Jerusalem artichoke tuber's flour. The composition of Jerusalem artichoke tuber's powder was analysed in LUHS Animal Nutritionology laboratory, the amount of inulin in Jerusalem artichoke tuber's powder was determined in Llithuanian Agriculture Institute, chemical analysis laboratory. Jerusalem artichoke tuber's flour contained 6.40 % of homopolysaccharide inulin.
Lambs were weighed after being born, 21st day of age, 2 months of age, 3 months of age, 4 months of age and 6 months of age, i.e. before slaughter. Weighings were performed before morning feeding. Meat samples were analysed 48 hours after animal's slaughter, samples were taken from *musculus longissimus dorsi.* Before analysis samples were held in + 4°C temperature. Following indexes of meat quality were analysed: pH, color (L*, a*, b*),drip loss, water coherence, cooking loss, tenderness, amount of fat, ash, protein and fatty acids.
Meat pH was analysed with ph-meter INOLAB3, meat color was determined with color analyser Minolta „Chroma Meter 400" (meat brightness (L*), redness (a*), yellowness (b*)). Meat drip loss was determined by calculating sample's weight loss while keeping them hung in special bags for 24 hours (at +4°C temperature). Meat water coherence was determined by pressure method, while pressing 0,3 g of meat with 1 kg weight (Hamm R., 1972). Meat tenderness was determined by TA.XT Plus texture analyser. The dry matter content was determined by drying meat to constant weight (at 105°C), the fat content was determined by Soxhlet method, the fat extracted with chloroform for 8 hours. Protein content was determined by the Kjeldahl method. The fatty acid's content in meat samples was determined by Shimadzu gas chromatograph mass spectometer GCMS-QP2010 Plus.
Following indexes were calculated: the arithmetic mean (x), their dispersion characteristics - standard deviations (SD) and coefficient of variation (CV). The estimated influence of the age difference between statistical significance (P). The difference between the average values of reliability at P<0.05.

Results and discussion

A positive effect of probiotic supplementation in small ruminants health and growth performance has been recorded by many researchers (Whitley et al. 2009). It has, in general, been reported that impact of probiotics in performance of animals may vary, as supplementation can increase feed intake (Desnoyers et al. 2009), or bodyweight gain (Hussein 2014). Haddad and Goussous (2005) found that supplementation with yeast culture of diets of Awassi lambs had resulted in increased bodyweight gain compared to controls (266 versus 212 g daily).

Table 1: Jerusalem artichoke tuber's powder influence on lamb's weight, kg

Age of lamb	Group	
	I (control group)	II (experimental)
Born lamb weight	3.93±0.59	3.48 ± 0.49
20 days	7.88±0.56	7.14 ± 0.72
2 months	15.75±1.38	15.67 ± 2.52
3 months	19.80±2.02	22.55 ± 3.91
4 months	28.68±1.59	29.25 ± 3.88
6 months	39.67±1.92	41.62 ± 5.54

Lamb's growth dynamics is presented in Table 1. Born lamb's weight in experimental group was 11 % lesser (P>0.05) than control group's. At 20 days of age lambs from experimental group had this index decreased by 9 % (P>0.05) comparing to control group. At 2 months of age the body weight of experimental group's lambs was 1 % lesser (P>0.05). After 4 months, this parameter had increased by 2 % (P>0.05) compared to the control group. At the end of the trial (6 months age), the body weight of experimental group's lambs increased by 5 % (P>0.05) comparing to the control group.

Table 2: Jerusalem artichoke tuber's powder influence on lamb meat chemical composition, %

Parameter	Group	
	I (control)	II (experimental)
Dry matter	25.22±0.53	25.63 ± 0.61
Protein	20.51±0.85	21,21 ± 0.75
Fat	2.72±0.12	4.55 ± 0.32*
Ash	1.09±0.06	1.03 ± 0.06

*- data statistically significant when P<0.05

The lamb meat chemical composition is presented in Table 2. The content of dry matter in *musculus longissimus dorsi* in experimental group increased by 0.41 % (P>0.05), protein – 0.7 % (P>0.05), fat – 1.83 % (P<0.05), but the content of ash decreased by 0.06 % (P>0.05) comparing to the control group.

Table 3: Jerusalem artichoke tuber's powder influence on lamb meat technological indexes.

Index	Control group	Experimental group
Water coherence, %	57.41 ± 1.38	60.28* ± 1.39
Cooking loss, %	27.98 ± 0.90	21.00 ± 0.79
Drip loss, %	3.50 ± 0.38	3.48 ± 0.12
pH	5.64 ± 0.05	5.67* ± 0.08
Tenderness, kg/cm^3	1.56 ± 0.12	1.52 ± 0.07
Color:		
L*	43.00 ± 1.56	41.50* ± 0.75
a*	15.97 ± 0.55	16.40 ± 1.35
b*	6.78 ± 0.68	6.62 ± 0.12

*- data statistically significant when p<0.05

Meat technological indexe's analysis (Table 3) had shown that control group distinguished for having 2.87 % lesser water coherence and 6.98 % (p<0.05) bigger cooking loss while comparing to experimental group. The pH of control and experimental group's meat varied insignificantly, experimental group's meat distinguished for having 0.5 % (p<0.05) bigger pH than control group's. The differrence of meat tenderness between groups was not high, only 0.04 kg/cm^3, or 2.56 %, control group's meat distinguished for being more tender. While comparing the color of meat, we noticed, that experimental group's lambs meat distinguished for being darker. The difference between groups was 3.4 % (p<0.05). Though experimental group's meat was more red – by 2.62 % comparing to control group's meat.

Table 4: Jerusalem artichoke tuber's powder influence on lamb meat fatty acids content, %

Common name	Fatty acid	Content, pct.	
		Control group	Experimental group
Decanoic acid	C10:0	0.34 ± 0.01	0.33 ± 0.01
Lauric acid	C12:0	0.74 ± 0.03	0.45 ± 0.04
9-Tetradecanoic acid	C14:1 (n-9)	0.33 ± 0.01	0.33 ± 0.02
Tetradecanoic acid	C14:0	5.4 ± 0.11	5.04 ± 0.03
Pentadecanoic acid	C15:0	1.83 ± 0.08	1.99 ± 0.01

Table 4 (Continued)

9-Hexadecanoic acid	C16:1(n-7)	3.04 ± 0.04	3.44 ± 0.14
Hexanoic acid	C16:0	21.52 ± 0.15	20.4 ± 0.23
8-Heptadecanoic acid	C17:1	1.5 ± 0.01	1.91 ± 0.01
Heptadecanoic acid	C17:0	2.01 ± 0.04	1.83 ± 0.13
9,12 Octadecanoic acid	C18:2n6cis	4.54 ± 0.06	3.53 ± 0.12
9-Octadecanoic acid	C18:1n9cis	35.73 ± 0.23	36.13 ± 0.21
trans-9-Octadecanoic acid	C18:1n9trans	1.44 ± 0.01	2.45 ± 0.09
Oktadecanoic acid	C18:0	19.94 ± 0.31	20.33 ± 0.32
5,8,11,14 Tetra-eicosanoic acid	C20:4(n-6)	0.11 ± 0.23	0.15 ± 0.01
5,8,11,14,17-Penta-eicosanoic acid	C20:5(n-3)	0.29 ± 0.02	0.32 ± 0.02
13-Eicosanoic acid	C20:1(n-7)	0.3 ± 0.01	0.4 ± 0.04
Eicosanoic acid	C20:0	0.3 ± 0.01	0.34 ± 0.01
Dodecanoic acid	C22:0	0.21 ± 0.02	0.22 ± 0.02
Content of saturated fatty acids, %		52.29 ± 0.22	50.93* ± 0.39
Content of monounsaturated fatty acids, %		42.05 ± 0.07	44.66* ± 0.14
Content of polyunsaturated fatty acids, %		5.66 ± 0.05	4.00* ± 0.12

Fatty acid's content in lamb meat analysis (Table 4) had shown that lamb meat contained the biggest amount of saturated fatty acids (C10:0, C12:0, C14:0, C15:0, C16:0, C17:0, C18:0, C19:0, C20:0, C22:0), a little less, i.e. 7, monounsaturated fatty acids (C14:1, C16:1, C17:1, C18:1, C18:1, C19:1, C20:1), which contained one *cis* and trans isomers. The content of saturated fatty acids in control group's meat 52.29 %, i.e. 1.36 % more comparing to experimental group. Experimental group's lamb contained a bigger amount of monounstaturated fatty acids – 44.66 % at all which was 2.61 % more comparing to control group's lamb meat.
Studies on performance responses of sheep and goats supplemented with probiotics have been variable. Growth rate and efficiency of bodyweight gain were found to be similar or reduced in some studies (Tripathi and Karim 2010), while others researchers reported improved weight gain, feed consumption and feed efficiency of gain after probiotic supplementation (Stella et al. 2007) which coincides with our research result's.

Conclusion

Compound feed's supplementation with Jerusalem artichoke tuber's powder had effect on lamb's growth as well as on their meat (*longissimus dorsi*) chemical and technological properties such as content of fat, water coherence, meat pH and color.

References

Baldini, M.; Danusco, F.; Turi, M.; Vannozzi, G.P. Evaluation of new clones of Jerusalem artichoke (Helianthus tuberosus L.) for inulin and sugar yield from stalks and tubers. Ind. Crops Prod. 2004. 19. P. 25–40.

Desnoyers M, Giger-Reverdin S, Bertin G, Duvaux-Ponter C, Sauvant D (2009) Meta-analysis of the influence of Saccharomyces cerevisiae supplementation on ruminal parameters and milk production of ruminants. J Dairy Sci 92: 1620-1632.

Gunnarsson, I.B.; Svensson, S.-E.; Johansson, E.; Karakashev, D.; Angelidaki, I. Potential of Jerusalem artichoke (Helianthus tuberosus L.) as a biorefinery crop. Ind. Crops Prod. 2014. 56. P. 231–240.

Haddad SG, Goussous SN (2005) Effect of yeast culture supplementation on nutrient intake, digestibility and growth performance of Awassi lambs. Anim Feed Sci Techn 118: 343-348.

Hamm R. Die Kolloidchemie des Fleisches. Berlin and Hamburg: Paul Parey, 1972.

Hussein AF (2014) Effect of biological additives on growth indices and physiological responses of weaned Najdi ram lambs. J Exp Biol Agr Sci 2: 597- 607.

Loes M.D., 2000. The Healing Power of Jerusalem Artichoke Fiber. Freedom Press. Topanga, CA, 2000. 13. P. 98-105.

Ma M.X., L.H. Zhang, H.B. Shao, G. Xu, F. Zhang, F.T. Ni, M. Brestic, Jerusalem artichoke (Helianthus tuberosus), a medicinal salt-resistant plant has high adaptability and multiple-use values, J. Med. Plants Res. 2011. 5. P. 1272–1279.

Panchev I., N. Delchev, D. Kovacheva, A. Slavov, Physicochemical characteristics of inulins obtained from Jerusalem artichoke (Helianthus tuberosus L.), Eur. Food Res. Technol. 2011. 233. P. 889–896.

Praznik W., E. Cieslik, A. Filipiak-Florkiewicz, Soluble dietary fibers in Jerusalem artichoke powders: composition and application in bread, Nahrung. 2002. 46. P. 151–157.

6Roberfroid, M. B. Introducing-inulin-type fructans. British Journal of Nutrition. 2005. 93 (1). P. 13-26.

Rodriguez Furlan, L. T., Padilla, A. P., & Campderros, M. E. Development of reduced-fat minced-meats using inulin and bovine plasma-proteins as fat replacers. Meat Science. 2014. 96 (2, Part A). P. 762-768.

Seo JK, Kim SW, Kim MH, Santi D, Kam DK, Ha JK(2010) Direct-fed microbials for ruminant animals. Asian-Aust J Anim Sci 23: 1657-1667

Stella AV, Paratte R, Valnegri L, Cigalino G, Soncini G, Chevaux E, Dell'Otro V, Savoini G (2007) Effect of administration of live Saccharomyces cerevisiae on milk production, milk composition, blood metabolites and faecal flora in early lactating dairy goats. Small Rumin Res 67: 7-13.

Swanton C.J., A.S. Hamill, Jerusalem Artichoke. Factsheet, Ministry of Agriculture and Food, Ontario. 1994. P. 77–94.

Tripathi MK, Karim SA (2010) Effect of individual and mixed live yeast culture feeding on growth performance, nutrient utilization and microbial crude protein synthesis in lambs. Anim Feed Sci Techn 155: 163-171.

Whitley NC, Cazac D, Rude BJ, Jackson-O'Brien D, Parveen S (2009) Use of commercial probiotics supplement in meat goats. J Anim Sci 87: 723-728.

Corresponding author

Guoda Stanyte
Tilžės str. 18,
LT-47181 Kaunas, Lithuania,
tel/fax: +370 37 363505
E-mail: guoda.stanyte(at)lsmuni.lt

Influence of linseed oil, natural and synthetic antioxidants on laying hens productivity, short chain fatty acid (SCFA) and ammonia nitrogen

V. Buckiuniene[1], R. Gružauskas[1], S. Bliznikas[1], L. Asmenskaite[2], V. Viliene[1] and A. Raceviciute-Stupeliene[1]

[1] Lithuanian University of Health Sciences, Veterinary Academy, Institute of Animal Rearing Technologies, Kaunas, LT

[2] Lithuanian University of Health Sciences, Faculty of Public Health, LT

Abstract

Poultry and eggs are nutritious and healthy foods that contain high-quality proteins and low levels of fat compared with other meats. Recent studies have shown that poultry performance is closely associated with colonic health. The aim of this study was to investigate the effects of dietary supplemented linseed oil, lycopene and santoqun on laying hens productivity, short chain fatty acid and ammonia nitrogen concentration in caecum.

A total of 40 *Lohman Brownn* laying hens which were 30 weeks old were assigned to three treatment groups (10 hens per each treatment group) and fed with the experimental diets for 8 weeks. The I (control) group compound feed was supplemented with linseed oil (4.5 %), the II (experimental) group - was supplemented with linseed oil (4.5 %) + lycopene (25g/kg) and III (experimental) group – linseed oil (4.5%) + santoqun (0.15g/kg) and keeping in the same conditions. The results shown that on laying hens productivity parameter antioxidants did not had any statistical significant effect. Statistical significant results were get just in butyric acid content in laying hens caecum, it decreased from 22 to 35 % ($P<0.05$). The results of this study clearly demonstrate that natural and synthetic antioxidants used in laying hens nutrition decreased SCFA and ammonia nitrogen content in caecum.

Introduction

The poultry industry over recent decades has made tremendous adjustments to meet the increasing demand for inexpensive and safe supply of meat and eggs. Intensification in poultry production resulted in disturbances in the balance of chicken gut microflora leading to proliferation of pathogens. This led to increased use of antibiotics in the poultry industry for therapeutic, prophylactic and growth promotion purposes (Vineetha et al., 2017).

Antioxidants play a vital role in both food and chemical systems as well as in the human body to reduce oxidative processes (Van den Ende et al., 2011; Roblet et al., 2012; Rozoy et al., 2012).

Due to advances in high-throughput sequencing technology, it has become apparent that diet has a considerable effect on the composition of gut microbiota, which affects the health status and performance of chickens due to their physiological, nutritional, and immunological functions in the gut (Chambers and Gong, 2011; Stanley et al., 2013).

Intestinal microbiota and their metabolic end product, especially short chain fatty acids (SCFA), play an important role in maintaining homeostasis in the gastrointestinal tract (GIT). The previous studies have demonstrated that SCFA affected intestinal motility by nerve and muscle stimulation. Moreover, the intestinal mucus secretion and cell proliferation were affected by luminal SCFA. In addition besides their beneficial effects on GIT structure and function, SCFA have been shown to control the whole luminal microbial ecology. Dietary oils have high caloric value and thus provide increased energy levels at a lower cost (Lopez-Bote et al., 1997; Baiao & Lara, 2005). In addition, oil improves the absorption of oil soluble vitamins, increases the palatability of rations, reduces pulverulence, increases the efficiency of the consumed energy (Baiao & Lara, 2005; Chwen et al., 2013) and also reduces the rate of passage of digesta in the gastrointestinal tract, which gives room for adequate and efficient absorption of the nutrients present in such diet (Baiao & Lara, 2005).

Main fatty acids in the digestive tract are acetate, propionate and butyrate. Lactate occurs only in small amounts. The production of SCFA in the poultry gastrointestinal tract is correlated with the composition of the diet, its physical form as well as the age of the bird (Barnes, 1979; Carre et al., 1990; Choct et al., 1996, 1999; Bedford and Apajalahti, 2001; Lazaro et al., 2003; Jozefiak et al., 2004a, 2004b). Following intestinal absorption, SCFA play specific roles in the body. Acetate is transported to the liver and is used as energy source by muscles; propionate is converted in glucose in the liver (Montagne et al., 2003) and may also inhibit pathogens, such as Salmonella. Butyrate, one of the specific SCFAs, is an important energy source for intestinal epithelial cells and plays a role in the maintenance of colonic homeostasis by acting on a variety of colonic mucosal functions (Hamer et al., 2008). A few studies are available in literature with respect to the effect of butyrate in broiler chickens (Leeson et al., 2005; Antongiovanni et al., 2007).

The effects and mechanisms of linseed oil, natural and synthetic antioxidants on short chain fatty acid (SCFA) and ammonia nitrogen concentration in laying hens caecum have not been thoroughly investigated. Therefore, this study was conducted to investigate the effects of linseed oil, natural and synthetic antioxidants as a laying hen feed supplement on the production performance, SCFA and ammonia nitrogen concentration in caecum.

Material and methods

Feeding trial was conducted laying hens of *Lohman Brownn* strain at the age of 30 weeks. The laying hens were divided into 3 groups, 10 laying hens in each group. I group is the control group which was added linseed oil 4.5% (T1), II group was the experimental, added linseed oil (4.5) + lycopene (25g/kg) and III group was also the experimental group where compound feed was supplemented with linseed oil (4.5%) + santoqun (0.15g/kg). During the feeding trial, the laying hens were held in the individual cages with stationary drinking-bowl and feed box under the same feeding and holding conditions. The laying hens were fed with compound feed 125 g per day (NRC, 1994).

every 14 days weighed on feed remain and calculated total feed consumption, feed conversion ratio of 1 kg of egg mass produced, the average of egg weight and laying hens rate

The content of short chain fatty acids (SCFA) in caecum was determined by high performance liquid chromatography method using ESC AccQ Tag (Waters inc., USA) technology. The content of ammonia nitrogen in caecum determined by Foss Tecator method ASN 3302.

Statistical Analysis. The results of the experiment were analysed using the 1-way ANOVA test, and significant differences between groups were determined by Duncan's multiple range test. Statistica 8.0. for Windows™ software was used. Differences were considered significant at $P<0.05$.

Results and discussions

Data of performance parameters are given in Table 1. The total feed consumption (g) in group II increased 1 % ($P>0.05$), in group III it decreased 2% ($P>0.05$) compared to the control group. When analysed data of feed consumption to produced 1kg of egg mass, we determined that in experimental groups it had tendency to decreased from 5 to 6 % ($P>0.05$) compared to the control group. Using an antioxidants (synthetic and natural) in laying hens nutrition, the average of egg weight increased from 1 to 3 % ($P>0.05$). And finally, the laying hens rate in experimental groups increased from 2.27 to 5.59 % ($P>0.05$) compared to the control group.

Table 1: Influence of natural and synthetic antioxidants using linseed oil in laying hens nutrition on productivity

Parameter	Groups		
	I (control) group	II (experimental) group	III (experimental) group
Laying hens rate, %	80.00±8.47	85.59±5.22	82.27±5.72
Total feed consumption, g	1648±21.87	1663±13.53	1613±41.34
Feed consumption to produce 1 kg of egg mass, kg	2.36±0.21	2.25±0.16	2.21±0.16
The average of egg weight, g	61.36±3.22	62.26±3.61	63.32±2.46

Some researches revealed association between microbes and flaxseed oil in chicken. However, these studies focused on parasites (Allen et al., 1998, 1996; Danforth et al., 1997) and a study that identify whole intestinal microbiota of chicken have been absent.

Table 2: Influence of natural and synthetic antioxidants using linseed oil in laying hens nutrition on SCFA and ammonia nitrogen concentration, *µmol/g*

Parameter	Groups		
	I (control) group	II (experimental) group	III (experimental) group
Acetic acid	75.25±44.06	70.60±13.04	69.37±13.70
Propionic acid	37.74±17.94	34.25±6.12	34.23±5.97
Butyric acid	17.23±16.37	13.40±4.54*	11.23±4.39*
Ammonia nitrogen	376.70±63.08	365.42±44.13	351.65±18.20

*-data statistically significant at $P<0.05$

The results of SCFA is presented in Table 2. Natural and synthetic antioxidants in laying hens nutrition decreased all SCFA in caecum. Acetic acid decreased from 6 to 8 % ($P>0.05$), propionic acid – 9 % ($P>0.05$) and butyric acid – from 22 to 35 % ($P<0.05$) compared to the control group.

Long-term exposure to ammonia not only reduces the productive performance of animals, also induces diseases, such as pulmonary edema, dyspnea, anemia, coma, and even death to the public (Stokstad, 2014). Ammonia nitrogen content in laying hens caecum is presented in Table 3. Using in laying hens nutrition antioxidants (natural and synthetic) this parameter had tendency to decreased from 3 to 7 % ($P>0.05$) compared to the control group.

Conclusions

The results of this study clearly demonstrate that natural and synthetic antioxidants used in laying hens nutrition decreased SCFA and ammonia nitrogen content in caecum.

Acknowledgement

Financed by the ministry of Agriculture of the Republic of Lithuania; project MT 11/30.

References

Allen PC, Danforth HD, Augustine PC (1998) Dietary modulation of avian coccidiosis. Int J Parasitol 28(7):1131–1140.

Allen PC, Danforth HD, Levander OA (1996) Diets high in n-3 fatty acids reduce cecal lesion scores in chickens infected with Eimeria tenella. Poult Sci 75(2):179–185.

Antongiovanni, M., A. Buccioni, F. Petacchi, S. Leeson, S. Minieri, A. Martini, R. Cecchi, 2007: Butyric acid glycerides in the diet of broiler chickens: effects on gut histology and carcass composition. Ital. J. Anim. Sci. 6, 19-25.

Baiao NC, Lara L. 2005. Oil and fat in broiler nutrition. Rev Bras de Ciência Avícola. 7:129–141.

Barnes, E.M., 1979: The intestinal microflora of poultry and game birds during life and after storage. J. Appl. Bacteriol. 46, 407-419.

Bedford, M.R., J. Apajalahti, 2001: Microbial interactions in response to Exogenous enzyme utilization. Enzymes in Farm Animal nutrition, CABI Publishing, 299-314.

Carre, B., L. Derouet, B. Lecrecq, 1990: The digestibility of cell-wall polysaccharides from wheat (bran or whole grain), soybean meal, and white lupin meal in cockerels, muscovy ducks, and rats. Poult. Sci. 69, 623-633.

Chambers JR, Gong J (2011) The intestinal microbiota and its modulation for Salmonella control in chickens. Food Res Int 44(10):3149–3159.

Choct M., R.J. Hughes, J. Wang, M.R. Bedford, A.J. Morgan, G. Annison, 1996: Increased small intestinal fermentation is partly responsible for the anti-nutritive activity of non-starch polysaccharides in chickens. Br. Poult. Sci. 37, 609-621.

Choct, M., R.J. Hughes, M.R. Bedford, 1999: Effects of a xylanase on individual bird variation, starch digestion throughout the intestine, and ileal and caecal volatile fatty acid production in chickens fed wheat. Br. Poult. Sci. 40, 419-422.

Chwen LT, Foo HL, Thanh NT, Choe D. 2013. Growth performance, plasma fatty acids, villous height and crypt depth of preweaning piglets fed with medium chain Triacylglycerol. Asian Austral J Anim Sci. 26:700–704.

Danforth H, Allen P, Levander O (1997) The effect of high n-3 fatty acids diets on the ultrastructural development of Eimeria tenella. Parasitol Res 83(5):440–444.

Hamer, H.M., D. Jonkers, K. Venema, 2008: Review Article: the role of butyrate on colonic function. Aliment Pharm Therap. 27, 104-119.

Jozefiak, D., A. Rutkowaki, M. Fratczak, D. Boros, 2004a: The effect of dietary fibre fractions from different cereals and microbial enzymes supplementation on performance ileal viscosity and short-chain fatty acids concentration in caeca of broiler chickens. Anim. Feed Sci. 13, 487-496.

Jozefiak, D., A. Rutkowaki, S.A. Martin, 2004b: Carbohydrate fermentation in the avian caeca – a review. Anim. Feed Sci. Technol. 113, 1-15.

Lazaro, R., M. Garcia, P. Medel, G.G. Mateos, 2003: Influence of enzymes on performance and digestive parameters of broilers fed rye-based diets. Poult. Sci. 82, 132-140.

Leeson, S., H. Namkung, M. Antongiovanni, E.H. Lee 2005: Effect of butric acid on the performance and carcass yield of broiler chickens. Poult. Sci. 84, 1418-1422.

Lopez-Bote CJ, Rey AI, Sanz M, Gray JI, Buckley DJ. 1997. Dietary vegetable oils and α-tocopherol reduce lipid oxidation in rabbit muscle. J Nutr. 127:1176–1182.

Montagne, L., J. Pluske, A. Hamson, 2003: Hampson. A review of interaction between dietary fibre and the intestinal mucosa, and their consequences on digestive health in young non-ruminant animals. Anim. Feed Sci. Tech. 108, 95-117.

Roblet, C., Amiot, J., Lavigne, C., Marette, A., Lessard, M., Jean, J., Ramassamy, C., Moresoli, C. and Bazinet, L. (2012). Screening of in vitro bioactivities of a soy protein hydrolysate separated by hollow fiber and spiral-wound ultra filtration membranes. Food Res. Int. 46:237–249.

Rozoy, E., Simard, S., Liu, Y., Kitts, D., Lessard, J. and Bazinet, L. (2012). The use of cyclic voltammetry to study the oxidation of l-5-methylte-trahydrofolate and its preservation by ascorbic acid. Food Chem. 132:1429–1435.

Stanley D, Geier MS, Denman SE, Haring VR, Crowley TM, Hughes RJ, Moore RJ (2013) Identification of chicken intestinal microbiota correlated with the efficiency of energy extraction from feed. Vet Microbiol 164(1):85–92.

Stokstad E (2014) Air pollution ammonia pollution from farming may exact hefty health costs. Science 343(6168):238–238.

Van den Ende, W., Peshev, D. and De Gara, L. (2011). Disease prevention by natural antioxidants and prebiotics acting as ROS scavengers in the gastrointestinal tract. Trends Food Sci. Technol. 22:689–697.

Vineetha P.G., Tomar S. Saxena V.K., Kapgate M., Suvarna A., Adil K. 2017. Effect of laboratory-isolated Lactobacillus plantarum LGFCP4 from gastrointestinal tract of guinea fowl on growth performance, carcas s traits, intestinal histomorphometry and gastrointestinal microflora pop ulation in broiler chicken. Journal of Animal Physiology and Animal Nutrition. 1: 1-9.

Corresponding author:

Buckiuniene Vilija
E-mail: vilija.buckiuniene(at)lsmuni.lt

Hähnchenmastversuch mit einem konzentrierten, algenhaltigen Ergänzungsfuttermittel als teilweisen Ersatz von synthetischem Methionin

Herbert Sinning[1], Elisabeth Zißler[2] und Klaus Damme[3]

[1] LIPTOSA, Madrid, ES
[2] Pulte GmbH & Co. KG, Grünwald, DE
[3] LfL/LVFZ für Geflügel Kitzingen, DE

Abstract

Methionine is an essential amino acid required for maintenance of the vital functions and optimal growth. Industrial livestock production requires additional doses of synthetic methionine in the diet. Methionine is essential for the absorption, transport and bioavailability of certain minerals and is acting as a donor for methyl groups in order to prevent the accumulation of excess fat in the liver. In this study the effect of a partly substitution of synthetic Methionine through a supplementary feed with algae (METHPLUS® and METHPLUS® 110) was tested 3400 Broilers where divided in 4 treatments (Positive control, METHPLUS® group, METHPLUS® 110, negative control). In the trail groups 1 kg/to Methionine was substituted by either 1kg METHPLUS® or METHPLUS® 110.
Result: There were no remarkable differences between the groups fed with METHPLUS® or METHPLUS® 110 and the control groups in rearing performance. An explanation could be that the supplementary feed METHPLUS® can effective substitute part of the synthetic Methionine. Also positive effects on liver weight, a tendency of reduction of Mortality and better litter quality where confirmed.

Einleitung

In diesem Versuch sollte untersucht werden, ob ein Großteil des zugesetzten synthetischen Methionins durch ein algenhaltiges Ergänzungsfuttermittel beim Masthähnchen ersetzt werden kann. In Versuchen mit anderen Nutztieren wurde bereits bestätigt, dass dieses Ergänzungsfuttermittel die Aufnahme von DL-Methionin aus dem Futter durch das Tier optimiert, es erhöht die Effektivität des Methionin Recycling-Pfades und verbessert die Leberfunktionen sowie Nährstoffverdaulichkeiten. Methionin ist essentiell für die Aufnahme, Transport und Bioverfügbarkeit bestimmter Mineralien und fungiert als Spender für Methylgruppen, um der Ansammlung von überschüssigem Fett in der Leber vorzubeugen und diese somit zu entlasten [1, 2, 3].

Material und Methoden

Tiere: 3.400 Ross 308 Küken
Mastdauer: 37 Tage
Aufstallung: LVFZ für Geflügel Kitzingen, Neuer Niedrigenergiestall;
Futter: Nach einer Fütterung von Starterfutter mit Kokzidiostatikum das für alle Tiere gleich war, erhielten die Tiere 4 Futtervarianten ohne Kozidiostatica.
A: Positivkontrollgruppe
B: Versuchsfutter mit 1 kg/to MethPlus im Austausch gegen Methionin
C: Versuchsfutter mit 1 kg/to MethPlus110 im Austausch gegen Methionin
D: Negativkontrollgruppe, 1 kg weniger synthetisches Met als Gruppe A

Influence of extruded rapeseeds and faba beans mixture on rumen fluid parameters of dairy cows'

Gintarė Dovidaitienė[1], Romas Gružauskas[2], Rolandas Stankevičius[1], Ingrida Monkevičienė[3], Jonė Kantautaitė[3], Ieva Kudlinskiene[2], Aida Grockienė[1] and Rasa Želvytė[3]

[1] Department of Animal Breeding and Nutrition, Lithuanian University of Health Sciences, LT

[2] Institute of Animal Rearing Technologies, Lithuanian University of Health Sciences, LT

[3] Research Centre of Digestive Physiology and Pathology, Department of Anatomy and Physiology, Faculty of Veterinary Medicine, Veterinary Academy Lithuanian University of Health Sciences, LT

Abstract

The study was conducted to evaluate the influence of extruded rapeseeds (70 %) and faba beans (30%) mixture for dairy cows on fermentation processes of rumen fluid. 20 holsteinizated Lithuanian cows of black-and-white breed of II-IV lactation were selected and divided in to two groups (10 cows for each) for this study applying the principle of analogous groups. pH, total volatile fatty acid (VFA), fluid of total and ammonia nitrogen were investigated during the whole experimental period. The investigation showed no crucial influence of the extruded rapeseeds and faba beans mixture on microbiological and biochemical indicators.

Introduction

Today the most important task for the dairy farming is to get cost-effective production of high quality. The cellulose is broken down to glucose and sugar in rumen, so carbohydrates are necessary for bacteria growth and protein synthesis (Nocek and Tamminga, 1991). The optimal ruminal pH of dairy cows is 6.3–6.8. When it drops below 6.0, the growth rate of anaerobic fungi and protozoa is decreased. If pH is lower than 5.5, protozoa die and activity of ruminal bacteria become destabilized (Sederevičius et al., 2001). Due to their great number and mobility, protozoa mix and loosen the fluid of a rumen which results in greater surface area of the forage and better conditions for activities of bacteria and enzymes. Protozoa accumulate reserved polysaccharides which are not only vital for their own life but are also important to the cattle nutrition. Protozoa actively break down cellulose, hemicellulose, and starch, and participate in the digestive processes in the rumen (Karim and Santra, 2002).Volatile fatty acids are the main energy source for cows that provide approximately 70 % of energy and consist in the rumen during fermentation. During presence of microorganisms in the rumen, the carbohydrates ferment, amino acids break down, other processes take place. Concentration of volatile fatty acids in the rumen varies from 60 to 150 mmol/l, and it is strongly influenced by ration composition (Aschenbach et al., 2011).

The aim of this study was to assess the influence of a mixture of extruded rapeseeds (70 %) and fodder beans (30 %) for dairy cows on fermentation processes of rumen fluid.

Material and methods

The investigation was carried out in a dairy cow farm in Marijamplole district. The experiment was divided in two periods –initial 14 days and experimental 90 days. Selected dairy cows were divided into 2 groups (control and trial), 10 animals each according to the principle of analogous groups (considering lactation, parity, productivity during the former lactation, the animal's weight, milk production). The cows were tethered, watered from automatic water troughs, milked using milking pipelines and fed twice a day. The experiment was carried out with 20 holsteinizated Lithuanian Black-and-White dairy cows of II-IV lactation. The experiment was carried out complying with the Law of the Republic of Lithuania on animal care, housing and use No. XI-2271 of 03-10-2012, also with the amended Order of State Food and Veterinary Service on Approval for requirements for housing, care and use of animals for experimental and other scientific research (No. B1-872 of 24-09-2015). Rations for both groups were balanced based on the need of feed, mineral substances and vitamins (see Table 1). Nutritional and energy value of the rations was calculated using a computer feeding programme HYBRIMIN® Futter 2008.

Table 1: Averaged day ration of control and trial groups.

Forage	Control group	Trial group
Grass haylage, kg	14.00	14.00
Maize silage, kg	23.00	23.00
Straws, kg	0.50	0.50
Molasses, kg	1.00	1.00
Silage from sugar beet pulp, kg	10.00	10.00
Compound feed	8.00	-
Compound feed (+extruded rapeseeds (30 %) and faba beans (70 %) mixture), kg	-	8.00
Ration contains:		
Dry matter, kg	24.94	24.96
NEL (net energy for lactation), MJ/kg SM	6.72	6.78
Crude proteins, g/kg SM	167	170
Crude fat, g/kg SM	26	29
Crude fibre, g/kg SM	165	166
Crude ashes, g/kg SM	85	84

Methods/technique

During the experiment, the rumen fluid samples were collected from three randomly selected animals of each group with a stomach tube (Sederevičius, 2000) 3 hours after morning feeding. The samples were analysed for the pH, total VFA fluid, total and ammonia nitrogen. Ruminal pH was measured immediately after sampling, using a handheld pH-meter (Horiba - Twin pH, Spectrum Technologies). Total VFA was defined by rumen fluid distillation in a Marcgamus apparatus according to the method of Pustovoj (1978). Total nitrogen was analysed by Kjeldahl procedure (Behr system, Germany), ammonia nitrogen – by titrimetric method with the preliminary distillation (Behr steam distillation unit S1, Germany).

Statistical analysis

Statistical analysis was carried out by the means of "SPSS for Windows" software, 15.0 version (SPSS Inc., II, USA, 2006). It includes calculation of arithmetic mean values of the traits, errors of the mean values, the obtained results are statistically significant when $P<0.05$.

Results

It was detected the difference of ruminal pH between the control (pH 6.83) and the trial group cows (pH 6.81) in 0.02 at the beginning of the experiment (table 3). But there were no significant differences during the experiment and at the end of it. The ruminal pH was within the physiological norm (Dijkstra et al., 2012) during all experimental time. Table 2 shows that at the beginning of the experiment, the difference between the rumen fluid pH of the control group cows (pH 6.83) and the trial group cows (pH 6.81) was 0.02. During the experiment and at the end of it, the rumen fluid pH of both groups showed no significant differences and was within the physiological norm.

Table 2: The ruminal parameters during experimental time

pH variation over the experimental period			
Group	Beginning	Middle	End
Control group	6.83	6.54	6.78
Trial group	6.81	6.68	6.80
Variation of the number of volatile fatty acids in the rumen fluid, mmol/l			
Control group	66.67±5.77	86.67±23.09	83.33±5.77*
Trial group	66.67±11.54*	103.33±15.27*	76.67±15.27*
Variation of total nitrogen in the rumen fluid, mg/100 ml			
Control group	60.90±8.77	109.67±24.47	134.40±37.11
Trial group	60.20±19.33	86.33±11.21	125.30±29.40
Variation of ammonia nitrogen in the rumen fluid, mg/100 ml			
Control group	15.21±4.04	29.49±9.26	23.89±7.00
Trial group	16.24±1.56	21.93±5.52	27.81±11.96

*P<0.05

Analysis of number variation of VFA at the beginning of the experiment showed that the number of volatile fatty acids in both groups of cows was similar at the beginning as well as at the end of the experiment, i. e. 66.67 mmol/l at the beginning for the control group of cows and 83.33 mmol/l at the end of the experiment. For the trial group, the number of VFAs was the same as of the control group of cows (66.67 mmol/l), and at the end of the experiment it was 76.67 mmol/l. (P<0.01). Analysis of fermentation of nitrogen substances in the rumen showed that the variation of the fluid of total nitrogen and ammonia nitrogen comparing the two groups was different throughout the experiment. Analysis of variation of total nitrogen fluid over the experimental period showed that the concentration of the total nitrogen in the rumen fluid in the control group as well as in the trial group was within the physiological norm throughout the whole experimental period (P>0.05). Analysis of the total ammonia nitrogen fluid during the first experimental month revealed that the fluid in the rumen fluid of both groups was control group 15.21 mg/100 ml and trial group 16.24 mg/100 ml, respectively. Halfway through the experiment, the ammonia nitrogen fluid of the control group of cows was 7.56 mg/100 ml higher that the trial group of cows. At the end of the experiment, the fluid of total ammonia nitrogen was similar in both groups: 23.89 mg/100 ml in the control group of cows and 27.81 mg/100 ml in the trial group of cows. Comparison of the fluid of total ammonia nitrogen during the three stages of the experiment shows that the mean fluid of ammonia nitrogen was within the physiological norms.

Discussion

Activity of fermentation processes of rumen fluid is unstable. It could depend on the time of feeding, composition of the ration, quality of the forage, the amount of time after the feeding, the rate the rumen fluid is passed to other parts of the digestive tract, etc. (Laugalis et al., 2007). Throughout the entire experiment, the rumen fluid pH of the trial group of cows varied from 6.68 to 6.81 and was within the norms (Dijkstra et al., 2012). pH of the control group of cows varied from 6.54 to 6.83. VFAs are the main source of cow energy. Cows obtain approximately 70 % of energy from this source. VFAs are produced in the rumen during the fermentation process. During this experiment, the variation of the fluid of VAFs was similar in the rumen fluid of the control group of cows as well as of the trial group of

cows (from 66.67 mmol/l to 103.33 mmol/l) and was within the physiological norms. The fluid of ration determines the VAF concentration in the rumen and it varies from 60 to 150 mmol/l (Aschenbach et al., 2011). There is a possibility that productive cows will get too much nitrogen compounds with the forage that break down quickly to ammonia and, while accumulating in the organism, distort the liver. In such a way the metabolism is impaired, especially of minerals. Synthesis of vitamins becomes worse, level of magnesium in the blood drops and the cow is diagnosed with tetany. Throughout the experiment, total nitrogen concentration in the rumen fluid of the control group of cows as well as in the trial group was within the physiological norms (60.20–134.40 mg/100 ml) and agree well with data of other authors (Reynolds, 2005). Analysis of the obtained data showed that the fluid of ammonia nitrogen in the rumen of the trial group of cows was unstable and increased from 16.24 to 27.81 mg/ml. Calsamiglia et al. (2010) also declares that concentration of ammonia nitrogen in the rumen fluid is usually unstable. The optimal fluid of ammonia nitrogen in the rumen fluid is from 3 to 25 mg/100 ml (Boucher et al., 2007). At the end of the experiment the fluid of ammonia nitrogen in the trial group was by 2.81 mg/100 ml higher; however, it did not influence the fermentation processes of the rumen since the excess ammonia nitrogen removed from the organism with urine (Agle et al., 2010).

Conclusion

The supplement of extruded rapeseeds (70 %) and faba beans (30 %) mixture used in the experiment had no considerable influence on the rumen fermentation parameters and they were within the norms normal throughout the whole experiment.

References

Agle M., Hristov A. N., Zaman S., Schneider C., Ndegwa P. M., Vaddella V. K. Effect of dietary concentrate on rumen fermentation, digestibility, and nitrogen losses in dairy cows. Journal of Dairy Science. 2010. Vol. 93. P. 4211–4222.

Aschenbach, J. R., Penner, G. B., Stumpff, F., & Gäbel, G. Ruminant nutrition symposium: Role of fermentation acid absorption in the regulation of ruminal pH. Journal of Animal Science. 89. 2011. P. 1092–1107.

Boucher S. E., Ordway R. S., Whitehouse N. L., Lundy F. P., Kononoff P. J., Schwab C. G. Effect of Incremental Urea Supplementation of a Conventional Corn Silage-Based Diet on Ruminal Ammonia Concentration and Synthesis of Microbial Protein. Journal of Dairy Science. 2007. Vol. 90. P. 5619–5633.

Calsamiglia S., Ferret A., Reynolds C. K, Kristensen N. B. Vuuren van A. M. Strategies for optimizing nitrogen use by ruminants. The Animal Consortium. 4:7. 2010. P. 1184–1196.

Dijkstra J., Ellis, J. L., Kebreab E., Strathe A. B., López S., France J., Bannink A. Ruminal pH regulation and nutritional consequences of low pH. Animal Feed Science and Technology. Vol. 172. 2012. P. 22-33.

Karim S. A., Santra A., Influence of ciliate protozoa on biochemical changes and hydrolytic enzyme profile in the rumen ecosystem. J.n Appl. Microbiol. 2002. Vol. 92. P. 801–811.

Laugalis J., Kabašinskienė A., Sederevičius A., Ramanauskienė J., Želvytė R., Monkevičienė I., Kantautaitė. Apsiveršiavusių melžiamų karvių kondicijos įtaka pieno produktyvumui. Veterinarija ir zootechnika. ISSN 1392-2130, Kaunas. 2007. T. 40(62). P. 39–42.

Nocek J. E., Tamminga S. Site of digestion of starch in the gastrointestinal tract of dairy cows and its effect on milk yield and composition. J. Dairy Sci. 1991. 74. P. 3598–3629.

Pustovoj V. K. Gazohromatograficheskoje opredielienije zirnyh kislot v kormah i biologicheskih substratah selskohozeistvenyh zyvotnyh (in Russian). Mietodychestkije rekomendacii. Borovsk, Russia. 1978 P. 3–8.

Reynolds C. K. Nitrogen metabolism by splanchnic tissues of ruminants. In Biology of metabolism of growing animals (ed. D Burrin and H Merssman). Elsevier Science. Oxford. England. 2005. P. 197–220.

Sederevičius A. Diagnostiniai ir gydomieji zondai galvijams. Kaunas, 2000. P. 3–9.

Corresponding author

Gintarė Dovidaitienė
Department of Animal Breeding and Nutrition, Lithuanian University of Health Sciences
tel. +370 61161668
E-mail: gintare.dovidaitiene(at)lsmuni.lt