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Editorial

Dear readers,

For forty-two years, you have been given an opportunity of reading original scientific papers or professional articles and information from the field of animal husbandry science, research and farming practice in the professional periodical Živočišná výroba. The periodical Živočišná výroba has won its permanent readership not only in the Czech Republic and in Slovakia, but also in foreign countries. The good reputation is not built by tradition only, but also by the high standard of published papers, language used and other formal characteristics (journal size, layout and form of regular information on the cover, professional classification of papers and their formal structure). The periodical is recorded in the prominent world database Current Contents, and in other professional and scientific databases.

The periodical Živočišná výroba, in which scientific papers in the Czech and Slovak languages only with summaries in foreign languages were published previously, has become a journal with an increasing proportion of papers written in English, and accordingly the periodical impact factor has been growing, which has made the journal rank among the thirty renowned professional periodicals in this field throughout the world. It has happened so in spite of the partly local nature of this periodical, making it more difficult to get among the absolutely top animal husbandry periodicals of the world. Great improvement of the quality of our periodical has been achieved in recent years, particularly thanks to the efforts of the professional and efficient international board of editors including the editor in chief. Taking into account the structure of the board of editors (18 experts from seven countries) and the increasing number of papers of other than Czech and Slovak origin, it is possible to consider the periodical Živočišná výroba as an international one.

The above described development and overall genesis of this periodical have suggested that the present name of this periodical is not apt any longer in formal, language and subject terms. Therefore the board of editors have decided to change the name. The new name is CZECH JOURNAL OF ANIMAL SCIENCE since this issue (1/1998) while the original name ŽIVOČIŠNÁ VÝROBA is maintained on the first page of the cover in a less conspicuous form to preserve the continuity of the periodical and to make the readers orientation easier. The meaning of the new name will permit to publish the results of applied and basic research at a somewhat larger professional scale as well as it will help include the journal among the scientific periodicals with similar names and subject-matters.

Dear readers and authors of scientific papers, I believe that you will understand this change and other small ones motivated by our efforts to improve the quality of this periodical and its availability at an international scale. I am also convinced that you, researchers and authors of original scientific papers, will avail yourselves of an opportunity to publish your good papers written in English in this periodical. You will contribute not only to the improvement of its standard but also you will ensure the rapid and worldwide publicity of your research work.

Ing. Vít Prokop, DrSc.
Board of Editors Chairman
of the periodical
CZECH JOURNAL OF ANIMAL SCIENCE
(Živočišná výroba)

Vážení čtenáři,

již čtyřicet dva let máte možnost na stránkách vědeckého časopisu Živočišná výroba sledovat výsledky původních vědeckých prací i odborné statě a informace z oblasti zootechnické vědy, výzkumu i odborné praxe. Časopis Živočišná výroba si za tu dobu získal stabilní okruh čtenářů nejen v České republice a na Slovensku, ale především v zahraničí. K renomé časopisu nestačí jen tradice, ale i kvalita publikovaných prací, používaný jazyk a řada formálních náležitostí (formát, uspořádání a forma nezbytných informací na obálce časopisu, odborné třídění prací a jejich formální struktura). Časopis je evidován v prioritní světové databázi Current Contents a v celé řadě dalších odborných a vědeckých databází.

Časopis Živočišná výroba, v němž byly dříve publikovány vědecké práce jen v češtině a slovenštině s cizojazyčnými souhrny, se stává stále více časopisem s rostoucím podílem anglicky psaných prací a roste tak i impact factor časopisu, který v poslední době posouvá časopis mezi třicítku renomovaných vědeckých časopisů na světě v tomto oboru. Je tomu tak přesto, že časopis má logicky částečně lokální charakter, což znesnadňuje jeho další posun do absolutní špičky světových vědeckých zootechnických časopisů. Přesto se v posledních letech podařil výrazný posun v kvalitě našeho časopisu, na němž má zásluhy především odborně i pracovně kvalitní mezinárodní redakční rada včetně vedoucí redaktorky časopisu. Právě s ohledem na strukturu redakční rady (18 odborníků ze 7 zemí) a nástup publikovaných prací jiné než české a slovenské provenience chápeme časopis Živočišná výroba jako časopis mezinárodní.

Uvedený rozvoj a celková geneze časopisu způsobily, že současný název časopisu přestal vyhovovat z hlediska formálního, jazykového i obsahového. Z těchto důvodů se redakční rada rozhodla změnit název časopisu. Od tohoto čísla (1/1998) je název časopisu CZECH JOURNAL OF ANIMAL SCIENCE s tím, že původní název časopisu ŽIVOČIŠNÁ VÝROBA zůstane pro zachování kontinuity a lepší orientaci čtenářů v méně výrazné podobě na první stránce obálky. Významový ekvivalent nového názvu jednak dovolí publikaci výsledků aplikovaného i základního výzkumu v poněkud širším odborném spektru, jednak se časopis začlení do řady vědeckých časopisů s obdobným názvem a náplní.

Věřím, vážení čtenáři a autoři vědeckých prací, že přijmete s pochopením tuto, ale i další drobné změny, které jsou motivovány snahou o další zvýšení kvality našeho časopisu i o jeho lepší mezinárodní čitelnost. Věřím také, že využijete možnosti publikovat své kvalitní příspěvky v angličtině v našem časopisu. Přispějete tak nejen ke zvýšení úrovně našeho časopisu, ale zajistíte si také rychlou a světovou publicitu výsledků vaší vědecké práce.

Ing. Vít Prokop, DrSc.
předseda redakční rady časopisu
CZECH JOURNAL OF ANIMAL SCIENCE
(Živočišná výroba)

EFFECTS OF SORBENTS DURING ORGANOPHOSPHATE INTOXICATION IN SHEEP

ÚČINOK SORBENTOV PRI INTOXIKÁCII ORGANOFOSFÁTOM U OVIEC

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ABSTRACT: Effects of zeolite and active charcoal during organophosphate VX intoxication in sheep were studied. In the first group of experiments zeolite was given to experimental sheep at a dose of 2 g/kg b.w. followed (after 20 min) by oral administration of organophosphate. After the organophosphate doses of 80, 41 and 33 μg/kg b.w. all of the animals died. In animals treated with 33 μg/kg b.w. of the organophosphate and zeolite, higher cholinesterase activities were observed (experimental group $AChE_{30min}$ = 19,4%, $BuChE_{30min}$ = 17,6%, control group $AChE_{30min}$ = 15,1%, $BuChE_{30min}$ = 5,7%), despite the deaths of all animals. Protective effects of zeolite were observed in sheep at the poison doses of 26 μg/kg b.w. (experimental group $AChE_{48hr}$ = 24,1%, $BuChE_{48hr}$ = 36,7%; control group $AChE_{48hr}$ = 2,7%, $BuChE_{48hr}$ = 25,4%) and 21 μg/kg b.w. (experimental group $AChE_{60min}$ = 38.1%, $BuChE_{60min}$ = 50%; control group $AChE_{60min}$ = 15.3%, $BuChE_{60min}$ = 14.9%; $P < 0.01$ and $P < 0.05$, resp.). In the second group of experiments, organophosphate was given to sheep at a dose of 33 μg/kg b.w. mixed with 20 g of zeolite. The decrease in cholinesterase activities in the experimental animals was rather slow. In one sheep that survived, the cholinesterase activities on 21st day reached nearly the initial values (AChE = 104%, BuChE = 89.7%). In the third group of experiments, organophosphate was administered to sheep at a dose 33, 66, and 131 μg/kg b.w. mixed with 20 g of the active charcoal – Norit A. All animals treated with Norit A survived and showed only moderate decrease in cholinesterase activities (Fig. 1, 2).

sheep; organophosphate; intoxication; sorbents; effects

ABSTRAKT: V experimente sme sledovali účinok zeolitu a aktivovaného živočíšneho uhlia pri intoxikácii oviec organofosfátom – látkou VX (O-etyl-S-/diizopropylaminoetyl/-ester kyseliny metyltiofosforitej). V prvej skupine experimentov bol zeolit aplikovaný v dávke 2 g/kg ž.h., 20 minút pred perorálnym podaním organofosfátu. Po dávkach 80 μg a 41 μg organofosfátu/kg ž.h. všetky zvieratá uhynuli. Po podaní látky VX v dávke 33 μg/kg ž.h. aktivita cholinesteráz v prvých 30 min (pokusná skupina $AChE_{30min}$ = 19,4 %, $BuChE_{30min}$ = 17,6 %, kontrolná skupina $AChE_{30min}$ = 15,1 %, $BuChE_{30min}$ = 5,7 %) experimentu bola vyššia u zvierat ošetrených zeolitom aj napriek úhynu zvierat. Ochranný účinok zeolitu bol pozorovaný tak v smere vývoja aktivít cholinesteráz, ako aj v prežití niektorých zvierat ošetrených zeolitom pri dávkach 26 μg/kg ž.h. (pokusná skupina $AChE_{48h}$ = 24,1 %, $BuChE_{48h}$ = 36,7 %; kontrolná skupina $AChE_{48h}$ = 2,7 %, $BuChE_{48h}$ = 25,4 %) a 21 μg/kg ž.h. (pokusná skupina $AChE_{60\ min}$ = 38,1 %, $BuChE_{60min}$ = 50 %; kontrolná skupina $AChE_{60min}$ = 15,3 %, $BuChE_{60min}$ = 14,9 %; $P < 0,01$, resp. $P < 0,05$). V druhej skupine experimentov bol organofosfát aplikovaný ovciam v dávke 33 μg/kg ž.h., zmiešaný s 20 g zeolitu na zviera. Pokles cholinesterázovej aktivity u zvierat ošetrených zeolitom bol pomalší a u zvieraťa, ktoré prežilo experiment na 21. deň, boli zistené takmer východzie hodnoty (AChE = 104 %, BuChE = 89,7 %). V tretej skupine experimentov bolo použité aktivované živočíšne uhlie – Norit A v dávke 20 g/zviera spolu s organofosfátom aplikovaným v množstve 33, 66 a 131 μg/kg ž.h. Všetky zvieratá ošetrené Noritom prežili experiment a preukázali len mierny pokles aktivity cholinesteráz (obr. 1 a 2).

ovce; organofosfát; intoxikácia; sorbenty; účinky

INTRODUCTION

Organophosphates are of considerable importance in national economy. In agriculture they play an important role in protection of animals and cultured plants. Although the organophosphates exhibit lower occurrence of environmental residues, their general toxicity is higher (Kováč, 1994). Their general availability creates conditions for organophosphate intoxications of accidental, professional or suicidal character (Bajgar, 1985). The effect of organophosphates is the inhibition of acetylcholinesterase within the nervous system. Subsequent cumulation of toxic levels of endogenous acetylcholine in the nervous system is manifested by muscarine and nicotine effects, and altered function of central nervous system (Moretto, Johnson, 1987).

Organophosphate metabolism in mammals is similar to that in insects. Toxic compounds can be absorbed through any way and the rate of absorption is influenced by composition and solubility of these compounds. They are metabolised mainly by oxidation and esterase hydrolysis. Metabolic end-products are eliminated through the urine and faeces (Ništiar et al., 1984). Young, fatigued, and stressed or hypothermic animals are the most susceptible to organophosphate intoxication (Piskač et al., 1985).

Regarding the simple therapeutic and preventive methods that are important also in organophosphate intoxication, the aim of this work was to study effects of oral administration of clinoptilolite and active charcoal on organophosphate intoxication in sheep.

MATERIAL AND METHODS

Organophosphate – VX substance (O-ethyl-S- /2-diisopropylaminoethyl/-ester of methylthiophosphonic acid) and zeolitic tuff from Nižný Hrabovec were used. The zeolite contains 60–65% of clinoptilolite with cation-exchange capacity 0.86 meq/g (particle size: < 0,045 mm 99,68%; 0,045–0,063 mm 0,26%; 0,063–0,1 mm 0,06%). Chemical composition of the tuff was as follows: SiO_2 69,22%, MgO 0,75%, TiO_2 0,18%, K_2O 2,48%, Al_2O_3 14,33%, Na_20 0,97%, CaO 3,40%, As and Pb < 0,001%). The experiments were done in merino sheep, body weight (b.w.) of 30–35 kg.

In the first group of experiments, the experimental animals were given zeolitic tuff at the dose of 2 g/kg b.w. with 200 ml of drinking water orally via the oesophageal tube. Approximately after 20 min, the organophosphate was administered by the same route at the doses of 80 (2 experimental/2 control animals), 41 (2/2), 33 (2/2), 26 (4/4), and 21 (4/4) µg/kg b.w.

In the second group of experiments, the organophosphate (31 µg/kg b.w.) was mixed with the zeolite (2 g/kg b.w.) and administered orally (4 experimental/2 control animals).

In the third group of experiments, the animals were given active charcoal – Norit A – at the dose of 20 g/animal orally together with the organophosphate at the doses of 33 (4/2), 66 (3/1), and 131 (2/1) µg/kg b.w.

The control animals received only the organophosphate without clinoptilolite.

Blood samples were collected at 0, 15, 30, 60, 90, and 120 min, 24, 48, and 72 hr, and 7, 14, and 21 day after the intoxication. Erythrocytary acetylcholinesterase (AChE E.C.3.1.1.7) and plasmatic butyrylcholinesterase (BuChE E.C.3.1.1.8) were estimated colorimetrically (Beneš et al., 1981). Acetylcholinesterase activities are expressed as average values and standard deviation (žs) in mmol/l and percentage (%). The activity of 100% represents the activity at the beginning of the experiment. The activities in the experimental and control groups were compared by Student's *t*-test.

RESULTS

In the first group of experiments animals treated with 80 and 41 µg/kg b.w. of organophosphate died between 30 min and 6 hr, without any differences in cholinesterase activities.

At the dose of 33 µg/kg b.w. the control animals died after 4 and 6 hr, while the experimental animals after 6 hr. Lower inhibition of cholinesterases in the experimental group (experimental group $AChE_{30min}$ = 19.4%, $BuChE_{30min}$ = 17.6%, control group $AChE_{30min}$ = 15.1%, $BuChE_{30min}$ = 5.7%) is suggesting protective effects of the zeolite within the first 30 min (statistically significant difference in BuChE activities, $P < 0.05$).

At the dose of 26 µg/kg b.w. (Tab. I) the enzyme activities were higher in the experimental group (experimental and control group $AChE_{15min}$ = 54.2% and 48.9%; $AChE_{90min}$ = 9.5% and 6.9 %; $AChE_{24hr}$ = 9.4% and 4.4%, $BuChE_{24hr}$ = 10.7% and 5%; $AChE_{48hr}$ = 24.1% and 2,7%; $BuChE_{48hr}$ = 36.7% and 25.4%, respectively). In the control group 3 animals died after 6 hr, one sheep died after 7 days. In the experimental group 2 sheep died after 6 hr, one after 48 hr. One experimental sheep survived with activities of AChE 61.80% and BuChE 99.70% on 21st day (Tab. I).

At the dose of 21 µg/kg b.w. all animals survived except one control sheep. In the experimental animals treated with zeolite the AChE activities were significantly higher after 30 and 60 min (experimental group $AChE_{30min}$ = 56.2%; $AChE_{60min}$ = 38.1%; control group 30.8% and 15.3%, resp.; $P < 0.05$ and $P < 0.01$). Activities of BuChE in the experimental group were significantly ($P < 0.05$) higher after 30, 60, and 90 min of the experiment (Tab. II).

In the second group of experiment, after administration of the organophosphate mixed with zeolite all animals died except one experimental sheep. Decrease in cholinesterase activities was smaller in the experimental group compared with the controls (experimental group $AChE_{15min}$ = 56.6%, $AChE_{30min}$ = 22.6%, $AChE_{60min}$ = 7.0%, $AChE_{90min}$ = 6.5%; control group $AChE_{15min}$ = 49.5%, $AChE_{30min}$ = 15.1%, $AChE_{60min}$ = 4.3%, $AChE_{90min}$ = 4.6%). In the sheep that survived the experiment, the cholinesterase activities on 21st day were almost the same as at the beginning of the experiment ($AChE_{21d}$ = 104%, $BuChE_{21d}$ = 89,7%) (Tab. III).

In the third group of experiments with the use of Norit A and organophosphate at the dose of 33 µg/kg b.w. all animals survived with significantly lower inhibition of cholinesterases. In the experimental group AChE activity 88.40% after 60 min was recorded compared with 4.30% in the control group ($P < 0.01$; Fig. 1). Similar activities were determined also for BuChE (70.70 and 13.00%, resp., $P < 0.01$). The control animals died.

At the dose of 66 µg/kg b.w. of organophosphate the control sheep died after 4 hr with a significant decrease in both cholinesterases. In the experimental group smaller inhibition of cholinesterases was recorded with

I. Average values of AChE and BuChE activities (μmol/l) in sheep blood after administration of 26 μg of the organophosphate per kg b.w. (experimental group – 2 g of zeolite/kg b.w.)

Time	AChE control group (4 sheep)			AChE experimental group (4 sheep)			BuChE control group (4 sheep)			BuChE experimental group (4 sheep)		
	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%
min 0	92.94	±2.36	100.0	93.51	±3.41	100.0	6.22	±0.13	100.0	6.10	±0.52	100.0
15	45.45	±2.80	48.9	50.70	±9.48	54.2	2.94	±0.21	47.3	2.94	±0.46	48.2
30	27.23	±3.34	29.3	30.06	±5.83	32.1	1.43	±0.29	23.0	1.56	±0.20	25.6
60	11.55	±4.58	12.4	10.44	±3.31	11.2	0.73	±0.51	11.7	0.35	±0.23	5.7
90	6.45	±1.43	6.9	8.85	±2.04	9.5	0.49	±0.16	7.9	0.57	±0.14	9.3
120	2.88	±1.65	3.1	4.30	±2.03	4.8	0.50	±0.11	8.0	0.33	±0.01	5.4
hr 4	5.50	±0.13	6.0	3.81	±0.73	4.1	0.53	±0.05	8.5	0.39	±0.42	6.4
6	5.67	±1.08	6.1	4.37	±1.43	4.7	0.27	±0.11	4.3	0.32	±0.11	5.2
24	4.08		4.4	8.75	±4.36	9.4	0.31		5.0	0.65		10.7
48	2.48		2.7	22.50	±1.26	24.1	1.58		25.4	2.24		36.7
72	3.11		3.3	23.22		24.8	2.48		39.9	3.02		49.5
day 7	29.64		31.9	27.48		29.4	4.18		67.2	4.39		72.0
14				43.44		46.5				5.99		98.2
21				57.80		61.8				6.08		99.7
	3 sheep died after 6 hr, and 1 after 7 days			2 sheep died after 6 hr, and 1 after 48 hr			3 sheep died after 6 hr, and 1 after 7 days			2 sheep died after 6 hr, and 1 after 48 hr		

AChE – acetylcholinesterase; BuChE – butyrylcholinesterase

II. Average values of AChE and BuChE activities (μmol/l) in sheep blood after administration of 21 μg of the organophosphate per kg b.w. (experimental group – 2 g of zeolite/kg b.w.)

Time	AChE control group (4 sheep)			AChE experimental group (4 sheep)			BuChE control group (4 sheep)			BuChE experimental group (4 sheep)		
	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%
min 0	99.98	±1.55	100.0	96.60	±4.62	100.0	7.67	±0.76	100.0	7.42	±1.64	100.0
15	70.75	±5.01	70.6	70.30	±5.47	72.8	5.38	±0.83	76.0	6.46	±1.79	87.1
30	30.77	±9.30	30.8	54.31	±8.63	56.2*	2.43	±0.53	31.7	5.18	±2.13	69.8*
60	15.28	±4.59	15.3	36.78	±6.92	38.1**	1.14	±0.29	14.9	3.71	±2.00	50.0*
90	14.94	±6.84	14.9	16.11	±3.23	16.1	0.64	±0.17	8.3	2.80	±1.57	37.7*
120	6.36	±2.20	6.4	16.04	±4.47	16.6	0.91	±0.20	11.9	2.24	±1.36	30.2
hr 4	4.12	±1.46	4.1	7.92	±2.86	8.2	0.43	±0.11	5.6	1.24	±0.70	16.7
6	5.41	±1.17	5.4	5.53	±2.22	5.7	0.66	±0.14	8.6	1.17	±0.61	15.8
24	22.35	±2.49	22.4	13.90	±3.87	14.4	1.73	±0.16	22.6	2.40	±1.47	32.3
48	20.00	±6.06	20.0	19.13	±3.70	19.8	3.33	±0.66	43.4	4.36	±1.43	58.8
72	33.56	±0.78	33.6	32.21	±2.87	33.3	4.39	±0.94	57.2	5.00	±1.70	67.4
day 7	41.04	±1.38	41.0	43.86	±9.18	45.4	5.32	±0.53	69.4	8.22	±4.13	110.8
14	52.26	±2.55	52.3	57.66	±3.83	59.7	6.09	±0.29	79.4	8.82	±3.90	118.9
21	56.64	±0.46	56.7	66.24	±7.06	68.6	5.01	±2.05	65.3	9.07	±3.47	122.2
	1 sheep died after 6 hr						1 sheep died after 6 hr					

AChE – acetylcholinesterase; BuChE – butyrylcholinesterase; ** $P < 0.01$, * $P < 0.05$

the lowest activity of AChE after 4 hr (43.50% of the initial activity, Fig. 2), and BuChE after 24 hr (39.40%). The experimental animals survived with continuous increase in cholinesterase activities. After 21 days, the activities near the initial values were observed (AChE = 92.9%, BuChE = 91.3%).

III. Average values of AChE and BuChE activities (μmol/l) in sheep blood after administration of 33 μg of the organophosphate per kg b.w. (experimental group – 20 g of zeolite/animal)

Time	AChE control group (2 sheep)			AChE experimental group (4 sheep)			BuChE control group (2 sheep)			BuChE experimental group (4 sheep)		
	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%	$\bar{x}$	s	%
min 0	96.50	±4.80	100.0	94.68	±4.49	100.0	4.91	±0.08	100.0	7.75	±0.13	100.0
15	47.75	±0.09	49.5	53.61	±10.94	56.6	2.42	±0.04	49.3	3.97	±0.93	51.2
30	14.57	±11.62	15.1	21.39	±5.92	22.6	0.28	±0.08	5.7	1.58	±0.41	20.4*
60	4.18	±1.86	4.3	6.63	±1.63	7.0	0.64	±0.13	13.0	0.50	±0.12	6.5
90	4.42	±0.97	4.6	6.18	±0.70	6.5	0.36	±0.13	7.3	0.45	±0.14	5.8
120	3.73	±0.31	3.9	3.75	±1.02	4.0	0.56	±0.04	11.4	0.60	±0.06	7.7
hr 4	3.88	±0.44	4.0	1.75	±0.23	1.9	0.20	±0.15	4.1	0.20	±0.06	2.6
6	4.71		4.9	2.00	±0.74	2.1	0.20		4.1	0.33	±0.02	4.3
24				9.36	±0.30	9.9				0.93	±0.03	12.3
48				21.84	±0.45	23.1				2.09	±0.03	27.0
72				31.92		33.7				1.88		24.3
day 7				36.60		38.7				4.00		51.6
14				64.30		67.9				5.38		69.4
21				98.50		104.0				6.95		89.7
	2 sheep died after 4 and 6 hr			3 sheep died after 4, 6, and 10 hr			2 sheep died after 4 and 6 hr			3 sheep died after 4, 6, and 10 hr		

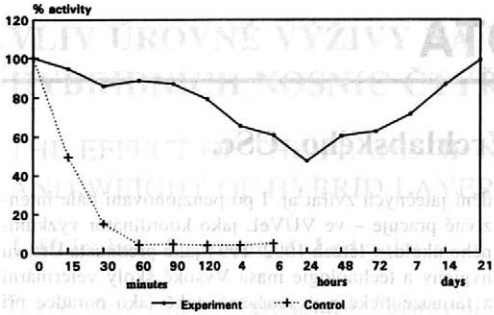
AChE – acetylcholinesterase; BuChE – butyrylcholinesterase; * $P < 0.05$

After administration of the organophosphate at the dose of 131 μg/kg b.w. the control animal died within 60 min with marked decrease in cholinesterase activities. The experimental animals treated with Norit A survived. The lowest activities of AChE (17.80%) were observed 24 hr, and BuChE (14.20%) 6 hr after administration of Norit A with the organophosphate.

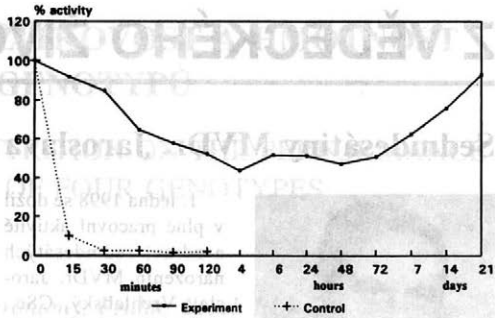
DISCUSSION

Regarding increasing tendency in intoxications of farm animals it is urgent to deal with the use of sorbents in therapy and prevention. In the literature available, there are reports on the use of active charcoal that is able to absorb pesticides, bacterial toxins, mycotoxins, phytotoxins, and zootoxins (Miller, 1983; Buck, Bratich, 1986). In the recent past, several experiments were done with sorption media binding toxic substances in animals and humans (K-, Ag-, H-montmorillonite, bentonite, zeolite). Sorption and ion-exchanging capabilities of zeolites and their possible use are studied in many areas of agriculture, animal production, water management, chemistry, and environmental protection (Mumpton, 1984; Bartko et al., 1983; Vrzgula et al., 1985; Kováč et al., 1988; Pond, 1993). Ništiar et al. (1984) administered zeolite to rats at the dose of 1 g/kg b.w. orally immediately before intoxication with dichlorvos. They reported protective effect of zeolite by increasing the survival of animals for 12 to 24 hours. This protective effect provided time to specific therapeutic measures (administration of atropine, oximes, etc.) (Mojžiš et al., 1986, 1994). The results presented in our work are not so significant as the results presented by the authors mentioned above. On the other hand, at lower doses of the organophosphate we observed the lower percentage of cholinesterase inhibition as well as survival of some animals in the experimental groups. From the practical point of view it would be advisable to use the zeolite for supplementation of diet suspicious of organophosphate contamination. However, the use of active charcoal showed excellent protective effects even in higher doses of the organophosphate.

The results obtained after oral administration of zeolite 20 min before organophosphate administration, as well as after simultaneous administration of the zeolite and organophosphate indicate partial protective effects against lower doses of the poison (33, 26, and 21 μg/kg b.w.) in sheep. The protective effect was manifested by a smaller decrease in cholinesterase activities, and survival of some experimental animals treated with zeolite. Administration of active charcoal – Norit A – resulted in the survival of all experimental animals and significantly lower inhibition of both erythrocytary acetylcholinesterase and plasmatic butyrylcholinesterase after organophosphate intoxication.



1. Activities of AChE after administration of 20 g of Norit A *pro toto* and 33 μg of the organophosphate/kg b.w.



2. Activities of AChE after administration of 20 g of Norit A *pro toto* and 66 μg of the organophosphate/kg b.w.

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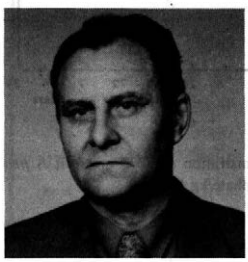
Z VĚDECKÉHO ŽIVOTA

Sedmdesátiny MVDr. Jaroslava Vrchlabského, CSc.



1. ledna 1998 se dožil v plné pracovní aktivitě a zdraví sedmdesátých narozenin MVDr. Jaroslav Vrchlabský, CSc., přední vědecký pracovník a uznávaný odborník v oblasti hygieny a technologie masa a masných výrobků.

Jeho rodištěm je Tišnov u Brna, kde také studoval na reálném gymnáziu. Po ukončení tohoto studia se zapsal na Vysokou školu veterinární v Brně, kterou absolvoval v roce 1952. Jeho další profesní vzdělávání zahrnuje atestační zkoušku pro výkon funkce okresního veterinárního lékaře, postgraduální studium tropického zemědělství a lesnictví na VŠZ v Praze v letech 1963–1964 a obhajobu kandidátské disertační práce v oboru veterinární hygieny.

Po ukončení vysoké školy pracoval postupně jako vedoucí krajské laboratoře masného průmyslu ve Vamberku a Hradci Králové, v letech 1956–1960 jako mikrobiolog na SVÚ v Jihlavě, pak jako obvodní veterinář, okresní hygienik a posléze jako vedoucí okresního veterinárního zařízení v Havlíčkově Brodě. Takto všestranně odborně vybaven, s precizními výsledky v práci a s pověstí zodpovědného a úspěšného vedoucího pracovníka přešel v roce 1965 do Výzkumného ústavu masného průmyslu v Brně. Nesporně významným impulzem pro jeho vědecko-výzkumnou činnost byl jednoroční pobyt ve Spolkovém ústavu pro výzkum masa v Kulmbachu (SRN), kde působil jako výzkumný pracovník v mikrobiologickém oddělení, pověřený řešením problematiky aktivity vody v surovinách a výrobcích masného průmyslu.

Po dvaceti letech intenzivní a velmi úspěšné vědecké práce ve VÚMP přešel v roce 1985 do Vývojového a racionalizačního střediska masného průmyslu do Prahy, kde byly jeho zkušenosti a výsledky výzkumné činnosti bezprostředně využívány při centrálním řízení oboru ve státě. Neméně úspěšné bylo jeho působení v Kroměříži (1987–1991), kde založil a vybudoval vývojové a racionalizační středisko, které brzy po založení produkovalo významné výsledky ve výzkumu cizorodých látek v mase a masných výrobcích, ve vývoji startovacích kultur, v ověřování metod jakostního třídění jatečných zvířat aj. I po penzionování dále intenzivně pracuje – ve VÚVeL jako koordinátor výzkumného úkolu, v letech 1992–1994 jako přednosta Ústavu hygieny a technologie masa Vysoké školy veterinární a farmaceutické a v současné době jako poradce při tvorbě celostátních koncepcí a legislativy a také v oblasti podnikatelské.

Vědecká práce jubilanta vycházela ze širších souvislostí a vztahů mezi zemědělskou prvovýrobou, masným průmyslem a požadavky spotřebitelské veřejnosti. Rovněž široká spolupráce s výzkumnými ústavy, vysokými školami i s podniky masného průmyslu a nesporně i jeho organizační předpoklady a schopnost dovést práci do konkrétních a účelných závěrů zesilovaly efektivnost jeho vědecko-výzkumné činnosti. Pro její velký rozsah ji nelze popsat v jednotlivostech, nýbrž jen v hlavních věcných úsecích; zahrnují jatečnou hodnotu a kvalitu masa u skotu, prasat, ovcí a hříbat, analýzu kvantitativních a kvalitativních ztrát u jatečných zvířat při přepravě a předporážkovém ošetření, zásady jakostního třídění zvířat při nákupu v živém a v mase, využití technických surovin (především krve) ke krmným účelům, vliv netradičních krmiv, aditiv a stimulátorů růstu na kvalitu masa u skotu a prasat. Výsledky byly zveřejněny ve více než 130 vědeckých a odborných publikacích v našich i zahraničních časopisech, devíti knižních titulech a ve sbornících ze 60 konferencí a sympozií. Také byly bezprostředně použity v četných školeních a přednáškách při postgraduální výuce a dále ve čtyřech případech patentního řízení a přihlášek vynálezů. Významně byly uplatněny při tvorbě norem a v návrzích opatření k objektivizaci nákupu jatečných zvířat směřujících k unifikaci se systémy EU. Neobyčejnou píli a pracovní aktivitu jubilanta dokresluje jeho dlouhodobá spolupráce se zahraničními odbornými časopisy, kdy např. ve zpravodaji výzkumného ústavu v Kulmbachu publikoval kolem 150 a pro časopis Fleischwirtschaft napsal na 600 sdělení a abstraktů z naší i zahraniční vědecké a odborné literatury.

Celoživotní práce MVDr. Jaroslava Vrchlabského, CSc., je hodnocena s velkým uznáním a respektem v široké odborné veřejnosti. Staví jej mezi významné vědecké osobnosti u nás i v mezinárodních dimenzích. Jeho přátelé a spolupracovníci mu přejí do dalších let neutuchající elán a úspěchy v práci, pevné zdraví a spokojenost v osobním životě.

Prof. Ing. Zdeněk Župka, DrSc., emeritní profesor
Mendelovy zemědělské a lesnické univerzity v Brně

VLIV ÚROVNĚ VÝŽIVY NA UŽITKOVOST A HMOTNOST HYBRIDNÍCH NOSNIC ČTYŘ GENOTYPŮ

THE EFFECT OF THE PLANE OF NUTRITION ON THE PERFORMANCE AND WEIGHT OF HYBRID LAYERS OF FOUR GENOTYPES

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ABSTRACT: Performance (egg production, egg weight), feed consumption and body weight were studied in four gene combinations of laying hybrids of hens (102 – RIR x RIW, 201 – LB x RIR, 523 – slowly feathering RIR, 823 – quickly feathering RIR) from 155th to 407th day of layer age. Three feed mixtures with different nutrient levels were used. The highest laying intensity was observed in most genotypes receiving IT diet, while genotype 823 was an exception, as it achieved the significantly highest laying intensity on diet P2. Feeding diet P2 with a crude protein content of 14.5% resulted in the higher laying intensity than feeding diet P1 with a crude protein content of 16.3%. The content of thio amino acids was approximately identical in both diets, but diet P2 had a higher proportion of lysine by 1.1 g/kg. The highest egg content was determined in hens receiving diet P2, and also in relation to the genotype. Every genotype responded to changes in the nutrient level of feed mixtures by different performance and body weight.

laying hen; performance of laying hybrids; nutrient level; body weight

ABSTRAKT: U čtyř genových kombinací nosných hybridů slepic (102 – RIR x RIW, 201 – LB x RIR, 523 – RIR pomalu opeřující, 823 – RIR rychle opeřující) jsme od 155. do 407. dne věku nosnic sledovali užitkovost (snáška, hmotnost vajec), spotřebu krmiva a tělesnou hmotnost. Ke krmení jsme použili tři krmné směsi s rozdílnou nutriční úrovní. Nejvyšší intenzity snášky bylo dosaženo u většiny genotypů při použití směsi IT, výjimkou byl genotyp 823, který dosáhl průkazně nejvyšší intenzity snášky na krmné směsi P2. Při zkrmování směsi P2 o obsahu 14,5 % N-látek bylo dosaženo vyšší intenzity snášky než u směsi P1 o obsahu 16,3 % N látek. Obsah sirných aminokyselin byl v obou směsích přibližně stejný, avšak ve směsi P2 byl vyšší podíl lyzinu o 1,1 g/kg. Nejvyšší vaječná hmotnost byla zjištěna u slepic krmených směsí P2, a to i v závislosti na genotypu. Každý genotyp reagoval na změnu v nutriční úrovni krmné směsi rozdílnou užitkovostí i tělesnou hmotností.

nosnice; užitkovost nosných hybridů; nutriční úroveň; tělesná hmotnost

ÚVOD

Výsledky mnoha pokusů prokázaly, že jednotliví, geneticky přesně definovaní hybridi drůbeže mají pro optimální užitkovost odlišné požadavky na hlavní živiny, ME i spektrum aminokyselin. Z tohoto hlediska musíme přistupovat i ke všem normám potřeby pouze orientačně, ať již je to ČSN 46 7070, či NRC, AEC nebo ARC. O nejednotnosti potřeby aminových kyselin pro nosnice svědčí řada prací (Al Bustany, Elwinger, 1986, 1987; Harms, 1986; Keshavarz, 1986; Kočí, 1987; Kočí et al., 1984; Tiller, 1992 aj.).

Růstovou křivku kuřic a nosnic, ale i snášku výrazně ovlivňuje především obsah a spektrum bílkovin v krmné směsi (Tiller, 1992). V našich podmínkách se doposud exaktně neprověřily všechny možnosti pro snížení obsahu N-látek v krmné směsi. Podnětné jsou v tomto směru experimentální závěry pokusů, ve kterých byl snížen obsah N-látek až na 11 % z obvyklých 17 % (Schutte et al., 1992; Harms, 1986 aj.).

Kromě spektra a množství aminokyselin u krmiv ovlivňuje snášku i řada dalších faktorů, které působí souběžně. Aminokyselinová potřeba může záviset jak na výši ME, tak i na teplotě prostředí či přídavku biostimulátoru (Jackson et al., 1987; McDonald, 1984; Belyavin, 1987; Holoubek et al., 1994; Holoubek, 1995; Koudela et al., 1994a, b).

Na výrazný vliv genotypu na užitkovost slepic upozornila řada autorů. Holoubek (1995) uvádí, že slepice RIR – pomalu opeřující vykazují nižší intenzitu produkce při nástupu snášky oproti ostatním typům nosnic, způsobenou především pozdějším pohlavním dospíváním.

Při sledování závislosti hmotnosti vajec na genotypu a nutriční úrovni zjistili Holoubek et al. (1994), že na hmotnost vajec působí primárně genotyp a teprve poté nutriční úroveň. Na obdobnou závislost upozorňuje i Avdonin (1986 – cit. Skřivan, 1990) s tím, že hnědovaječné nosnice mají v prvních třech měsících snášky vyšší hmotnost vajec v porovnání s nosnicemi bělovaječnými. Rozdíly v užitkovosti mezi bělovaječ-

nými a hnědovaječnými nosnicemi však pokládá za nevýznamné. Shalev (1995) porovnával užitkovost, tělesnou hmotnost, spotřebu krmiva a další parametry za posledních třináct let u nejrozšířenějších nosných užitkových hybridů v Evropě i USA na velkých populacích od 141 do 500 dnů věku. Během sledovaných let došlo u hnědovaječných i bělovaječných užitkových hybridů k snížení úhynů v dospělosti, snížení věku při 50% produkci, zvýšení snášky i hmotnosti vajec, avšak k poklesu spotřeby krmiva jak na jedno vejce, tak na 1 kg vaječné hmoty. Zatímco tělesná hmotnost naskladněných kuřic i vyskladňovaných slepic bělovaječných užitkových hybridů dosahuje v podstatě stabilních hodnot, u hnědovaječných užitkových hybridů došlo k jejímu poklesu. Zároveň je nutné konstatovat, že užitkové a ekonomické parametry obou skupin jsou v současné době vyrovnané.

MATERIÁL A METODY

V našich sledováních jsme použili čtyři různé, geneticky definované nosné hybridy z produkce Šlechtění a rozmnožování drůbeže Dobřenice a zjišťovali jsme jejich užitkovost na třech rozdílných krmných směsích.

K pokusu jsme použili tyto hybridy:

1) D 102 (kohout RIR x slepice RIW)
2) D 201 (kohout LB x slepice RIR)
3) D 523 (kohout RIR x slepice RIR – pomalu opeřující)
4) D 823 (kohout RIR x slepice RIR – rychle opeřující).

Slepice byly chovány v třípodlažních klecích vyrobených v STS Hostivice.

Pokusné nosnice jsme rozmístili do všech baterií v hale pouze ve střední etáži, abychom eliminovali rozdílné vlivy prostředí a ustájení v hale. Složení a rozbor použitých krmných směsí je uveden v tab. I a II.

Užitkovost pokusných nosnic jsme z technických a provozních důvodů sledovali od 155. dne věku, tj. od počátku snášky, do věku 404 dnů, tj. 9 období po 28 dnech.

Předmětem sledování byla intenzita snášky, hmotnost vajec zjišťovaná vážením všech snesených vajec vždy v posledních dvou dnech sledovaného období, spotřeba krmiva a tělesná hmotnost. Pro obšírnost sledování uvádíme až finální hodnoty.

VÝSLEDKY A DISKUSE

I když jsou obecně známy normy pro jednotlivé druhy a kategorie drůbeže, ukazuje se, že jejich platnost je pouze obecná a každý genotyp má své specifické požadavky na výživu, a na stejnou změnu ve složení krmné směsi reaguje rozdílným způsobem.

Výsledky sledování intenzity snášky v závislosti na genotypu a nutriční úrovni vykázaly značné rozdíly, které jsou dány především rozdílnými požadavky jednotlivých genotypů na množství a spektrum aminokyselin ve vazbě s metabolizovatelnou energií (Skřivan, 1990; Výmola, Kosař, 1993 aj.). Nejvyšší intenzity snášky bylo dosaženo u většiny genotypů na směsi IT, výjimkou byl genotyp 823, který dosáhl průkazně nejvyšší intenzity snášky na krmné směsi P2. Obsah N-látek v krmné směsi nebyl pro intenzitu snášky rozhodující.

I. Složení krmných směsí v % – Formulation of feed mixtures in %

Komponent[1]	IT	P1	P2
Rybí moučka[2]	1	–	1
Masokostní moučka[3]	2	–	–
Kvasnice[4]	–	2	2
Sójový extrahovaný šrot[5]	16	15,5	15,5
Kukuřice[6]	40	54,8	22
Pšenice[7]	25,96	16	47,8
Pšeničné otruby[8]	5	–	–
Sušená vojtěška[9]	–	1,95	2
Aminovitan SK Super	0,5	0,5	0,5
DL-MET	0,04	0,05	–
Krmná sůl[10]	0,2	0,2	0,2
Dikalciumfosfát[11]	1,5	1	1
Mletý vápenec[12]	7,8	8	8

[1]ingredient, [2]fish meal, [3]meat-bone meal, [4]yeast, [5]soybean meal, [6]corn, [7]wheat, [8]wheat bran, [9]dried alfalfa, [10]feeding salt, [11]dicalcium phosphate, [12]ground limestone

II. Chemická analýza krmných směsí – Chemical analysis of feed mixtures

	Pokusná směs[11]		
	IT	P1	P2
N-látky[1] (analýzou[2]) g.kg^{-1}	185,00	158,5	147,40
	185,00	161,8	149,30
	178,00	170,0	141,00
	182,00	161,0	142,00
Průměr[3]	182,50	162,8	144,90
ME (analýzou[2]) MJ.kg^{-1}	10,80	11,40	11,20
	10,90	11,40	10,90
	10,90	11,50	11,00
Průměr	10,87	11,40	11,03
Hodnoty vypočtené[4] (g.kg^{-1})			
Lyzin[5]	9,50	7,30	8,40
Metionin[6]	3,80	3,11	2,95
Cystin[7]	3,70	2,77	2,83
Metionin + cystin	7,50	5,88	5,78
Vápník[8]	34,50	31,00	31,80
Fosfor[9]	7,50	7,00	7,00
Vláknina[10]	43,20	42,30	44,40

[1]crude protein, [2]analytically, [3]average, [4]calculated values, [5]lysine, [6]methionine, [7]cystine, [8]calcium, [9]phosphorus, [10]fiber, [11]experimental mixture

III. Průměrná intenzita snášky za období od 155. do 407. dne věku v závislosti na krmné směsi a genotypu – Average laying intensity in the period from day 155 to day 407 of layer age in relation to feed mixture and genotype

Směs[1]	Kombinace[2]	$\bar{x} \pm s_{\bar{x}}$	s	v	Diference průměrů[3]	
					IT	P2
P1	102	76,6 ± 1,573	23,275	30,40	$-4,8^{+}$	$-4,5^{+}$
IT	102	81,4 ± 1,136	17,007	20,90	x	0,3
P2	102	81,1 ± 1,184	17,719	21,86	x	x
P1	201	78,4 ± 1,336	20,034	25,54	−3,6	−0,8
IT	201	82,0 ± 1,312	19,644	23,96	x	2,8
P2	201	79,2 ± 1,376	20,598	26,01	x	x
P1	523	76,7 ± 1,463	21,703	28,29	$-6,3^{++}$	$-5,6^{++}$
IT	523	83,0 ± 1,082	16,191	19,50	x	0,7
P2	523	82,3 ± 1,232	18,266	22,20	x	x
P1	823	73,2 ± 2,193	32,234	44,01	−0,3	$-6,4^{+}$
IT	823	76,2 ± 2,194	32,823	43,09	x	−3,4
P2	823	79,6 ± 1,612	24,067	30,23	x	x

[1]feed mixture, [2]combination, [3]difference in means

IV. Průměrná hmotnost vajec za období od 155. do 407. dne věku v závislosti na krmné směsi a genotypu – Average egg weight in the period from day 155 to day 407 of layer age in relation to feed mixture and genotype

Směs[1]	Kombinace[2]	$\bar{x} \pm s_{\bar{x}}$	s	v	Diference průměrů[3]	
					IT	P2
P1	102	64,6 ± 0,128	5,947	9,21	–	$-1,5^{+}$
IT	102	64,6 ± 0,116	6,106	9,45	x	$-1,5^{++}$
P2	102	66,1 ± 0,097	5,176	7,83	x	x
P1	201	62,4 ± 0,105	5,330	8,55	0,3	−0,7
IT	201	62,1 ± 0,088	4,856	7,82	x	−1,0
P2	201	63,1 ± 0,086	4,546	7,21	x	x
P1	523	61,8 ± 0,105	5,553	8,99	−0,9	−0,2
IT	523	62,7 ± 0,090	4,802	7,66	x	0,7
P2	523	62,0 ± 0,085	4,636	7,47	x	x
P1	823	61,8 ± 0,101	5,236	8,47	0,2	–
IT	823	61,6 ± 0,107	5,709	9,26	x	−0,2
P2	823	61,8 ± 0,087	4,661	7,55	x	x

For 1–3 see Tab. III

Použitím chudší krmné směsi P2 o obsahu cca 14,5 % N látek bylo dosaženo vyšší intenzity snášky než při použití směsi P1 o obsahu 16,3 % N-látek. Významnou roli zde patrně sehrálo zastoupení a spektrum aminokyselin. Metionin a cystin jsou u těchto směsí prakticky rovnoměrně zastoupeny, avšak obsah lyzinu je u směsi P2 o 1,1 g/kg vyšší (podrobnější závěry viz tab. III). Skřivan (1990) uvádí, že potřeba N-látek pro dosažení vysoké hmotnosti vajec je vyšší než pro dosažení vysoké snášky. V našem případě naopak nižší obsah N-látek obsažený ve směsi P2 umožňoval nejvyšší vaječnou hmotnost, a to i v závislosti na genotypu. Ukazuje se, že vysoký obsah lyzinu (9,5 g/kg) je k obsahu metioninu a cystinu (7,5 g/kg) nevhodný ve směsi IT a nepůsobí příznivě na hmotnost vajec. Podrobnější údaje jsou uvedeny v tab. IV. Směs IT však vykázala nejpříznivější ukazatele ve spotřebě krmiva jak na 1 krmný den, tak na 1 vejce a 1 kg vaječné hmoty u všech sledovaných genotypů. Směs P2, která je z nutričního hlediska ze všech použitých krmných směsí nejchudší, vykazovala ekonomickou použitelnost především ve vztahu konverze u všech genotypů (tab. V).

Indikátorem vhodnosti použité krmné směsi pro daný genotyp může být kromě vykázané užitkovosti i tělesná hmotnost při ukončení snášky. Hodnoty tělesné hmotnosti použitých originálních českých nosných hybridů, jak kuřic, tak i slepic, jsou nižší, než je ve světě běžné (Shalev, 1995), ale jsou v souladu s údaji, jež uvádí Závěrečná zpráva IV. mezinárodního snáškového testu finálních hybridů nosného typu slepic (Anonym, 1996) – tab. VI a VII.

V. Průměrná spotřeba krmiva a vaječná hmota za období od 155. do 407. dne věku v závislosti na krmné směsi a genotypu – Average feed consumption and egg content in the period from day 155 to day 407 of layer age in relation to feed mixture and genotype

Směs[1]	Kombinace[2]	Snáška celkem[3]	Průměrná hmotnost vajec[4] (g)	Vaječná hmota – průměrný stav[5] (kg)	Spotřeba krmiva na[6]		
					1 KD[7] (g)	1 vejce[8] (g)	1 kg vaječné hmoty[9] (g)
P1	102	38 023	64,6	12,519	121	158	2,428
IT	102	44 583	64,6	13,290	118	145	2,242
P2	102	45 244	66,1	13,537	123	152	2,288
P1	201	43 164	62,4	12,355	119	152	2,432
IT	201	45 481	62,1	12,851	118	143	2,305
P2	201	43 230	63,1	12,616	118	149	2,249
P1	523	42 035	61,8	11,967	116	151	2,435
IT	523	45 892	62,7	13,152	117	141	2,230
P2	523	45 151	62,0	12,887	116	141	2,261
P1	823	39 678	61,8	11,439	114	156	2,510
IT	823	42 423	61,6	11,856	114	150	2,424
P2	823	44 052	61,8	12,413	116	146	2,351

[1]feed mixture, [2]combination, [3]egg production in total, [4]average egg weight, [5]egg content (average state), [6]feed consumption per, [7]feeding day, [8]egg, [9]1 kg of egg content

VI. Průměrná hmotnost naskladňovaných kuřic použitých k pokusu ve věku 17 týdnů – Average weight of pullets included in a laying scheme, and used for the trial at the age of 17 weeks

Kombinace[1]	$\bar{x} \pm s_{\bar{x}}$	s	v
102	1,33 ± 0,008	0,116	8,90
201	1,22 ± 0,011	0,110	8,99
523	1,26 ± 0,012	0,116	9,02
823	1,27 ± 0,017	0,120	9,44

[1]combination

VII. Tělesná hmotnost slepic v 60. týdnu věku v závislosti na krmné směsi a genotypu – Body weight of hens in the 60th week of age in relation to feed mixture and genotype

Směs[1]	Kombinace[2]	$\bar{x} \pm s_{\bar{x}}$	s	v	Diference průměrů[3]	
					IT	P2
P1	102	1,89 ± 0,035	0,256	13,53	–0,04	$-0,25^{++}$
IT	102	1,93 ± 0,030	0,236	12,21	x	$-0,21^{++}$
P2	102	2,14 ± 0,023	0,191	8,94	x	x
P1	201	1,78 ± 0,022	0,172	9,64	$-0,08^{+}$	$-0,08^{+}$
IT	201	1,86 ± 0,028	0,227	12,18	x	–
P2	201	1,86 ± 0,024	0,193	10,36	x	x
P1	523	1,85 ± 0,025	0,209	10,30	$-0,13^{++}$	–0,03
IT	523	1,98 ± 0,027	0,213	10,76	x	$0,10^{++}$
P2	523	1,88 ± 0,021	0,171	9,117	x	x
P1	823	1,81 ± 0,016	0,131	7,25	$-0,08^{++}$	$-0,06^{+}$
IT	823	1,89 ± 0,026	0,210	11,13	x	0,02
P2	823	1,87 ± 0,024	0,201	10,76	x	x

For 1–3 see Tab. III

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ANONYM: IV. mezinárodní snáškový test finálních hybridů nosného typu slepic. Závěrečná zpráva 1995–1996, Ústražice, říjen 1996. 22 s.

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POROVNANIE PRODUKČNÉHO ÚČINKU SKRMOVANIA MÚČOK Z MUŠÍCH LARIEV A KUKIEL U DOSPELÝCH JAPONSKÝCH PREPELÍC*

COMPARISON OF PRODUCTION EFFECTS OF FEEDING MEALS FROM FLY LARVAE AND PUPAE TO ADULT JAPANESE QUAIL

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ABSTRACT: Two trials were conducted on adult Japanese quail to examine the feeding of different portions of meals made from fly larvae and pupae as aliquot replacements of fish meal in isoprotein and isoenergetic feed mixtures. A quarter and a half of the fish meal amount were replaced by meals from fly larvae and pupae in the first trial while a third and two thirds were replaced in the second trial (Tab. I). Both trials lasted 15 weeks (trial 1 from 7th to 21st week, trial 2 from 37th to 51st week of age). One group comprised 32 quails in the first trial, and 28 quails in the second trial. Japanese quail were housed in individual laying cages. Loose mixtures were offered *ad libitum*. The replacement of a quarter and a half of the fish meal amount by meals from fly larvae and pupae did not have any greater effects on egg production in trial 1 ($P > 0.05$), Tab. V. The half replacement by a fly pupae meal reduced the average egg weight by 4.9% ($P < 0.01$), which was reflected in a decrease in the total production of egg contents by 5.6% ($P < 0.05$). Egg analysis (Tab. VI) revealed a significant decrease in their weight when the portion of fly components was half ($P < 0.05$), particularly due to the lower albumen weight ($P < 0.05$). The feeding of fly larva meal also reduced egg-shell weight (group III) and increased the intensity of yolk color in all experimental groups ($P < 0.01$). The absolute feed consumption did not change substantially. The worse feed conversion by 2.6 to 6.6% in all experimental groups could be expressed only numerically ($P > 0.05$). The differences in Japanese quail live weight and mortality were not significant either. The differences in all indicators of performance (Tab. VII) were insignificant ($P > 0.05$) in trial 2. The trend of worse feed conversion in experimental groups by 3.1 to 9.3% was also observed ($P > 0.05$). Egg quality showed a difference in reduced weight and in reduced yolk proportion ($P < 0.05$). It can be stated from the above results that meals made from fly larvae and pupae can be fed as replacements of fish meal in isoprotein and isoenergetic feed mixtures for adult Japanese quail, making up two thirds of the fish meal amount.

feeding; Japanese quail; meals from fly larvae and pupae

ABSTRAKT: V dvoch pokusoch na dospelých japonských prepeliciach sa skúmala možnosť čiastočnej náhrady (štvrtinová až dvojtretinová) rybacej múčky múčkami z muších lariev a kukiel v izoproteinových a izoenergetických kŕmnych zmesiach. Znáška vajec sa signifikantne nezmenila ($P > 0,05$). Priemerná hmotnosť vajca a vaječnej hmoty bola signifikantne znížená iba u polovičnej náhrady rybacej múčky múčkou z muších kukiel ($P < 0,01$). V spotrebe krmiva nebol rozdiel. Aj čiastočné zhoršenie konverzie krmiva u všetkých pokusných skupín (o 2,6 až 9,3 %) bolo len nesignifikantné ($P > 0,05$). Živá hmotnosť prepelíc a ich mortalita neboli ovplyvnené.

kŕmenie; japonská prepelica; múčky z muších lariev a kukiel

ÚVOD

Zaradením muchy domácej (*Musca domestica* L.) do uzavretého ekosystému za účelom spracovania exkrementov japonskej prepelice – plánovaného heterotrofného článku v tomto systéme (Boďa et al., 1991; Sabo et al., 1982), sa okrem biohumusu vyprodukujú larvy, resp. kukly, ktoré je možné recyklizáciou opäť využiť ako zdroj živočíšnych bielkovín vo výžive prepelíc (Kozánek et al., 1994; Sabo et al., 1990). Ich výživnou hodnotou za účelom skrmovania sa zaoberali viacerí autori (Teotia, Miller, 1974; Strážnická, 1984 a iní).

Skrmovaním múčky z muších lariev, ako polovičnej i celej náhrady živočíšnych bielkovinových krmív v kŕmnych zmesiach u brojlerových kurčiat, sa dosiahli

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I. Schéma pokusov – Trial layout

Skupina[1]	Pokus[2] 1			Pokus 2		
	rybacia múčka[3]	larvy[4]	kukly[5]	rybacia múčka	larvy	kukly
I. K	6,0	–	–	6,0	–	–
II. ML-1	4,5	1,5	–	4,0	2,0	–
III. ML-2	3,0	3,0	–	2,0	4,0	–
IV. MK-1	4,5	–	1,5	4,0	–	2,0
V. MK-2	3,0	–	3,0	2,0	–	4,0

[1]group, [2]trial, [3]fish meal, [4]larvae, [5]pupae

porovnateľné výsledky v ich úžitkovosti (Chrappa et al., 1990). Chrappa et al. (1996) podávali múčku z muších kukiel ako alikvotnú tretinovú, dvojtretinovú i celú náhradu rybacej múčky v kŕmnej zmesi japonským prepeliciam v období znášky. Zníženie úžitkovosti sa prejavilo až pri plnej náhrade rybacej múčky múčkou z muších kukiel.

Cieľom práce bolo zistiť a porovnať produkčný účinok skrmovania múčok vyrobených z muších lariev a kukiel ako čiastočnej náhrady za rybaciu múčku v kŕmnej zmesi dospelých japonských prepelíc na ich úžitkovosť.

MATERIÁL A METÓDA

Urobili sa dva pokusy s dospelými japonskými prepelicami, ktorým sa skrmovali rôzne podiely múčok vyrobených z muších lariev a kukiel ako náhrada za rybaciu múčku v izoproteínových a izoenergetických kŕmnych zmesiach (tab. I). Ich zloženie je uvedené v tab. II.

Na pokus 1 sa použilo 160 odchovaných prepelíc vo veku 6 týždňov (12. 3. 1996), ktoré sa na základe živej hmotnosti rozdelili rovnomerne do 5 skupín po 32 zvieratách. Kŕmili sa zmesami, v ktorých sa štvrtina a polovica rybacej múčky nahradila múčkou z muších lariev a kukiel. Zloženie kŕmnych zmesí je uvedené v tab. III.

V pokuse 2 sa použilo 140 prepelíc vo veku 36 týždňov (8. 10. 1996), ktoré sa na základe predchádzajúcej znášky rozdelili rovnomerne do 5 skupín po 28 zvieratách. Prepelice sa kŕmili zmesami, v ktorých sa tretina a dve tretiny rybacej múčky nahradili alikvotne múčkami z muších lariev a kukiel. Ich zloženie je uvedené v tab. IV.

Prepelice boli umiestnené v individuálnych znáškových klietkach. Kŕmili sa sypkými kŕmnymi zmesami *ad libitum*. Svetelný režim trval 17 hodín. Každý pokus trval 15 týždňov.

V oboch pokusoch sa sledovali tieto ukazovatele:

a) znáška vajec – individuálne dennou evidenciou;
b) hmotnosť vajec – individuálnym denným vážením;
c) kvalita vajec – analýzou 50 vajec po 10. a 15. týždni znášky (v pokuse 2 aj v 5. týždni);
d) spotreba krmiva – týždenným navažovaním;
e) živá hmotnosť – individuálnym vážením na začiatku a konci pokusu;

II. Zloženie muších lariev a kukiel (VUK Ivanka pri Dunaji) – The composition of fly larvae and pupae (VUK Ivanka pro Dunaji)

Ukazovateľ[1]	Jednotka[20]	Mušie larvy[21]	Mušie kukly[22]
Voda[2]	%	4,69	5,04
Sušina[3]	%	95,31	94,96
N-látky[4] (N x 6,25)	%	48,04	56,97
SNL[5]	%	37,85	38,72
Tuk[6]	%	21,02	15,15
ČKT	mg KOH	41	84
Popol[7]	%	10,4	8,51
Vláknina[8]	%	7,25	13,14
Aminokyseliny[9]:			
Asp	%	3,846	4,117
Thr	%	1,800	1,890
Ser	%	1,671	1,684
Glu	%	6,054	5,942
Pro	%	1,702	1,756
Gly	%	2,008	2,431
Ala	%	2,575	2,280
Val	%	2,034	2,253
Ile	%	1,713	1,837
Leu	%	4,294	4,590
Tyr	%	2,426	2,440
Phe	%	4,161	4,679
His	%	1,299	1,527
Lyz	%	2,894	3,040
Arg	%	1,697	2,003
Met	%	1,081	0,959
Cys	%	0,239	0,190
Minerálne látky[10]:			
Fosfor[11]	g/kg	13,18	12,70
Vápnik[12]	g/kg	17,56	13,46
Sodík[13]	g/kg	7,15	5,84
Draslík[14]	g/kg	18,91	14,86
Horčík[15]	g/kg	3,25	3,29
Meď[16]	mg/kg	48,8	40,66
Železo[17]	mg/kg	955,1	513,3
Mangán[18]	mg/kg	171,1	169,6
Zinok[19]	mg/kg	2 300,8	1 453,8

[1]indicator, [2]water, [3]dry matter, [4]crude protein, [5]digestible crude protein, [6]fat, [7]ash, [8]fiber, [9]amino acids, [10]minerals, [11]phosphorus, [12]calcium, [13]sodium, [14]potassium, [15]magnesium, [16]copper, [17]iron, [18]manganese, [19]zinc, [20]unit, [21]fly larvae, [22]fly pupae

III. Zloženie kŕmnych zmesí (pokus 1) – Feed mixture formulation (trial 1)

Komponent[1] v %	Skupina[22]				
	I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Rybacia múčka[2]	6,0	4,5	3,0	4,5	3,0
Mušie larvy[3]	–	1,5	3,0	–	–
Mušie kukly[4]	–	–	–	1,5	3,0
Sójový extrahovaný šrot[5]	21,0	21,5	22,0	21,0	21,5
Pšenica[6]	22,7	22,2	21,7	22,7	22,2
Kukurica[7]	40,0	40,0	40,0	40,0	40,0
Olej (slnečnicový)[8]	3,0	3,0	3,0	3,0	3,0
Soľ[9]	0,3	0,3	0,3	0,3	0,3
Dikalciumfosfát[10]	1,0	1,0	1,0	1,0	1,0
MKP-2	1,0	1,0	1,0	1,0	1,0
Kŕmny vápenec[11]	4,0	4,0	4,0	4,0	4,0
DB-NP	1,0	1,0	1,0	1,0	1,0
Spolu[12]	100,0	100,0	100,0	100,0	100,0
Obsah[13] v $g.kg^{-1}$:					
ME v $MJ.kg^{-1}$	12,03	12,02	12,00	12,03	12,02
Voda[14]	106,9	106,2	105,5	106,4	105,6
N-látky[15] (N x 6,25)	200,2	199,5	199,2	199,4	200,3
Tuk[16]	54,7	56,7	58,7	55,8	56,8
Popol[17]	96,0	95,0	94,0	94,5	93,3
Vláknina[18]	39,0	40,5	41,9	41,0	43,3
BNLV[19]	503,2	502,1	500,7	502,9	500,7
Vápnik[20]	25,1	24,5	23,9	24,4	23,8
Fosfor[21]	8,4	7,6	7,3	8,1	7,3
Lyz	11,3	10,9	10,6	10,8	10,5
Met	3,7	3,6	3,5	3,6	3,5
Cys	3,3	3,3	3,2	3,2	3,2

Doplnok biofaktorov NP: vitamíny – A 20 000 m.j., D_3 2 000 m.j., K 2 mg, E 30 mg, B_1 2 mg, B_2 7 mg, B_6 4 mg, B_{12} 0,04 mg, niacín 15 mg, biotín 0,15 mg, kyselina listová 0,50 mg, pantotenát vápenatý 12 mg, cholin-chlorid 600 mg, metionín 600 mg, kurasan 125 mg, uhličitan manganatý 20 mg

[1]ingredient, [2]fish meal, [3]fly larvae, [4]fly pupae, [5]soybean meal, [6]wheat, [7]corn, [8](sunflower) oil, [9]salt, [10]dicalcium phosphate, [11]fodder limestone, [12]total, [13]content, [14]water, [15]crude protein, [16]fat, [17]ash, [18]crude fiber, [19]nitrogen-free extract, [20]calcium, [21]phosphorus, [22]group

f) mortalita – evidenciou uhynutých a vybrakovaných zvierat.

VÝSLEDKY A DISKUSIA

Pokus 1

Základné výsledky úžitkovosti sú uvedené v tab. V.

Znáška vajec nebola skrmovaním múčky z muších lariev i kukiel výraznejšie ovplyvnená. Hmotnosť vajec sa signifikantne znížila iba u skupiny s polovičnou náhradou rybacej múčky múčkou z kukiel o 4,9 % ($P < 0,01$), čo sa prejavilo aj v zníženej produkcii vaječnej hmoty o 5,6 % ($P < 0,05$).

Analýzou vajec (tab. VI) sa zistilo signifikantné zníženie ich hmotnosti pri najvyššom podiele oboch muších komponentov, čo bolo najmä v dôsledku nižšej hmotnosti bielka ($P < 0,05$). Pri múčke z muších lariev bola znížená ešte hmotnosť škrupiny (III. skupina) a zvýšená intenzita zafarbenia žĺtka u všetkých pokusných skupín (II.–V. skupina).

Skrmovanie múčky z lariev a kukiel neovplyvnilo signifikantne absolútnu spotrebu krmiva. Aj zhoršenie relatívnej spotreby krmiva o 2,6 % až 6,6 % u pokusných skupín malo len numerický charakter ($P > 0,05$).

Rozdiely v živej hmotnosti (1,9–4,4 %) boli nesignifikantné.

Skrmovanie muších lariev a kukiel neovplyvnilo negatívne mortalitu prepelíc.

Pokus 2

Základné výsledky úžitkovosti sú uvedené v tab. VII.

Rozdiely vo všetkých ukazovateľoch úžitkovosti boli nesignifikantné ($P > 0,05$). Je však opäť vidieť ten-

IV. Zloženie kŕmnych zmesí (pokus 2) – Feed mixture formulation (trial 2)

Komponent[1] v %	Skupina[22]				
	I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Rybacia múčka[2]	6,0	4,0	2,0	4,0	2,0
Mušie larvy[3]	–	2,0	4,0	–	–
Mušie kukly[4]	–	–	–	2,0	4,0
Sójový extrahovaný šrot[5]	21,0	22,0	23,0	21,5	22,0
Pšenica[6]	22,7	21,7	20,7	22,2	21,7
Kukurica[7]	40,0	40,0	40,0	40,0	40,0
Olej (rastlinný)[8]	3,0	3,0	3,0	3,0	3,0
Soľ[9]	0,3	0,3	0,3	0,3	0,3
Dikalciumfosfát[10]	1,0	1,0	1,0	1,0	1,0
MKP-2	1,0	1,0	1,0	1,0	1,0
Kŕmny vápenec[11]	4,0	4,0	4,0	4,0	4,0
DB-NP	1,0	1,0	1,0	1,0	1,0
Spolu[12]	100,0	100,0	100,0	100,0	100,0
Obsah[13] v $g.kg^{-1}$:					
ME v $MJ.kg^{-1}$	12,03	12,01	11,97	12,02	12,01
Voda[14]	106,9	106,0	105,1	106,0	105,2
N-látky[15] (N x 6,25)	200,2	200,6	201,0	200,8	201,4
Tuk[16]	54,7	57,4	59,9	56,1	57,6
Popol[17]	96,0	94,8	93,8	94,2	92,5
Vláknina[18]	39,0	41,2	43,3	42,0	44,9
BNLV[19]	503,2	500,0	496,9	500,9	498,4
Vápnik[20]	25,1	24,3	23,5	24,2	23,3
Fosfor[21]	8,4	7,5	7,1	7,4	7,1
Lyz	11,3	10,9	10,5	10,8	10,3
Met	3,7	3,6	3,5	3,6	3,4
Cys	3,3	3,2	3,2	3,2	3,1

Doplnok biofaktorov NP: vitamíny – A 20 000 mj., D_3 2 000 mj., K 2 mg, E 30 mg, B_1 2 mg, B_2 7 mg, B_6 4 mg, B_{12} 0,04 mg, niacín 15 mg, biotín 0,15 mg, kyselina listová 0,50 mg, pantotenát vápe- natý 12 mg, cholin-chlorid 600 mg, metionín 600 mg, kurasan 125 mg, uhličitan manganatý 20 mg

For 1–22 see Tab. III

denciu zhoršenia konverzie krmiva o 3,1 až 9,3 % u všetkých pokusných skupín ($P > 0,05$).

Rozdiely v analyzovaných ukazovateľoch kvality vajec sa ukázali iba v signifikantnom znížení hmotnosti vajca, hmotnosti žĺtka a jeho podielu u skupiny s tretinovou náhradou rybacej múčky múčkou z lariev ($P < 0,05$).

Pri celkovom hodnotení oboch pokusov možno konštatovať, že znáška vajec nebola vo všetkých skúmaných podieloch muších múčok signifikantne ovplyvnená. Je to v súlade s prácou autorov Chrappa a Sabo (1996), v ktorej sa u múčky z muších kukiel znáška signifikantne zhoršila až pri celej náhrade rybacej múčky. Menšie rozdiely v hmotnosti a kvalite vajec mohli vyplynúť z rozdielneho veku prepelíc v jednotlivých pokusoch. Zhoršenie konverzie krmiva u pokusných skupín, i keď len nesignifikantné, sa zistilo v oboch pokusoch a bolo opäť v súlade s predchádzajúcou prácou.

Na základe súhrnného hodnotenia získaných výsledkov možno konštatovať, že múčky vyrobené z muších lariev a kukiel možno skrmovať ako alikvotnú až dvojtretinovú náhradu rybacej múčky v izoproteínových a izoenergetických kŕmnych zmesiach dospelých japonských prepelíc.

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V. Úžitkovosť prepelíc (pokus 1) – The performance of Japanese quail (trial 1)

Ukazovateľ[1]	Jednotka[2]	Skupina[3] I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Znáška vajec[4]	ks	93,1	93,3	94,3	93,5	92,8
	S.D.	1,3	1,3	0,9	1,1	1,3
	i	100,0	100,2	101,3	100,4	99,7
	%	88,7	88,9	89,8	89,0	88,4
Hmotnosť vajca[5]	g	950,7	924,4	933,3	922,9	897,9^{+}
	S.D.	15,5	12,4	11,6	15,2	14,7
	i	100,0	97,2	98,2	97,1	94,4
Krmivo[6]: na 1 prepelicu[7]	g	10,2	9,9	9,9	9,9	9,7^{++}
	S.D.	0,1	0,1	0,1	0,1	0,1
	i	100,0	97,1	97,1	97,1	95,1
Krmivo: na 1 kg vajec[8]	g	2 311	2 312	2 399	2 379	2 323
	S.D.	46,4	68,6	74,3	65,8	60,2
	i	100,0	100,0	103,8	102,9	100,5
Živá hmotnosť[9]	g	2 446	2 509	2 586	2 587	2 607
	S.D.	58,3	78,3	94,8	66,9	65,5
	i	100,0	102,6	105,7	105,8	106,6
Mortalita[10]	g	162,2	159,1	155,0	158,5	156,4
	S.D.	3,5	2,7	2,5	2,9	3,0
	i	100,0	98,1	95,6	97,7	96,4
	ks	3	2	0	0	2
	%	9,4	6,3	0,0	0,0	6,3

$^{+}P < 0,05$, $^{++}P < 0,01$

[1]indicator, [2]unit, [3]group, [4]egg production, [5]egg weight, [6]feed, [7]per quail, [8]per 1 kg of eggs, [9]live weight, [10]mortality

VI. Analýza vajec (pokus 1) – Egg analysis (trial 1)

Ukazovateľ[1]	Jednotka[2]	Skupina[3] I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Hmotnosť vajca[4]	g	10,3^{a}	10,1^{ab}	10,0^{b}	10,1^{ab}	10,0^{B}
	i	100,0	98,1	97,1	98,1	97,1
Z toho[5]: bielok[6]	g	5,8^{a}	5,5^{b}	5,5^{B}	5,6^{b}	5,5^{B}
	i	100,0	94,8	94,8	96,6	94,8
žĺtok[7]	g	3,2^{a}	3,3^{a}	3,3^{a}	3,2^{a}	3,2^{a}
	i	100,0	103,1	103,1	100,0	100,0
škrupina[8]	g	1,3^{ac}	1,3^{ac}	1,2^{Bd}	1,3^{a}	1,3^{cd}
	i	100,0	100,0	97,1	100,0	100,0
Podiel[9]: bielok[6]	%	56,3	54,4	55,0	55,4	55,0
	i	100,0	96,6	97,7	96,6	97,7
žĺtok[7]	%	31,1	32,7	33,0	31,7	32,0
	i	100,0	105,1	106,1	101,9	102,9
škrupina[8]	%	12,6	12,9	12,0	12,9	13,0
	i	100,0	102,4	95,2	102,4	103,2
Index tvaru[10]		77,9^{ab}	77,8^{ab}	77,2^{b}	78,4^{a}	78,2^{a}
	i	100,0	99,9	99,1	100,6	100,4
Index bielka[11]		15,4^{ab}	15,4^{ab}	15,8^{A}	15,4^{ab}	14,9^{B}
	i	100,0	100,0	102,6	100,0	96,8
Farba žĺtka[12]		3,8^{A}	4,2^{B}	4,5^{C}	4,5^{C}	4,5^{C}
	i	100,0	110,5	118,4	118,4	118,4

Nerovnaké písmena: malé – $P < 0,05$, veľké – $P < 0,01$
Types of letters: small – $P < 0.05$, capital – $P < 0.01$

[1]indicator, [2]unit, [3]group, [4]egg weight, [5]of this: [6]albumen, [7]yolk, [8]shell, [9]propoportion, [10]shape index, [11]albumen index, [12]yolk color

VII. Úžitkovosť prepelíc (pokus 2) – The performance of Japanese quail (trial 2)

Ukazovateľ[1]	Jednotka[2]	Skupina[3] I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Znáška vajec[4]	ks	92,8	90,2	92,4	91,0	90,3
	S.D	1,1	1,5	1,8	1,8	2,4
	i	100,0	97,2	99,6	98,1	97,3
	%	88,4	85,9	88,0	86,7	86,0
	g	967,6	916,4	963,8	946,0	935,5
	S.D.	12,6	17,0	25,0	24,6	27,5
	i	100,0	94,7	99,6	97,8	96,7
Hmotnosť vajca[5]	g	10,3	10,1	10,4	10,4	10,4
	S.D.	0,1	0,1	0,1	0,1	0,1
	i	100,0	98,1	101,0	101,0	101,0
Krmivo[6]: na 1 prepelicu[7]	g	2 680	2 668	2 730	2 769	2 769
	S.D.	54,0	73,6	57,8	70,6	70,6
	i	100,0	99,6	101,9	103,3	103,3
Krmivo[6]: na 1 kg vajec[8]	g	2 732	2 885	2 870	2 986	2 833
	S.D.	37,5	85,7	80,0	121,6	99,0
	i	100,0	105,6	105,1	109,3	103,7
Živá hmotnosť[9]: na začiatku[11]	g	172,5	169,1	173,3	171,0	174,0
	S.D.	3,1	3,8	3,6	3,2	2,6
	i	100,0	98,0	100,5	99,1	100,9
Živá hmotnosť[9]: na konci[12]	g	170,7	174,2	178,8	178,4	177,2
	S.D.	2,7	4,4	3,5	3,9	2,2
	i	100,0	102,1	104,7	104,5	103,8
	%	10,7	14,3	0,0	3,6	7,1

Všetky rozdiely sú nesignifikantné ($P > 0,05$) – All differences are insignificant ($P > 0.05$)

For 1–10 see Tab. V; [11]at the beginning, [12]at the end

VIII. Analýza vajec (pokus 2) – Egg analysis (trial 2)

Ukazovateľ[1]	Jednotka[2]	Skupina[3] I. K	II. ML-1	III. ML-2	IV. MK-1	V. MK-2
Hmotnosť vajca[4]	g	10,6^{a}	10,1^{b}	10,5^{a}	10,4^{ab}	10,5^{a}
	i	100,0	95,3	99,1	98,1	99,1
Z toho[5]: bielok[6]	g	5,6^{a}	5,4^{a}	5,6^{a}	5,5^{a}	5,6^{a}
	i	100,0	96,4	100,0	98,2	100,0
žĺtok[7]	g	3,6^{a}	3,3^{B}	3,5^{ab}	3,5^{ab}	3,5^{a}
	i	100,0	91,7	97,2	97,2	97,2
škrupina[8]	g	1,4^{a}	1,4^{a}	1,4^{a}	1,4^{a}	1,4^{a}
	i	100,0	100,0	100,0	100,0	100,0
Podiel[9]: bielok[6]	%	52,8^{a}	53,4^{a}	53,3^{a}	52,9^{a}	53,1^{a}
	i	100,0	101,1	106,9	100,2	100,6
žĺtok[7]	%	34,1^{a}	32,8^{b}	33,4^{ab}	34,0^{ab}	33,9^{ab}
	i	100,0	96,2	97,9	99,7	99,4
škrupina[8]	%	13,1^{a}	13,8^{a}	13,3^{a}	13,1^{a}	13,0^{a}
	i	100,0	105,3	101,5	100,0	99,2
Index tvaru[10]		77,3^{a}	77,7^{a}	77,3^{a}	76,6^{a}	77,0^{a}
	i	100,0	100,5	100,0	99,9	99,6
Index bielka[11]		13,5^{a}	13,4^{a}	13,0^{a}	13,0^{a}	13,4^{a}
	i	100,0	99,3	96,3	96,3	99,3
Farba žĺtka[12]		4,7^{a}	4,9^{a}	4,8^{a}	5,1^{a}	5,2^{a}
	i	100,0	104,3	102,1	108,5	110,6

Nerovnaké písmena: malé – $P < 0,05$, veľké – $P < 0,01$
Types of letters: small – $P < 0.05$, capital – $P < 0.01$

For 1–12 see Tab. VI

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INFLUENCE OF GENOTYPE ON THE SHARE AND DISTRIBUTION OF MUSCLE, FATTY AND BONE TISSUES AS WELL AS COMMERCIAL AND ENERGY VALUE OF PIG CARCASSES

VLIV GENOTYPU NA PODÍL A ROZLOŽENÍ SVALOVÝCH, TUKOVÝCH A KOSTNÍCH TKÁNÍ I NA KOMERČNÍ A ENERGETICKOU HODNOTU JATEČNÝCH TRUPŮ PRASAT

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ABSTRACT: Research was carried out on the carcasses of Large White, Swedish Landrace and Line 3. Carcasses were dissected after W e n i g e r et al. (1963) method. Carcasses of Line 3 (57.10%) and Swedish Landrace (56.49%) had approximately the same muscle tissue share whereas Large White carcasses had a lower muscle tissue share (50.99%). Different distribution of muscle, fatty and bony tissue in carcasses of the investigated pig genotypes was determined. Carcasses of Line 3 and Swedish Landrace, which had approximately the same meatiness, also differed in the share of muscle, fatty and bony tissue. The largest share of ham tissue and abdominal rib part in pig carcass weight was determined in Line 3 (20.29%, i.e. 10.43%). Muscle tissue of back, shoulder and neck had the highest share in the weight of Swedish Landrace carcasses (10.96%, 10.94%, i.e. 6.47%). As a consequence of different tissue shares and distribution, different sales value of pig carcasses of analyzed genotypes was determined. Higher commercial value was genotype carcasses with higher muscle tissue share – Swedish Landrace and Line 3 and lower in Large White carcasses. Tissues arrangement, i.e. their composition had significant influence on commercial carcass value. Of total 20 right dissected carcasses of each genotype, the largest number of Large White carcasses (11) belonged to commercial class „U", whereas the largest number of Swedish Landrace carcasses (14, i.e. 16) and Line 3 belonged to class „E". Energy value of Swedish Landrace carcasses and Line 3 was the same and statistically very significantly lower than energy values of Large White carcasses.

genotype; share and distribution of tissue; commercial and energy value; pig carcass

ABSTRAKT: Sledování se uskutečnilo na jatečných trupech prasat plemen bílé ušlechtilé, švédská landrase a linie 3. Rozbor jatečných trupů byl proveden podle metody autorů W e n i g e r et al. (1963). Jatečné trupy prasat linie 3 (57,10 %) a plemene švédská landrase (56,49 %) měly přibližně shodný podíl svalové tkáně, zatímco jatečné trupy prasat plemene bílé ušlechtilé obsahovaly nižší podíl svalové tkáně (50,99 %). Zjistili jsme rozdílné rozložení svalové, tukové a kostní tkáně v jatečných trupech sledovaných genotypů prasat. Jatečné trupy prasat linie 3 a plemene švédská landrase, které vykazovaly přibližně shodnou zmasilost, měly rovněž různé podíly svalové, tukové a kostní tkáně. Nejvyšší podíl masa z kýty a z krkovičky v abdominální části z hmotnosti jatečné půlky jsme zaznamenali u linie 3 (20,29 %, tj. 10,43 %). Svalová tkáň z oblasti hřbetu, plece a krku vykazovala nejvyšší podíl z hmotnosti jatečných půlek u plemene švédská landrase (10,96 %, 10,94 %, tj. 6,47 %). Jako důsledek rozdílného podílu a rozložení tkání u analyzovaných genotypů byly stanoveny různé prodejní hodnoty jatečných trupů. Trupy genotypů s vyšším podílem svalové tkáně měly vyšší komerční hodnotu – švédská landrase a linie 3, nižší hodnotu měly trupy plemene bílé ušlechtilé. Rozložení jednotlivých tkání, resp. jejich složení mělo významný vliv na komerční hodnotu jatečných trupů. Z 20 pravých jatečných půlek od každého genotypu, které jsme podrobili rozboru, patřil do komerční třídy „U" nejvyšší počet trupů plemene bílé ušlechtilé (11), zatímco do třídy „E" patřil nejvyšší počet trupů plemene švédská landrase (14, tj. 16) a linie 3. Energetická hodnota trupů plemene švédská landrase a linie 3 byla shodná a statisticky velmi významně nižší než energetická hodnota trupů prasat plemene bílé ušlechtilé.

genotyp; podíl a rozložení tkání; komerční a energetická hodnota; jatečný trup prasete

INTRODUCTION

Pigs are mainly raised for meat. That's why pig carcass value has been considerably determined by muscle tissue share. Since all parts of carcasses do not have the same commercial value apart from muscle tissue share in carcasses (fleshiness), its distribution is also important. Reference data (Oster et al., 1987; Kralik et al., 1990; Godfrey et al., 1991 and others) indicate different shares of some side parts and different tissue distribution in the sides, i.e. in side parts depending on genotype. Different phenotypic statement of meatiness is mostly the result of genetic and paragenetic factors. It is supposed that genotypic statement of pig meatiness of different genotypes under the same fattening conditions will distinguish and thereby usable pork sides of analysed genotypes. The aim of this paper is to investigate how genotypes in the same paragenetic conditions affect yield and tissue distribution i.e. different composition and commercial carcass value.

MATERIAL AND METHODS

The investigation was carried out on pig carcasses of Large White, Swedish Landrace and Line 3. Twenty right pig carcasses which originated from pigs fattened from 25 to 105 kg body weight were analyzed from each genotype. Male castrates/gilts ratio was roughly equal in each group. Pigs of all genotypes were fed in the same conditions of housing and feeding. Pigs from 20 to 60 kg of body weight received mixture ST_1 which contained 16% of raw proteins and 13.92 MJ ME/kg, whereas pigs from 60 to 105 kg of body weight received mixture ST_2 with 14% of raw proteins and 14.02 MJ ME/kg.

The carcasses were dissected after Weniger et al. (1963) method in order to determine absolute and relative shares of some carcasses parts, tissue share in them and in carcasses. Cooled (+4 °C) right pig carcasses were dissected into the main parts (ham, back part, shoulder, neck, abdominal-rib part, head, tail and knuckles). The main parts were dissected to muscle tissue, adipose tissue with skin and bone tissue. Less valuable parts, i.e. head with a tail, fore legs and knuckles were not dissected.

Commercial value of pig carcasses was determined in two ways: 1. on the basis of muscle tissue value sum (8.92 DM/kg) and fatty tissue (2.12 DM/kg), according to the rate of exchange of 3.5 kunas for one German mark (DM) and 2. on the basis of tissue retail price (muscle, fatty) and bones from some carcass parts. Energy value of carcasses was expressed in metabolic energy (ME) and was calculated as a sum of muscle energy values (5.32 MJ ME/kg) and fatty (9.73 MJ ME/kg) tissue (ARC, 1981). By analysis of variance significance of differences between the genotypes in tissue share and commercial and energy value of pig carcasses was determined. On the basis of muscle tissue share pig carcasses were classified in commercial classes according to Regulations (1995).

RESULTS AND DISCUSSION

Shares of muscle, fatty and bony tissue in pig carcasses of the investigated genotypes could be seen from Tab. I. Carcasses of Swedish Landrace (23.75 kg) and Line 3 (24.04 kg) had approximately the same yield of muscle tissue whereas Large White's carcasses considering muscle tissue yield (21.52 kg) were worse. Relative share of muscle tissue in carcasses was the highest in Line 3 (57.10%), then Swedish Landrace (56.49%) and Large White (50.99%). No statistically significant differences were determined in muscle tissue shares between the carcasses of Swedish Landrace and Line 3. Muscle tissue share in carcasses was affected by genetic and paragenetic factors. That's why the results of some authors' investigations differ in reference to muscle tissue share with the same pig genotype. Thus, Kralik et al. (1990) determined 50.17% of muscle tissue in Swedish Landrace carcasses, Stern et al. (1990) 61.2%, i.e. 58.3% and Anastasijević et al. (1992) 60.8%. Oster et al. (1987) determined 50.6%, Wysshari et al. (1987) 53.25%, i.e. 52.37% and Kralik et al. (1990) 53.01% of muscle tissue in Large White carcasses.

Large White carcasses had absolutely and relatively statistically very significantly ($P < 0.01$) more fatty tissue (13.73 kg, i.e. 32.53%) than Swedish Landrace carcasses (10.67% and 25.38%) and Line 3 (10.61kg and 25.20%). Statistically significant differences ($P < 0.05$) in absolute and relative fatty tissue share in carcasses were not determined between Swedish Landrace and Line 3.

Bony tissue was the most representative in Swedish Landrace carcasses (4.45 kg, i.e. 10.58%) followed by Line 3 (4.17 kg, i.e. 9.91%) and Large White (4.06 kg, i.e. 9.63%).

Apart from shares of muscle, fatty and bony tissue, their distribution in carcasses is also important. Absolute and relative muscle tissue shares of the carcasses main parts in the pig carcasses weight were presented in Tab. II.

The largest share in pig carcass weight with Large White was determined in ham muscle tissue (17.75%), followed by shoulders (9.93%), abdominal-rib part (8.98%), back part (8.58%) and neck (5.67%).

The largest share in Swedish Landrace carcass weight was as follows: ham muscle tissue (18.53%), muscle tissue of the back part (10.96%), shoulders (10.94%), abdominal-rib part (9.59%) and neck (6.64%).

As for Line 3, muscle tissue of the back part according to share in the carcass weight (10.86%) comes after ham muscle tissue (20.29%), followed by muscle tissue of abdominal-rib part (10.43%), shoulders (10.43%) and neck (5.46%).

I. Shares of tissues and less valuable parts in pig carcasses

Kind of tissue	Share	Statistical parameters	Large White (n = 20)	Swedish Landrace (n = 20)	Line 3 (n = 20)
Muscle	kg	$\bar{x}$	$21.52^{2,3**}$	23.75^{1**}	24.04^{1**}
		s	1.61	1.91	1.09
		vk	7.48	8.04	4.53
	%	$\bar{x}$	$50.99^{2,3**}$	56.49^{1**}	57.10^{1**}
		s	2.95	3.69	2.78
		vk	5.79	6.53	4.87
Fatty	kg	$\bar{x}$	$13.73^{2,3**}$	10.67^{1**}	10.61^{1**}
		s	1.40	1.82	1.32
		vk	10.20	17.06	12.44
	%	$\bar{x}$	$32.53^{2,3**}$	25.38^{1**}	25.20^{1**}
		s	3.37	4.10	2.62
		vk	10.36	16.15	10.44
Bones	kg	$\bar{x}$	4.06^{2**}	4.45^{1**3*}	4.17^{2*}
		s	0.31	0.37	0.34
		vk	7.63	8.31	8.15
	%	$\bar{x}$	9.63^{2**}	10.58^{1**3*}	9.91^{2*}
		s	0.72	0.77	0.83
		vk	7.48	7.28	8.38
Less valuable parts	g	$\bar{x}$	$2.89^{2,3**}$	3.17^{1**}	3.28^{1**}
		s	0.26	0.32	0.41
		vk	9.00	10.09	12.50
Weight of cooled carcasses	kg	$\bar{x}$	42.20	42.04	42.10
		s	1.44	1.89	1.15
		vk	3.41	4.49	2.73

$^{*}P < 0.05$; $^{**}P < 0.01$

II. Muscle tissue shares in the main parts in pig carcass weight

Part of carcass	Muscle tissue share	Statistical parameters	Large White (n = 20)	Swedish Landrace (n = 20)	Line 3 (n = 20)
Ham	kg	$\bar{x}$	7.49^{3**}	7.79^{3**}	$8.54^{1,2**}$
		vk	10.28	10.78	6.09
	%	$\bar{x}$	17.75^{3**}	18.53^{3**}	$20.29^{1,2**}$
		vk	9.18	9.71	6.90
Back part	kg	$\bar{x}$	$3.62^{2,3**}$	4.61^{1**}	4.57^{1**}
		vk	14.92	13.45	9.63
	%	$\bar{x}$	$8.58^{2,3**}$	10.96^{1**}	10.86^{1**}
		vk	10.72	12.32	10.50
Shoulder	kg	$\bar{x}$	4.19^{2*}	$4.60^{1,3**}$	4.24^{2**}
		vk	12.65	9.78	9.67
	%	$\bar{x}$	9.93^{2**}	$10.94^{1,3**}$	10.07^{2**}
		vk	12.49	8.32	9.04
Neck	kg	$\bar{x}$	2.43^{2**}	$2.72^{1,3**}$	2.30^{2**}
		vk	13.17	13.60	20.87
	%	$\bar{x}$	5.76^{2**}	$6.47^{1,3**}$	5.46^{2**}
		vk	12.33	12.98	20.51
Abdominal rib part	kg	$\bar{x}$	$3.79^{2,3**}$	$4.03^{1,3**}$	$4.39^{1,2**}$
		vk	8.44	9.43	10.25
	%	$\bar{x}$	$8.98^{2,3**}$	$9.59^{1,3**}$	$10.43^{1,2**}$
		vk	6.46	8.03	10.55
Total	%	$\bar{x}$	$50.99^{2,3**}$	56.49^{1**}	57.10^{1**}

$^{*}P < 0.05$; $^{**}P < 0.01$

III. Fatty tissue shares in the main parts in pig carcass weight

Part of carcass	Fatty tissue share	Statistical parameters	Large White (n = 20)	Swedish Landrace (n = 20)	Line 3 (n = 20)
Ham	kg	$\bar{x}$	$3.34^{2,3**}$	2.38^{1**}	2.22^{1**}
		vk	13.47	19.75	15.76
	%	$\bar{x}$	$7.92^{2,3**}$	5.66^{1**}	5.27^{1**}
		vk	13.76	21.02	14.99
Back part	kg	$\bar{x}$	$2.75^{2,3**}$	$2.32^{1,3**}$	$1.68^{1,2**}$
		vk	18.54	23.27	30.26
	%	$\bar{x}$	6.52^{2*3**}	5.51^{1*3**}	$3.99^{1,2**}$
		vk	18.25	22.87	28.32
Shoulder	kg	$\bar{x}$	$1.69^{2,3**}$	1.21^{1**3*}	1.42^{1**}
		vk	13.02	29.75	18.31
	%	$\bar{x}$	$4.00^{2,3**}$	2.87^{1**3*}	3.37^{1**2*}
		vk	13.50	28.22	16.91
Neck	kg	$\bar{x}$	0.76^{3**}	0.73^{3**}	0.62^{1**2*}
		vk	25.00	24.66	25.81
	%	$\bar{x}$	1.80^{3*}	1.73^{3*}	$1.47^{1,2*}$
		vk	26.67	24.27	25.85
Abdominal rib part	kg	$\bar{x}$	$2.79^{2,3**}$	$2.20^{1,3**}$	2.50^{1**2*}
		vk	25.45	19.54	14.40
	%	$\bar{x}$	6.61^{2**}	5.23^{1**3*}	5.94^{2*}
		vk	25.72.	18.16	12.46
Double chin	kg	$\bar{x}$	1.27^{2**3*}	$0.98^{1,3**}$	1.50^{1*2**}
		vk	27.56	28.57	15.33
	%	$\bar{x}$	3.01^{2**}	$2.33^{1,3**}$	3.56^{2**}
		vk	27.57	29.61	15.73
Grease	kg	$\bar{x}$	$1.13^{2,3**}$	0.85^{1**3*}	0.67^{1**2*}
		vk	25.66	35.29	29.85
	%	$\bar{x}$	$2.68^{2,3**}$	$2.02^{1,3**}$	$1.59^{1,2**}$
		vk	24.63	14.85	29.56
Total	%	$\bar{x}$	$32.53^{2,3**}$	25.38^{1**}	25.20^{1**}

$^{*}P < 0.05$; $^{**}P < 0.01$

Ham muscle tissue had the highest share in sides weight of the leanest genotype – Line 3 (20.29%), Swedish Landrace (18.53%) and Large White (17.75%). Especially high share of ham muscle tissue in the side is very important since high developed markets mostly require muscle tissue of this part of the side (Topel, 1986; Bichard, Bruce, 1989).

Share of back muscle tissue in pork side weight is the highest with Swedish Landrace (10.96%), the genotype selected to a longer carcass, i.e. more dugs followed by Line 3 (10.86%) and Large White (8.58%). From the above mentioned different composition of pig carcass is obvious as a consequence of the special selection aim. Specific composition of Swedish Landrace sides in the Republic of Croatia was pointed out earlier by Senčić et al. (1995).

Shoulder muscle tissue participated the most in Swedish Landrace carcass weight (10.94%) followed by Line 3 (10.07%) and Large White (9.93%).

Muscle tissue share of Swedish Landrace neck in the total pig carcass weight (6.47%) was larger than the share in Large White (5.67%) and Line 3 (5.46%).

Muscle tissue of abdominal-rib part was the most represented in total weight of pig carcasses with Line 3 (10.43%) followed by Swedish Landrace (9.59%) and Large White (8.98%). Branscheid et al. (1990) determined that muscle tissue of abdominal-rib part increases more than proportionally by muscle tissue increase in the carcass. Kralik et al. (1990) and Godfrey et al. (1991) also determined a higher muscle tissue share of abdominal-rib part in the sides in leaner pig genotypes. Absolute and relative muscle tissue shares of the basic sides parts are in this investigation impossible to be completely compared with other investigators results since pigs were fattened in different conditions and slaughtered at different body weights. The ways of sides dissection are not often properly defined.

Fatty tissue relative share of the main parts in pig carcass weight can be seen in Tab. III. Share of ham fatty tissue in pig carcass weight in reference to fatty tissue shares of other carcasses parts was with all three genotypes the largest and ranged from 5.27% in Line 3 to 5.66% in Swedish Landrace and 7.92% in Large White. The second place according to fatty tissue share

IV. Bone shares in the main parts in pig carcass weight

Part of carcass	Bone tissue share	Statistical parameters	Large White (n = 20)	Swedish Landrace (n = 20)	Line 3 (n = 20)
Ham	kg	$\bar{x}$	1.23	1.27	1.31
		vk	14.63	11.02	10.69
	%	$\bar{x}$	2.91	3.02	3.11
		vk	13.06	11.26	11.90
Back part	kg	$\bar{x}$	0.90^{2**}	$1.13^{1,3**}$	0.88^{2**}
		vk	13.33	16.81	19.32
	%	$\bar{x}$	2.13^{2**}	$2.69^{1,3**}$	2.09^{2**}
		vk	13.62	16.36	19.14
Shoulder	kg	$\bar{x}$	$0.73^{2,3**}$	$0.82^{1,3**}$	$0.90^{1,2**}$
		vk	9.59	8.53	0.09
	%	$\bar{x}$	$1.73^{2,3**}$	$1.95^{1,3**}$	$2.14^{1,2**}$
		vk	9.83	8.20	10.28
Neck	kg	$\bar{x}$	0.60^{3**}	0.61^{3**}	$0.43^{1,2**}$
		vk	25.00	22.58	32.56
	%	$\bar{x}$	1.42^{3**}	1.45^{3**}	$1.02^{1,2**}$
		vk	26.76	22.07	33.33
Abdominal rib part	kg	$\bar{x}$	0.60	0.62	0.65
		vk	15.00	12.90	12.31
	%	$\bar{x}$	1.42	1.47	1.54
		vk	14.79.	11.56	13.64
Total	%	$\bar{x}$	9.63^{2**}	10.58^{1**3*}	9.91^{2*}

$^{*}P < 0.05$; $^{**}P < 0.01$

in pig carcasses weight in Large White and Line 3 belongs to fatty tissue of abdominal-rib part (6.61%, i.e. 5.94%) whereas in Swedish Landrace it is fatty tissue of back part (5.51%). Fatty tissue shares of other parts per genotypes are shown in Tab. III.

Considering bony tissue share of the main parts in pig carcass weight (Tab. IV), differences between the genotypes were mostly significant for back part, shoulder and neck whereas no statistically significant differences between the genotypes were determined for ham and abdominal-rib part. The largest relative share of bony tissue in pig carcass weight with all genotypes was observed in ham followed by back part, shoulder, abdominal-rib part and neck.

Differences between the genotypes in gain and distribution of muscle, fatty and bony tissue in carcasses were also reflected in differences in their commercial and energy value (Tab. V). Large White carcasses which had the most fatty and the least muscle tissue had the lowest commercial value (estimated in both ways). Differences were also determined between the carcasses of Swedish Landrace and Line 3 in commercial value on the basis of retail prices although there were no statistically significant differences in muscle tissue share. It indicates that pig carcasses composition apart from fleshiness affect also their commercial and consumable value.

By pig carcasses grading into commercial classes according to Regulations (1995), it was determined that the largest number of Large White carcasses (11) belonged to class „U" whereas the largest number of Swedish Landrace (13) and Line 3 (10) carcasses belonged to class „E".

Large White carcasses had higher energy value than Swedish Landrace and Line 3 carcasses due to larger fatty tissue share. It is known that larger fatty tissue share in pig's body is connected with higher food consumption per gain unit. Together with lower carcass fleshiness, it also reduces pig production.

CONCLUSION

Pigs of different genotypes (Large White, Swedish Landrace, Line 3), kept under the same paragenetic conditions, give carcasses with different shares of muscle, fatty and bony tissue with different tissue distribution (composition) and different commercial and energy value.

Approximately the same muscle tissue shares were determined in carcasses of Swedish Landrace and Line 3 (56.49%, i.e. 57.10%) and lower share was found in Large White carcasses (50.99%).

The largest share of the commercially most valuable ham muscle tissue (20.29%) and less valuable muscle tissue of abdominal-rib part (10.43%) in pig carcasses weight was determined with Line 3.

Muscle tissue of consumable commercially valuable parts of back, shoulder and neck had the largest share in Swedish Landrace carcass weight (10.96%, 10.94% i.e. 6.47%).

Genotype carcasses with higher muscle tissue share had higher commercial value – Swedish Landrace and Line 3 whereas Large White carcasses had lower value.

V. Commercial end energetic values of pig carcasses

Indicator	Statistical parameters	Large White (n = 20)	Swedish Landrace (n = 20)	Line 3 (n = 20)
Value of carcasses (DM)[1]	$\bar{x}$	$221.07^{2,3**}$	234.47^{1*}	236.93^{1*}
	s	12.87	14.47	11.85
	vk	5.82	6.30	5.00
Value of carcasses (DM)[2]	$\bar{x}$	$281.14^{2,2**}$	304.28^{1**3*}	292.86^{1**2*}
	s	15.43	19.14	14.26
	vk	5.49	6.29	4.87
Commercial classes:				
E	n	1	14	16
U	n	11	5	4
R	n	8	1	–
O	n	–	–	–
P	n	–	–	–
Energetic value (MJ ME)	$\bar{x}$	$939.84^{2,3**}$	798.73^{1**}	798.36^{1**}
	s	66.34	55.83	57.48
	vk	7.06	6.99	7.20

[1] on the basis of total muscle and fatty tissue shares
[2] on the basis of retail trade tissue price in the main parts of carcasses
$^{*}P < 0.05$; $^{**}P < 0.01$

Position of tissues, i.e. their composition, affect significantly commercial carcasses value.

Energy value of Swedish Landrace and Line 3 carcasses was the same and statistically significantly lower than energy value of Large White carcasses.

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FROM THE SPHERE OF SCIENCE

XVII INTERNATIONAL SYMPOSIUM ON ANIMAL PHYSIOLOGY

XVII International Symposium on Animal Physiology was held in Košice (Slovak Republic) 12.–14. 11. 1997. Symposium of Animal Physiology is organized every other year in cooperation of the Institute of Animal Physiology in Košice and Institute of Animal Biochemistry and Genetics in Prague. The meeting covered different topics of animal physiology, nutrition and reproduction. Contributions were presented in main lectures and different poster sessions. Official languages were Slovak, Czech and English. Any requests dealing with the Symposium will be solved by the Organizing Committee:

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CHANGES IN FEATHER CONDITION IN RELATION TO FEATHER PECKING AND AGGRESSIVE BEHAVIOUR IN LAYING HENS

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The aim of this experiment was to describe and examine the relationship between pecks received by individual birds and the feather and skin damage of those birds at different ages. The effect of group size was also studied. Laying hens were raised in floor pens in group sizes of 15, 30, 60 and 120 birds, each with four replicates. Behavioural observations were performed at the ages of 22, 27, 32 and 37 weeks. Detailed feather scoring was carried out at the ages of 18, 23, 28 and 33 weeks. Behavioural observations focused on the number of feather pecks (gentle and severe) and aggressive pecks received, and on the part of the body that was pecked. Scoring of feather and skin damage focused on the same eleven parts of the body. Increasing levels of aggressive pecks received were associated with decreased body weight at all ages. Feather damage on the head correlated with the number of aggressive pecks received, but not with gentle or severe feather pecks. The number of severe feather pecks received was significantly correlated with feather damage at all ages, however, no correlation with gentle feather pecks received was found (except at the age of 32 weeks).

USE OF FECAL AND ILEAL METHODS OF NUTRIENT DIGESTIBILITY DETERMINATION IN GILTS

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Influence of two levels of crude fibre (CF) in diet – 6.6% (control group) and 10.2% (experimental group) was studied in 8 gilts (body weight 110 ± 3 kg). Indicator method (Cr_2O_3 – 0.3% in DM) for determination of digestibility was used in ileum and large intestine. Analysing the influence of CF content on nutrient digestibility in gilts it was observed:
– digestibility in ileum: higher content of CF in experimental group had a negative effect on crude protein (CP) digestibility (coefficient of digestibility – CD 74.7%) in comparison with control group (CD 80.3%). A similar trend was observed in NFE (74.4% and/or 79.8%), crude fat (CF 51.0% and/or 56.9%), lysine (71.5% and/or 79.3%), threonine (67.3% and/or 77.3%), valine (68.9% and/or 75.1%), isoleucine (74.0% and/or 81.3%), phenylalanine (81.8% and/or 77.4%) digestibility. The differences in histidine, arginine and leucine were not significant.
– digestibility in large intestine: lower value of CD of CP and NFE (72.0% and/or 81.2%) were observed in the group with 10.2% of CF in diet in comparison with control group (75.9% and/or 84.9 %). There was not any significant difference in CF digestibility between groups (53.1% and/or 53.3%). Slightly higher CD of amino acids were observed in the group with lower CF content. Higher CD of nutrients were observed using ileal method. Negative effect of higher CF level was observed in both methods used for determination of digestibility with more expressive demonstration in ileum.

THE SPECIFIC ANTIBODY PRODUCTION IN THYREOPATHY OF RAMS

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The aim of our study was to observe the specific antibody production in breeding rams suffering from iodopenia and thyroid gland hypertrophy to the therapy with potassium iodide. Ten Merino breeding rams aged 2 years were included in the experiment. All animals were diagnosed for iodopenia with hypothyreosis. The experimental rams (6 animals) received potassium iodide at a daily dose of 0.5 g per animal in the BAK feed mixture throughout 5 weeks. The control group consisted of 4 rams. First, all animals were s.c. immunized with ovalbumin at a dose of 0.2 mg/kg of live weight and after 3 weeks revaccinated. Prior to the first immunization, blood samples from *v. jugularis* were collected from all animals and then in 6 weekly intervals. A modified ELISA method was used to determine specific OVA antibodies in the sera. Throughout the observation, the intensity of the specific OVA antibody production was increased in experimental animals from week 3 on. In the experimental group, the maximum concentration was seen in weeks 4 and 5 after the first OVA administration (0.858 ± 0.418 and 0.706 8 ± 0.354, respectively). Our findings testify that potassium iodide exerts an immunomodulative effect on animals suffering from iodine metabolism disorders.

MANIPULATION OF DIGESTIVE PROCESSES OF YOUNG ANIMALS WITH PROBIOTICS

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The use of probiotic preparations in the nutrition of young farm animals is one of the most effective forms of biotechnology implementation in animal production. This is in accordance with the worldwide trend of using probiotics as an alternative to antibiotics and chemotherapeuticals. The optimizing effect of probiotics on digestive processes is mediated by the optimization of the digestive tract microflora composition, enhancement of its enzyme activity, improvement of the digestibility and utilization of the feed. The application of probiotics to calves, lambs and kids helps in the development of rumen ecosystem that forms a basis for the future rumen population with high fermentation activity. The colonization of rumen with selected cultures of living organisms enables the earlier and more stable onset of rumen-type digestion. Probiotics are successfully used also in the nutrition of piglets in which during the first days after weaning the digestive ability of their stomach-gut system is reduced, which results in insufficient digestion of feed accompanied by digestive disorders and growth retardation. The application of probiotics in the period of weaning stimulates the digestive processes of weaners and acts as a prevention against digestive tract disorders. Elucidation of the mechanism of the effect of probiotics will make it possible to optimize the criteria of the selection of micro-organisms for probiotic purposes as well as to improve the efficacy of probiotics.

THE OCCURRENCE OF ADHESION PROTEIN, WHICH MEDIATES COAGGREGATION OF ANIMAL ORAL *STREPTOCOCCI* WITH ACTINOMYCES

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A total of 37 strains of *Streptococci* were isolate from the oral cavity of piglets and calves. Aggregation activity was seen between eight homofermentative autoaggregative *Streptococci* and two strains of animal *Actinomyces bovis* and *A. pyogenes*. Putative adhesion genes were identified in each of these streptococcal strains by hybridisation of their chromosomal DNA with 30-base oligonucleotide probe (Neikirik et al., Infection and Immunity, *61*, 1993: 981). The chromosomal DNA of *Streptococcus sp.* L 8/5, L 8/6 were shown to have strong hybridisation signals with oligonucleotide probe. Six strains (7/4, 9/1, 9/2, 9/5, 9/6, 10/5) had weak hybridisation signals. Other strains had negative reactions. In addition, antibiotic resistance and hydrophobicity (adherence to n-hexadecane) were investigated. The hydrophobicity varied from 20 to 50%. Eight *Streptococcus sp.* strains isolated from the animal oral cavity were screened for DNAse activity, also. The presence of DNAse in cell extract was tested by incubation with lambda DNA, followed by agarose gel electrophoresis. Lambda DNA was not degraded by the cell extracts. The method described can be used to identify potential recipient strains for transformation or as a simple and rapid screening technique for specific restriction endonucleases of oral bacteria. This observation is the first step in the construction of recombinant live vaccines in which commensal streptococci as well as other gram-positive bacteria may be used as vectors to deliver heterologous antigens to the immune systems.

EFFECT OF MANGANESE, AND ZINC CHELATES ON SELECT PHYSIOLOGICAL INDICES OF HENS BLOOD AND BONE

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The aim of this study was to test the effect of mineral nutrition on select physiological indices of blood using a chelated form of Mn and Zn. The experiment was carried out with 288 young hens of the hybrid combination Isa Brown. These birds were divided into four groups. The first group was a control group, the birds were administered 100% inorganic manganese

and zinc in the form of zinc oxide and manganese sulphate. The second group was administered 20% chelated manganese and zinc of the total amount of mineral supplement, the third group received 40% chelated manganese and zinc, and the fourth group received 40% chelated manganese and zinc with organic blocked chromium. The blood and pectoral bone was taken from the hens before egg production and three times during egg production. We determined biochemical and metabolic value in blood and mineral composition of pectoral bone. The most parameters of internal environment were not significantly affected by feeding interventions. For example, the intensity of egg production, the length of egg production, the exhausting bodily backlog or age of hens have much bigger effect on haematological indices than feed intervention. We certify effect of feed intervention on a zinc level in blood plasma and manganese content in pectoral bone.

SUBSTRATE-HORMONAL MECHANISMS OF PIGS NEONATAL ADAPTATION

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Sudden changes of the hormonal profile take place after the mammalia birth. First of all they are connected with necessity of substrate-regulatory activation of functions of many organs and systems of newborns. It has been noted that newborn piglets (0.5 hour old) were characterized by high concentrations of cortisol and T_4 in blood plasma (430.6 ± 50.5 and 120,0 ± 15.3 nmol/l accordingly). After they received first colostrum (6–12 hrs of life), an increase of insulin (2.1 times) and T_3 (1.85 times) and a decrease of T_4 and cortisol content in the blood plasma have been observed. It has been found that piglets whose dams received a high energy diet during the last trimester of gestation (feeding fat 5 MJ was added to the ration) were born with higher birth weight and higher concentration of substrate (glucose, NEFA, TG) but with a lower blood plasma concentration of urea. It results in the decrease of protein catabolism and gluconeogenesis from amino acids and lowering of their investment in thermogenesis. The feeding of high energy supplements promoted not only the increase of transplacental fuels from a maternal organism to a fetus, but the nutritive value of colostrum and milk have increased. Decrease of heat loss per weight unit and better substrate supply of processes of postnatal adaptation have resulted in the corresponding improvement of hormonal profile. Newborn piglets were distinguished by highly expressed dynamics of elevation of concentration in blood plasma during the 1st day their life. It created the precondition for increasing synthetic processes in the organism. The inclusion of fodder fat with Se (0.2 mg/kg dry matter of fodder) to the ration of sows evoked increasing concentrations of both insulin and T_3 in 0,5; 6; 12; 24; 120 hrs of age.

EFFECT OF NaOH TREATED GRAINS ON RUMEN FERMENTATION AND SOME METABOLIC VARIABLES IN DAIRY COWS

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Twenty-four dairy cows in experiment 1 (field experiment) and twelve dairy cows in experiment 2 were used to evaluate the effect of NaOH treated wheat grain (3% NaOH) on rumen fermentation, some metabolic variables and acid-base status. In experiment 1 animals were fed diets containing silage, hay and 4.5 kg of concentrate (control) or silage, hay, 2.5 kg of concentrate and 2 kg of NaOH treated wheat (SHW) or green chop, pasture, silage, 2.5 kg of concentrate and 2 kg of NaOH treated wheat (GSW). Insignificant decreases of ammonia, VFA, acetic acid, propionic acid, significant decrease of butyric acid ($P < 0.01$) and significant increase of lactic acid ($P < 0.001$) in rumen content were observed in SHW and GSW groups. Serum concentrations of urea, glucose ($P < 0.001$), NEFA ($P < 0.001$), acetic acid (P) decreased and total protein, total lipids, triglycerids, lactic, betahydroxibutyric and butyric acid increased in SHW and GSW groups in comparison with control group. In experiment 2 animals were fed diets containing hay, 3 kg of concentrate and 2.5 kg of ground wheat (control) or hay, 3 kg of concentrate and 3 kg of NaOH treated wheat (HW). Increased values of HCO_3 and pCO_2 ($P < 0.001$), ABE and SBC ($P < 0.01$) and decreased pO_2 ($P < 0.001$) indicate the trend of metabolic acidosis with more expressive demonstration in control group. The results confirm the transfer of nutrient and starch digestion from the area of rumen fermentation to enzymatic digestion. Use of NaOH treated wheat in diets showed no adverse effects on health of animals.

THE EFFECT OF INTRAPORTAL INFUSION OF GLUCAGON ON RENAL FUNCTION IN SHEEP

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The effects on renal functions of infusing glucagon (100 $ng.kg^{-1}.min^{-1}$) into the portal vein system, were studied in young anaesthetized sheep kept on a diet with normal protein and digestible energy contents. The clearance measurements of the left kidney functions showed a decreased urine flow rate (0.36 ± 0.04 to 0.18 ± 0.03 $ml.min^{-1}$, $P < 0.01$) within the first 10 minutes of glucagon infusion falling to 0.07 ± 0.02 $ml.min^{-1}$ ($P < 0.01$) during the next 10 min. The glomerular filtration rate also decreased from 17.56 ± 2.92 $ml.min^{-1}$ to its lowest value 3.34 ± 1.02 $ml.min^{-1}$ ($P < 0.01$) after 20 minutes of glucagon infusion. Decreases in urea excretion (53.1 ± 6.46 vs. 3.82 ± 1.27 $mmol.min^{-1}$, $P < 0.01$) and osmotic clearance (0.67 ± 0.13 vs. 0.09 ± 0.02 $ml.min^{-1}$, $P < 0.01$) occurred during the first 20 min. The plasma level of glucose increased from 4.01 ± 0.53 to 8.33 ± 1.12 $mmol.l^{-1}$ ($P < 0.05$) 20 min after the start of glucagon infusion. Twenty minutes after the start of glucagon infusion, the values of all the parameters measured began to recover although they did not reach the control

level even after one hour. In conclusion, presented data demonstrate that sheep show a completely opposite renal response to the intraportal infusion of glucagon to that described in animals with simple stomach or in humans.

INFLUENCE OF SOME AMINO ACIDS ON LYSINE PASSAGE THROUGH THE SHEEP RUMEN EPITHELIUM

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Influence of some amino acids on lysine passage through the sheep rumen epithelium was determinated *in vitro* in the mucoso-serous direction after 60 min incubation. Rumen epithelium with submucosa was used in the experiment. The epithelium area was 13.2 cm^2 for each part of the experiment. Amino acids were dissolved in Thyrode solution with pH value 6.9 on the mucosa side and 7.4 on the serosa side. A constant temperature of 39 °C was maintained during the experiment. In the first part of experiment, lysine passage in 0.5 $mmol.l^{-1}$ was measured when lysine was the only amino acid in the Thyrode solution. In the second part of experiment leucine, methionine, ornithine and arginine (each of them in 20 $mmol.l^{-1}$ concentration) were added to lysine (in 0.5 $mmol.l^{-1}$ concentration). When the amount of lysine on the serous side after incubation was compared in both parts of experiment, it was found that the tested amino acids affected the passage of lysine through the rumen epithelium. Leucine, arginine, methionine and ornithine decreased the lysine passage by 62, 62, 68 and 79%, respectively.

PROTOZOA AND RUMEN METABOLISM

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The experiment was carried out on sixteen 5-month-old lambs with ruminal fistulas. The animals were divided into four groups (D – defaunated, T – totally refaunated, P – partially refaunated, I – intact). Significant differences in the total nitrogen in rumen fluid were only found between groups D and I. The values of bacterial nitrogen in the rumen and mutual relationship among the groups could be expressed by the following ratios: D > P > T > I.

RESTRICTION FRAGMENT LENGTH POLYMORPHISMS IN RUMEN FUNGI

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Rumen anaerobic fungi have been assigned to the family of the Neocallimasticaceae of the class Chytridiomycetes. Six genera have been morphologically recognized within this family: Neocallimastix, Piromyces, Caecomyces (monocentric fungi), and Orpinomyces, Anaeromyces, Ruminomyces (polycentric fungi). The main problem of species identification is extensive morphological variation of isolates depending on environmental conditions. In this study we attempted to determine the feasibility of using restriction fragment length polymorphism (RFLP) analysis to distinguish the isolates of rumen anaerobic fungi. RFLPs was applied to seven polycentric fungi K1, Zu1, Zu2, LG1, LG2, ALP, DK15 (not yet identified), and five monocentric fungi Cx (*Neocallimastix frontalis*), RE1 (*Neocallimastix patriciarum*), PJ1/8, BV2, DK5 (not yet identified). Fungi were isolated from different animals living in different territories. The EcoRI restriction of genomic DNAs revealed three different cleavage profiles. I. The pattern for three monocentric strains Cx, RE1, and DK5 (3.9, 3.4,1.8 kb). II. The pattern for four polycentric fungi K1, Zu1, LG1, and DK15 (3.4, 2.5, 1.7 kb). III. The pattern for polycentric fungi Zu2, LG2 and ALP (3.9, 3.0, 1.7kb). The restriction fragment pattern for strain PJ1/8 resembled group II, and pattern for strain BV2 was similar to group III. The hybridization of EcoRI digested DNA samples with the probe containing repetitive element RS2 proved the high similarity among isolates in group III and group II (with exception of strain DK15). The isolates of the group I were less homogenous. Strains BV2 and PJ1/8 exhibited the individual fingerprints.

THE INFLUENCE OF L-TRYPTOPHAN LOADING ON THE PINEAL GLAND, PLASMA AND GASTROINTESTINAL TRACT MELATONIN CONTENT IN CHICKEN

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Melatonin is a hormone synthesized predominantly in the pineal gland but recently local production in the gastrointestinal tract (GIT) was suggested. Biosynthesis of melatonin starts from the amino acid L-tryptophan (L-Trp) and therefore the aim of our study was to ascertain if application of L-Trp is able to increase melatonin concentration in the pineal gland, plasma and GIT of birds. Chickens of both sexes (2–3 weeks old) were kept from hatching under a 12L : 12D lighting regimen with feed and water available *ad libitum*. L-Trp was given orally as a warm solution (37 °C) by intragastric gavage (150 mg/1 000 g of body weight). Two experiments were performed with sampling 60 min after L-Trp administration during the light time

and in the middle of the dark and light period 3 hours after loading of L-Trp. No significant increase of melatonin 60 min after the L-Trp load was found in the pineal gland and GIT. However, an increasing trend was observed in plasma (P = 0,055). A significant increase of daytime pineal melatonin concentration in comparison with control was found 3 hours after the L-Trp load. Melatonin levels in the plasma and GIT remained unchanged in this trial. During the dark time L-Trp did not induce any significant alterations of melatonin concentrations in the studied biological materials. Present results are in agreement with those reporting a presence of melatonin in the GIT but we did not confirm a massive elevation of melatonin during the daytime in chickens after L-Trp treatment. Our findings indicate that an availability of L-Trp can modulate melatonin levels but administration of L-Trp failed to induce serious changes of the melatonin rhythm derived from the pineal gland.

CHITINOLYTIC ENZYMES OF ANAEROBIC RUMEN FUNGI

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Chitin is the principal structural component in the cell wall of anaerobic fungi that inhabit the rumen. Chitinolytic enzymes are produced by these microorganisms for their basic physiological needs. The fungal strains *Orpinomyces joyonii* A4 and *Neocallimastix patriciarum* C_x were cultivated in the medium M10 with a mix of cellobiose and glucose as the growth substrate. In both fungi the endochitinase, N-acetylglucosaminidase, chitosanase and chitin deacetylase activities were measured in extracellular, cytosolic and cell wall fractions. Activity of chitin deacetylase was found mainly in the extracellular fraction of both fungi (269 and 5 769 ng glucosamine/h/ml for C_x and A4, respectively). Chitosanase activity was dominant in cell fractions. In the culture of strain C_x the highest activity was observed in cell wall fraction (12 290 ng glucosamine/h/ml) and in the culture of strain A4 in cytosolic fraction (12 540 ng glucosamine/h/ml). Endochitinase dominated in extracellular fraction of A4 (27 600 ng N-acetylglucosamine/h/ml) and in cytosolic fraction of the strain C_x (3 680 ng N-acetylglucosamine/h/ml). The activity of N-acetylglucosaminidase was not detected in any fungal fraction tested. In comparison with bacterial chitinolytic complex, the main difference is the lack of fungal N-acetylglucosaminidase activity and lower production of endochitinase activity by anaerobic fungi.

HYDROLYTIC ENZYMES OF ANAEROBIC FUNGI: DEGRADATION OF CELLULOSE

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The fungi, polycentric species *Orpinomyces joyonii* A4 and monocentric species *Caecomyces communis* C_x were grown on microcrystalline cellulose or alfalfa hay and monitored over 5 day period for fermentation products and activities of endoglucanase and β-glucosidase. The major fermentation products of these fungal strains were formate, acetate and ethanol. Both fungi also produced variable amounts of lactate, CO_2 and hydrogen. Endoglucanase and β-glucosidase activities were measured in cell wall, cell extract and extracellular fractions. Highest endoglucanase activities were found in extracellular fraction of A4 culture grown on microcrystalline cellulose (397.7 μg glucose/ml/h) and on alfalfa hay (471.7 μg glucose/ml/h), respectively. The β-glucosidase activity was highest in extracellular fraction of JB1 culture grown on microcrystalline cellulose (1 159 μg glucose/ml/h). In general, polycentric fungus *O. joyonii* A4 produced endoglucanase mainly into extracellular fraction and β-glucosidase bound to the cell wall. On the opposite, in the culture of monocentric strain *C. communis* JB1 both enzymes predominated in extracellular fraction. In cultures of *O. joyonii* grown on microcrystalline cellulose, there was observed production of Yellow Affinity Substance (YAS), with similar properties to the YAS from *Clostridium thermocellum*. This compound was involved in adsorption of fungal endoglucanases to microcrystalline cellulose in a wide range of pH (from pH 5–8) and temperature (30 to 60 °C). In the presence YAS the adsorption rate of endoglucanase onto microcrystalline cellulose was significantly higher.

HISTOCHEMISTRY OF ALKALINE AND ACID PHOSPHATASES IN PHEASANTS UNDER THE CONDITIONS OF ACUTE INTOXICATION BY SELECTIVE HERBICIDE

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Histochemical evaluation of alkaline phosphatase and acid phosphatase was carried out in liver, kidney, and small intestine of the control group of pheasants (5), and survived individuals (1st experimental group – 1 pheasant, 5 ml/kg b.w.; 2nd experimental group – 2 pheasants, 4.5 ml/kg b.w.) sacrificed by jugular incision. In the control group of animals the mild density of reaction product of alkaline phosphatase was determined at the top of the small intestine villi, and high density in the middle part of the microvillous zone of the small intestine. The mild density of reaction product of this enzyme was observed in all villi of both experimental groups of pheasants. Comparing samples of the liver from the experimental and the control pheasants it was found to be located in the hepatocytes microvilli towards intercellular biliary canaliculi. Activity of this enzyme in the control group of pheasants was high to very high. In both experimental groups of animals the density of reaction product of alkaline phosphatase in the liver parenchyma was partially high to very high passed into some areas with

very low activity of this enzyme. In group I of the experimental animals these areas were more expressive. The high to very high activity of alkaline phosphatase in the epithelium of kidney canals in the control group of animals was observed. In both experimental groups of pheasants the activity of this enzyme in the epithelium of kidney canals was high to very high passed into some areas with very low activity. In all experimental animals in the cytoplasma of enterocytes no significant changing the activity of acid phosphatase was observed. In both experimental and the control animals the similar picture was observed in the liver. Mild to high density of reaction product of acid phosphatase was determined in the kidney of the control group of pheasants. Comparing samples of the pheasants an evident decreasing of this enzyme activity was observed in both experimental groups of animals.

LACTATE DEHYDROGENASE RELEASE AS A MARKER OF CYTOTOXICITY

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A variety of methods has been utilized to measure cellular death. Some of them are based upon the measurement of vital dye exclusion, release of small endogenous or exogenous compounds or the uptake of fluorescent pH sensitive dye. Other methods utilize the release of intracellular enzymes. The measurement of lactate dehydrogenase level (LDH) is one of the most widely used and accepted methods for measuring cellular death/lysis. The cytotoxicity was defined as the release of LDH from lysed cells as a percentage of the highest LDH activity. In our work, the effect of zinc pretreatment on cadmium cytotoxicity was examined. Zinc pretreatment decreased the release of LDH at low concentrations of Cd. LDH activity in the medium of the control cells was 58.09 ± 2.60% against 51.13 ± 23,17% in the medium, when the cells were influenced by zinc ($P < 0.001$). At 5 μM Cd, amounts of LDH were 64.12 ± 1.30% and 60.01 ± 2.38% with Zn pretreatment ($P < 0.001$). At 10 μM, the activity of LDH was 68.32 ± 1.43% against 62.88 ± 1.51% ($P < 0.001$) and at 25 μM 72.88 ± 1.56% against 65.97 ± 1.83% ($P < 0.001$).

THE EFFECT OF CADMIUM ON SELECTED HEMATOLOGICAL PARAMETERS IN LAYING HENS

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In a biological trial with laying hens selected haematological indices after long-term Cd exposure have been studied. Laying hens were divided into eight groups as follows: Groups 1, 3, and 5 were experimental (0.3; 0.6; 6.0 $mg.kg^{-1}$ $CdCl_2$, respectively); groups 2, 4, and 6, with the same Cd concentrations and supplemented with vitamin D_3. K1 was control group and K2 was control group supplemented with vitamin D_3. Evaluating the erythrocyte (Ec) count throughout the experiment, statistical significance ($P < 0.05$) between control group (K1) and experimental group 5 with highest Cd supplementation was found. In the course of the experiment, a slight decrease in Ec was observed depending on the time of Cd administration. Throughout the experiment an increasing, insignificant tendency of Lc count was observed. In spite of this fact Lc counts both in control and experimental groups ranged within the physiological values, i.e. 20–60 $G.l^{-1}$. In all experimental groups, Hb values were found to be lower than the given physiological value for Hb, i.e. 9.39 $g.dl^{-1}$. Throughout the experiment a slight insignificant decrease in Hb values was recorded. The decrease in Hb content in blood could be due to Cu and Fe deficiency caused by decreased Zn resorption by the effect of Cd.

BIOLOGICAL TREATMENT OF WHEAT STRAW BY WHITE-ROT FUNGI

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This study evaluated thirteen white-rot basidiomycetes for their potential to improve the ruminal degradation of wheat straw. *Pleurotus ostreatus* (PO), *Pleurotus ostreatus – mutant* (PO–M), *Trametes gibbosa* (TG), *Lyophyllum ulmarium* (LU), *Polyporus ciliatus* (PC), *Polyporus brumalis* (PB), *Lentinus tigrinus* (LT), *Phelinus laevigatus* (PL), *Hericium clathroides* (HC), *Daedalea quercina* (DG), *Inonotus andersonii* (IA), *Inonotus obliquus* (IO) and *Inonotus dryophilus* (ID) were incubated on wheat straw for 30 days at 28 °C. Detergent fiber, crude protein and *in vitro* dry matter digestibility (IVDMD) were determined. The results showed increasing crude protein and ash contents in all fungus-treated straw. IVDMD values were increased in straws treated with most fungi and decreased in straws treated with LU, LT and PB, respectively. Relative to untreated wheat straw, the detergent fiber content – neutral detergent fiber (NDF) and acid detergent fiber (ADF) – was significantly reduced in the most fungi-treated straw and less reduced in the straw treated with IA, IO, ID, LT and PL, respectively. Out of the three fractions – hemicellulose, cellulose and lignin, hemicellulose showed the largest proportionate loss, whereas lignin the smallest one in the most fungi-treated straw. It is evident, that most of tested fungi are suitable to convert wheat straw to higher quality ruminant feed.

PROTEIN AND LIPID CONTENT OF RUMEN, ABOMASUM, LARGE INTESTINE, SMALL INTESTINE MUCOSA OF CATTLE

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Digestion in separate compartments of the digestive tract of ruminants is closely tied with their morphofunctional peculiarities, although physiological aspects of these peculiarities are not studied sufficiently. Taking into consideration the above mentioned fact, the aim of our work was a comparative investigation of protein content and correlation of its separate fractions, on the one hand, and content of lipids and correlation of their separate classes on the other hand, in rumen, abomasum, duodenum and large intestine mucosa of 2 years old bulls. Protein content of these tissues was determined using a biuretic method, correlation of separate protein fractions – using electrophoresis in polyacrylamide gel, lipid content by weight method after extraction in chloroform–methanol 2 : 1, correlation of separate lipids classes by thin layer chromatography. It has been determined that protein content in the small and large intestine and in abomasum mucosa was higher than in rumen mucosa ($P < 0.05$), in the mucosa of small intestine than in the large intestine mucosa ($P < 0.05$). In the mucosa of abomasum, small and large intestines 9–10, and in rumen – 7–8 protein fractions were found that were distributed according to their electrophoretic moiety. The total lipid content of phospholipids and cholesterol contents in abomasum, small and large intestines mucosa were higher than in rumen ($P < 0.05$), but differences between two compartments of intestine are not significant. Obtained results demonstrate the relation between the ultrastructure of cells of separate compartments of digestive tract of cattle and separate fractions of proteins and lipids contents in them.

PRODUCTION HEALTH OF SHEEP BRED IN THE EMISSION AREA OF COPPER PRODUCING WORKS AND ITS AFFECTION

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Our task was to observe the production health affection of sheep in the area of central Spiš which is polluted by industrial waste from copper producing works during the years 1995–1996. 1 520 sheep were fed the feed mixture OV-05 DZ fortified with 3 000 g of ammonium molybdate and 6 000 g of sodium sulphate per 100 kg of mixture for three weeks in January 1995 and 1996 . Daily dose of mixture was 0.1 kg per animal. We followed dynamics parameters of haematologic, hepatal and mineral metabolism. Effectiveness of feed with medical supplements was already manifested by gradual adjustment of the observed indices during February. Majority of analysed parameters were in excess of the physiologic range mostly in 1996. Copper accumulation exceeded the maximum admissible amount in the liver of sheep deceased in the area of copper producing works in 1995 and 1996.

THE EFFECTS OF ROOIBOS TEA (*ASPALATHUS LINEARIS*) ON JAPANESE QUAIL INTERMEDIARY METABOLISM AND EGG PRODUCTION

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Rooibos tea contains phenolic compounds and exhibits antioxidant and superoxide anion scavenging activity. The aim of presented work was to study the effects of Rooibos tea on Japanese quail intermediary metabolism and egg production. One year old Japanese quail hens were divided into two groups with high and low egg production. One half of each group was provided with Rooibos tea instead of drinking water for 4 month. The egg production was recorded daily. The birds were killed at 16 months of age and the body weight, weight of organs (heart, liver, gut, intestine), abdominal fat, and the parameters of intermediary metabolism in plasma (glucose, total proteins, albumins, creatinine, uric acid, cholesterol and triacylglycerols) were estimated. The egg production in both high and low egg-laying group, during the whole experiment, was significantly higher in the tea drinkers. At the end of experiment there were no differences in body weight or weight of internal organs between the four groups. There were not found any detectable effects of Rooibos tea treatment on concentration of glucose, total proteins, albumins or uric acid. There was lower creatinine concentrations in plasma detected in tea drinking groups. Significant decrease of triacylglycerols and cholesterol concentration in plasma was observed in the low egg production group which drunk water. Results of these studies suggest that Rooibos tea could improve physiological conditions in the older Japanese quail.

METABOLISM OF SECONDARY INTERMEDIATES IN THE SYNTROPHIC RUMEN BACTERIA

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The classical example is the syntrophy of *Streptococcus bovis* or *Butyrivibrio fibrisolvens* and other bacteria producing lactate, formate etc. with the cells of *Megasphaera elsdenii* which form propionate by assimilating lactate by the acrylate metabolic pathway. In the end of fermentation in *S. bovis* we have discovered 10–20 times more lactate than in *M. elsdenii*. Exogenic formate in the 11 mM and higher concentrations influences both bacteria in different ways. It clearly inhibits ammonia formation and other processes especially in *S. bovis*. It intensifies the activity of NAD-dependent lactate dehydrogenase by 60%, while in *M. elsdenii* activity is decreased by 40%. The activity of NAD-depending formate dehydrogenase is reduced by 50% in *S. bovis* and increases by 20% in *M. elsdenii*. In both bacteria the activity of the following intracellular enzymes: aconitase, isocitrate dehydrogenase, fumarase, malate dehydrogenase and others changes in a peculiar way. The discovered alterations show that in *S. bovis* the exogenic formate under certain conditions may assist in assimilating polysaccharides which ferment to lactate, and in *M. elsdenii* it activates the utilization of lactic acid. It should be noted that in the *B. fibrisolvens* culture, which was growing on glucose and xylose, not only great production of butyrate (9–11 mM), acetate (7–11 mM) and lactate (6–7 mM) was observed but also great production of formate (12–15 mM). It is interesting that in this bacteria no activity of phosphoketolase was discovered during the metabolism of two substrates, while the activity of this enzyme was high in the control strain *Lactobacillus plantarum* 185.

THE USE OF HPLC IN THE DIAGNOSTICS OF EXOCRINE ACTIVITY IN THE PANCREAS OF FARM ANIMALS

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Eight clinically healthy 16 months old hens, seven clinically healthy 14 days old male calves, six 3–5 months old pigs were used in the experiment. During the preparatory period, the animals were fed without addition of soybean flour. After fasting which lasted 24 h, the animals were administered the substrate ALTAB (4-(N-acetyl-L-tyrozyl)-aminobenz oic acid), always at an amount of 250 mg ALTAB/kg of the live weight. Blood was taken 3 hours after administration of the substrate. Then, during the 7-day experimental period, the soya flour containing protease inhibitors was added into the feed. After 7 days, the animals were given the same amount of the substrate ALTAB again and the concentration of PABA (P-aminobenzoic acid) in blood was examined. After feeding of soya flour, the plasma concentration of PABA increased from 17.5 $\mu mol.l^{-1}$ prior to the administration to 27.3 $\mu mol.l^{-1}$ after feeding in calves and from 203.8 to 349.2 $\mu mol.l^{-1}$ in hens. In pigs the average plasma concentration of PABA was 174.8 $\mu mol.l^{-1}$ prior to the experiment. In pigs, the 7 days lasting feeding of the soya flour extract, in contrast with the effect of protease inhibitors in calves and chickens, decreases the plasma concentration of PABA to 33.0 $\mu mol.l^{-1}$. Feeding of protease inhibitors leads to the increased size of the pancreas and to the higher production of the pancreatic juice, thereby also to the higher production of chymotrypsin in the small intestine. In pigs, the excretion of the pancreatic juice is not higher. The administered inhibitor inactivates the definite part of chymotrypsin in the small intestine and consequently, the plasma concentration of PABA decreases. The results suggest that in pigs, the soya inhibitors neither damaged pancreas directly nor stimulated the higher production of the pancreatic juice. The effect of protease inhibitors present in the fed soya flour was not the same in all observed animal species.

RELATIONSHIP BETWEEN PLASMA VERY LOW DENSITY LIPOPROTEINS AND FATNESS IN BROILERS

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Body weight at killing age was the main selection criterion in broiler production for a long time. It showed some negative results (high fatness, degenerative changes in skeleton, decreased reproduction and increased mortality). Therefore other, alternative selection criterions for selection against body fat were searched. The level of plasma very low density lipoproteins (VLDL) would be one of them. Our experiment confirmed the possibility of prediction of abdominal fat content using a rapid turbidimetric assay for plasma very low density lipoproteins (VLDL). Broilers (males) of 2 different hybrid lines were reared to age 42 days. They were fed with modified feed mixture. It contains relatively low concentration of fat (about 25 g/kg). Measurements of plasma VLDL concentration were effected in plasma from 5-week-old broilers. We used a turbidimetric method for plasma very low density lipoproteins developed by Griffin and Whitehead. This method is based on selective precipitation of VLDL with heparin and Mg^{2+}. In addition to the level of VLDL we used the samples of plasma for measurements of the mass of cholesterol and total body lipids. After killing we provided carcass analyses and measurements of abdominal fat. Birds were selected for high and low level of VLDL. The birds with a low level of VLDL had a significantly

lower content of total body lipids, lower content of cholesterol in blood plasma and abdominal fat. There were, however, no significant effects of plasma VLDL on body weight and percentage yield of broilers.

THE EFFECT OF COBALT AND COPPER SUPPLEMENTATION ON THE RUMEN CILIATE POPULATION IN SHEEP

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The effect of physiological doses of sulfate form of copper (12 mg.kg^{-1} DM), cobalt (2 mg.kg^{-1} DM) and cobalt + copper (2 + 12 mg.kg^{-1} DM) in two different diets on the rumen protozoa of four Merino sheep with rumen cannulae was investigated. The number of *Entodinia* spp., trichostomatid protozoa (*Dasytricha* plus *Isotricha*) and large protozoa (*Polyplastron multivesiculatum* plus *Ophryoscolex caudatus tricoronatus*) was counted in the rumen fluid 3 h after feeding the animals. The experiment lasted 30 days, the first 14 days were an adaptation period after changing the diet. The number of *Entodinia* spp. significantly increased with diet A (complete food ration = meadow hay + feeding mixture + corn + molasses + mineral supplement + treated beech sawdust) without microelement supplementation. No significant effect of Co, Cu or Cu + Co supplementation on the growth of *Entodinia* spp. was observed with the diet A. The supplementation of Cu significantly decreased the number of *Entodinia* spp. with the diet B (meadow hay + barley meal), when their mass was decreased in the rumen with the diet. The number of trichostomatid protozoa was significantly decreased with the diet A, which was probably due to feeding molasses. After supplementation with Co, their growth was significantly higher with the diet A. No significant effect of Cu or Cu + Co supplement on the growth of trichostomatids was observed either with the diet A or the diet B. No significant effect of Co, Cu or Cu + Co supplementation on the growth of *Polyplastron m.* and *Ophryoscolex c.t.* was observed either with the diet A or the diet B.

ANTIOXIDANT STATUS IN COWS IN THE NORTH-EAST OF POLAND

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The aim of this paper is to present the activity of blood superoxide dismutase (SOD) and glutathione peroxidase (GPX) in cows from the North-East of Poland. The experiment was performed on 36 cows aged 4–7 years with milk yield about 4 200 l per year. All animals belonged to the Black and White breed. Taking into account regional conditions, the animals were allotted into 3 groups. During the grazing season the animals were kept on pasture, while in winter their diet consisted of grass silage, hay and concentrate. Blood samples were taken twice a year from all the animals to determine SOD and GPX. First time during dry period (1 week before calving) and second time in average milk yield period. SOD and GPX activity were determined with Randox kits. The results were evaluated statistically by Student's test. The role of SOD is to accelerate the dismutation of the toxic superoxide radical, produced during an oxidative energy process to hydrogen peroxide and molecular energy. Superoxide dismutase is a Cu and Zn dependent enzyme. Glutathione peroxidase is a selenium dependent enzyme which is found in most animal tissues. GPX catalyses the degradation of organic hydroperoxides and hydrogen peroxides. SOD activity in erythrocytes of cows from group A, B and C during dry period was 52.8 ± 4.8; 89.4 ± 9.2; 73.2 ± 5.5 U/mg Hb, respectively, however in average milk yield period it was statistically lower 38.9 ± 4.1; 69.2 ± 7.8 and 51.3 ± 4.7 U/mg Hb, respectively. GPX activity in the plasma of cows from group A, B and C in dry period was 242.8 ± 21.4; 333.5 ± 20.3 and 299.7 ± 26.3 U/dm^3, respectively. The mentioned results were statistically higher ($P \leq 0.05$) than in average milk yield period: 198.5 ± 12,5; 222.4 ± 17.7 and 241.7 ± 20.9 U/dm^3, respectively. The lower activity of the enzymes in the blood of cows in the milk yield period can be dependent on an increase of elimination of trace elements.

BACTERIAL ENZYMES INVOLVED IN CHITIN DEGRADATION IN THE RUMEN

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Chitinolytic microorganisms are responsible for the inhibition of fungal cellulases in the rumen. Four bacterial isolates were used for this study. The first one, *Clostridium tertium* CHK5, was isolated from the rumen of cow. Other three *Clostridium sp.*, OV12, OV13 and OV14 were isolated from the rumen fluid of sheep. All of them were able to inhibit the growth of anaerobic fungi. Carbohydrate utilization tests showed high similarities among ovine isolates but they were different from isolate CHK5. There were estimated activities of different enzymes of chitinolytic complex. Endochitinase activity was highest in the extracellular fraction of the strain CHK5 (46.17 μg N-acetylglucosamine/ml/h). The same activity in cell-bound fraction was highest in the strain OV14 (16.48 μg N-acetylglucosamine/ml/h). Activity of N-acetylglucosaminidase was highest in the culture of CHK5, in both cell-bound (3.40 μg N-acetylglucosamine/ml/h) and extracellular fraction (48 μg N-acetylglucosamine/ml/h). Chitosanase exhibited the highest activity in extracellular fraction of *Cl. sp.* OV14 (5.15 μg glucosamine/ml/h). Chitin deacetylase activities were detected mainly in extracellular fraction and the highest was in the culture of *Cl. sp.* OV 13 (0.477 μg glucosamine/ml/h). Electrophoresis of native extracellular and cell proteins confirmed

similarities of isolates OV12 and OV13. They were different from the other two bacterial strains. Zymogram of these proteins showed that chitinases are bound in high molecular complexes (MW higher than 100 kD). Final products of chitinase degradation were glucosamine, N-acetylglucosamine and a spectrum of chitin oligosaccharides.

THE EFFECT OF VITAMIN D_3 ON CHYMOTRYPSIN ACTIVITY IN THE DROPPINGS OF LAYING HENS AFTER AN EXPOSURE TO Cd

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In the experiment with laying hens, the effect of both vitamin D_3 and cadmium on chymotrypsin activity has been studied. Laying hens were divided into eight groups as follows: Groups 1, 3, and 5 were experimental (0.3; 0.6; 6.0 $mg.kg^{-1}$ $CdCl_2$, respectively); groups 2, 4, and 6 with the same Cd concentrations and supplemented with vitamin D_3. K1 was control group and K2 was control group supplemented with vitamin D_3. In groups 1–4, ACHT activities were rather high at the end of the experiment. An obviously low ACHT activity was seen in groups 5 and 6 (182.9; 213.5 $U.g^{-1}$, respectively). A low activity was observed due to the strong inhibition of chymotrypsin by Cd at increased Cd concentration. In group K1, considerably high mean value of ACHT activity was found out. The comparison of group K1 with groups 1, 3, and 5 revealed significant values in all groups. In group K2, even a higher value of ACHT activity was obtained. The comparison of groups 2, 4, and 6 with group K2 revealed significant values in all groups. At the highest Cd concentration, ACHT activity was less pronounced. A strong competitive inhibition of ACHT by Cd as well as stronger Cd absorption occurred there. It is possible to eliminate the toxic effect of Cd at small amounts in the feed and/or feed mixture by higher vitamin D_3 supplementation.

THE EFFECT OF CADMIUM ON LACTATE DEHYDROGENASE AND ALKALINE PHOSPHATASE ACTIVITIES IN LAYING HENS

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In the course of 6 months, the effect of cadmium and preventive dose of vitamin D_3 on alkaline phosphatase (ALP) and lactate dehydrogenase (LD) activities in laying hens was studied. Laying hens were divided into eight groups as follows: Groups 1, 3, 5 were experimental (0.3; 0.6; 6.0 $mg.kg^{-1}$ $CdCl_2$, respectively); groups 2, 4, 6 with the same Cd concentrations and supplemented with vitamin D_3. K1 was control group and K2 was control group supplemented with vitamin D_3. During the experiment, a decrease in ALP serum levels in all experimental groups was recorded. The comparison of group K1 with groups 1, 3, 5 as well as that of group K2 with groups 2, 4, 6 did not reveal any significant differences. The effect of cadmium on ALP activity is equivocal. In groups with vitamin D_3, a slightly increased, insignificant activity of ALP was found out. We suppose that these values were influenced by vitamin D_3. In the course of the experiment, a slight decrease in LD serum levels in all groups was observed. In group K1, the values were almost equable in the course of the whole experiment. In group K2, a slight insignificant increase in LD levels was recorded. When comparing LD activities, a slight insignificant decrease was observed depending on increasing Cd dose. In groups with vitamin D_3 a slight insignificant protective effect of vitamin D_3 on LD activities was recorded.

THE EFFECTS OF FOOD RESTRICTION ON DAILY HEART RATE, BLOOD PRESSURE AND BODY TEMPERATURE IN FOWL: A TELEMETRIC STUDY

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The aim of presented experiment was to examine, whether the diurnal changes in behaviour of restricted-fed birds are reflected by corresponding changes in heart rate (HR), blood pressure (BP) and body temperature (T), and how the circadian patterns of these physiological measures differ between restricted-fed and *ad libitum*-fed states. Three female broiler breeders (Ross 1, Ross Breeders, UK) were kept in individual cages under LD cycle 12 : 12 (lights on at 07.00 h). Water was provided *ad libitum*, and a single restricted food ration was provided daily at 09.00 h. At 16 weeks of age the feeding regime was changed from restricted to *ad libitum*. At 12 weeks each bird was implanted with a radiotelemetric transmitter (Data Sciences International, USA). Physiological measures were recorded during two 24-h periods at 15 weeks of age (restricted-fed phase), and during another two 24-h periods at 17 weeks (*ad libitum*-fed phase). There were marked circadian variations in BP, HR and T in the restricted-fed phase. During the night, HR and T were lower, and BP higher, than during the day. All 3 measures were highest during the 09.00 h meal (eaten in ca. 5 min). Previously reported declines in oral stereotyped behaviour of restricted-fed birds after the meal coincide with declines in HR and BP. Although there were similar differences in HR, BP and T between night and day in the *ad libitum*-fed phase, their magnitude was much reduced. HR and BP were consistently higher in *ad libitum*-fed phase, and nocturnal hypothermia was then minimal. A more detailed study of the relationships between food restriction, physiology and behaviour is in progress.

EFFECTS OF GOLDTHIOGLUCOSE ON ERYTHROCYTE GLUCOSE-6-PHOSPHATE DEHYDROGENASE ACTIVITY AND MALONDIALDEHYDE PRECURSORS CONTENT IN MICE TISSUES

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Experiments were conducted to determine whether goldthioglucose (GTG) application, known to produce lesions in the hypothalamus and other tissues in mice, is associated with increased lipid peroxidation and changes in antioxidative defense mechanisms. The glucose-6-phosphate dehydrogenase (G6PD) activity in red blood cells (RBC) and values of malondialdehyde (MDA) precursors in some tissues were determined. Three groups of 6 ICR adult male mice were injected for three consecutive days with either saline (controls) or GTG dissolved in saline, at a dose of 0.10 $mg.g^{-1}$ or 0.15 $mg.g^{-1}$ of body weight. The third day, two hours after injection, controls and groups with GTG were decapitated under aether anaesthesia and blood, brain, liver and kidneys were removed for analysis. In GTG-mice the G6PD activity in RBC increases to 298.60 ± 16.20 $mU.10^9$ Ec and 349.38 ± 17.46 $mU.10^9$ Ec relative to the GTG dose, compared to 258.2 ± 14.46 $mU.10^9$ in control animals. The increase relative to GTG dose and compared to control animals was statistically significant ($P < 0.001$). The content of MDA precursors in the liver and in the kidneys of GTG-mice significantly increases with $P < 0.001$ and $P < 0.02$, respectively. The MDA precursors content in the brain was also increased, but the difference compared to the controls was not statistically significant.

SOMATOTROPIN MAY DECREASE ADIPOSE TISSUE LIPOGENESIS BY MODULATION OF GTP-BINDING PROTEINS G_q/G_{11}

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In vivo and *in vitro* experiments have demonstrated that bovine somatotropin (bST) decreases lipogenesis in goat adipose tissue. The purpose of this investigation was to study the molecular basis for the inhibition of lipogenesis by bST in omental adipose tissue of young castrated male goats. Using ELISA competition assay in a preparatory study on one control and one bST treated animal an increase of GTP-binding proteins G_q/G_{11} concentration was observed, whereas the concentrations of G_S and $G_{i1,2}$ were not changed. Hence, in further experiment on four animals (two control, two bST treated) immunoblotting of omental adipose tissue membrane extracts was performed only with antiserum against C-terminal decapeptide of G_q/G_{11}. Following resolution of the membrane proteins in SDS-PAGE identified a polypeptide of some 42 kDa to be 170 and 180% higher in bST treated animals than in controls. These data suggest that bST treatment enhances signaling via phospholipase C-linked G_q/G_{11} proteins. When combined with our previous data, results suggest that bST inhibition of adipose tissue lipogenesis may be mediated by increasing the amount of G_q/G_{11}. (Supported by GA AS CR No A7-045608.)

THE LONG TERM EFFECT OF LOW PROTEIN DIET ON THE LEVELS OF GROWTH HORMONE AND INSULIN-LIKE GROWTH FACTOR I IN GROWING SHEEP

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Restrictions of nutrients in diet result in disturbances in the endocrine somatotrophic axis, which plays an essential role in the co-ordination of interactions leading to somatic growth of animals. One of the most important hormone that affects the growth of mammalian organisms is the growth hormone (GH), which influences the metabolism of protein and carbohydrates directly or indirectly by stimulation of insulin-like growth factors (IGFs) secretion. In ruminants, long term feeding on restricted energy or protein in diet resulted in an increase of serum GH concentrations. There are suggestions that the IGF-I level may be the best hormonal indicator of nutritional state of animals. It was found that in the sheep concentration of IGF-I was correlated with the level of energy in the diet. The present study was designed to investigate the influence of the low protein diet on the level of GH and IGF-I in blood plasma of growing female lambs and to elaborate the method of estimation of blood plasma IGF-I in this species. The experiment was undertaken on 4 pairs of growing ewes (/Merino x Romanov/ x Suffolk) subjected to the two levels of protein nutrition, low (8%) and high (18%) for a period of 3 months beginning at the age of 6 months. At the end of experiment, blood plasma was undertaken at 10 minutes intervals over hours for radioimmunological estimation of GH and IGF-I. The results showed that the mean concentration of GH (7.6 ± 5.4 ng/ml vs 3.9 ± 1.6 ng/ml) was higher in the group fed on a low protein diet. The level of IGF-I did not differ between both groups of ewes, fed at high and low level of protein in diet (40.2 ± 16.0 ng/ml vs 44.0 ± 16.0 ng/ml). In conclusions: restrictions of dietary protein lasting 3 months augment the GH but do not influence the IGF-I secretion in growing female lambs. (Supported by GA CR No 523/97/1220, and Polish Scientific Committee, No 5 PO6E 02410.)

INFLUENCE OF FOOD RESTRICTION ON BRAIN CATECHOLAMINE CONCENTRATION AND DOPAMINE RECEPTORS DENSITY IN FOWL

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The aim of this study was to assess the possible relationship between the degree of food restriction and brain dopaminergic activity. Fifteen broiler breeder females were divided into 3 groups, which received either a recommended commercial ration (R), twice that amount (2R), or ad *libitum* food (AL). At 60 days of age, birds were killed and their brains dissected into 6 regions: forebrain roof, basal telencephalon, diencephalon, mesencephalon, cerebellum and pons + medulla. Dopamine (DA) receptor densities were estimated by binding of [^{3}H]SCH 23390 (D_1) and [^{3}H]spiperone (D_2) and levels of DA and its metabolites DOPAC and HVA by HPLC. There were no significant differences in D_1 or D_2 receptor binding between the feeding treatments in any brain region tested. However, possible differences in more discrete areas cannot be excluded. The levels of DA in basal telencephalon were significantly higher in the R group than in the AL one (2 165 vs 1 595 pg/mg wet tissue, $P < 0.05$). On the other hand, there was significantly less DA in cerebellum (55 vs 65 pg/mg tissue, $P < 0.05$) and medulla + pons (125 vs 185 pg/mg wet tissue, $P < 0.05$) than in the AL birds. There were no significant differences in DOPAC and HVA levels between the different feeding treatment groups. The increased levels of DA in basal telencephalon found in restricted-fed birds are consistent with the results of our previous studies, showing stimulation and suppression of stereotypies following treatments with DA receptor agonists and antagonists, respectively.

THE EFFECT OF *ASPALATHUS LINEARIS* ON CHICK SKELETAL MUSCLE CELLS GROWTH IN CULTURE

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Aspalathus linearis (Rooibos tea – RT) extract contains natural antioxidants and scavenging agents. We investigated the effects of different concentrations of RT extract in medium on growth and changes of growth parameters of cultured chick embryonic skeletal muscle cells. Presence of 2, 10 and 100% of RT extract in the culture of primary cells significantly inhibited cell proliferation. The inhibition of cell growth reflected on decreased DNA, RNA and protein contents in primary cells culture as well as fibroblasts and myoblasts. The ability of the primary cells, fibroblasts and myoblasts to synthesize DNA and protein in the presence of RT extract, measured as an amount of [^{3}H]thymidine and [^{3}H]leucine incorporated into DNA and de novo synthesized protein, corresponded with decreasing DNA and protein contents in all three cell types. The inhibition effect of RT rose with increasing concentration of the tea extract in the culture medium. Ornithine decarboxylase activity (the rate-limiting enzyme in the conversion of ornithine into polyamines) was significantly affected only by 100% RT extract in every examined cell types. These results suggest that the inhibitory effect of RT extract on the growth of primary cells, fibroblasts and myoblasts is due to the potent scavenging activity of the RT extract.

EFFECT OF ENTEROCIN CCM 4231 IN THE RUMEN ECOSYSTEM

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The paper presents testing of enterocin CCM 4231 effect in the ruminal ecosystem as well as its effect towards listerial contamination. BAC CCM 4231 (produced by the ruminal isolate *Enterococcus faecium* CCM 4231) was used at a concentration of 3 200 AU/ml in our experiment. After its addition, cultivation of the rumen content was provided at 37 °C as well as at 30 °C. The best inhibition effect was observed towards enterococci at both temperatures (decrease of the total counts was from 10^8 cfu/ml to 10^1 cfu/ml) with a stronger inhibition effect concerning cultivation at 37 °C. Staphylococci were also inhibited, however with lower intensity (10^6 cfu/ml to 10^5–10^1 cfu/ml) at both temperatures. The growth of *E. coli* cells was suppressed from 10^7–10^6 cfu/ml to 10^5–10^1 cfu/ml at the temperatures used. In the case of BAC addition directly to growing strains (*Ent. faecium*, *Str. bovis* and *Listeria monocytogenes*) till 24h of fermentation significant inhibition effect was detected. It could be concluded that BAC CCM 4231 showed the antimicrobial activity also in the natural environment. Therefore, there is a real possibility for its application in biotechnological processes concerning the ecological problems and/or concerning ruminal metabolic problems.

MERCURY INFLUENCE ON THE ANTIOXIDANT ENZYME ACTIVITY OF *S. BOVIS* AND *S. RUMINANTIUM*

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In the present work we examined the influence of mercury (as Hg^{2+}) on the activity of antioxidant enzymes as superoxide dismutase (SOD), catalase (CAT) glutathione peroxidase (GSHPx) and glutathione reductase (GR) in two rumen bacteria species *S. bovis* and *S. ruminantium*. The activity of antioxidant enzymes was quite different in relation to cultivation. In aerobic cultivation of facultative *S. bovis* there was statistically important induction of SOD, GSHPx and GR activity in the presence of Hg^{2+}. In anaerobic cultivation only SOD was induced, activity of GSHPx remained unchanged and activity of GR was decreased at the highest concentration of Hg^{2+} (50 μg/ml). Anaerobe *S. ruminatium* grew well in the presence of 50 μg Hg^{2+} probably because of sulphide production, which appears to play an important role in metal detoxification of this bacteria. Antioxidant enzyme activity of *S. ruminantium* was lower than that of *S. bovis*. There were no SOD or CAT activities observed. GSHPx activity was almost 3 times lower in the presence of Hg^{2+} ions.

Concentration of thiobarbituric acid reactive substances (TBARS) which are considered as a biomarker of membrane lipid peroxidation was increased in the presence of 50 μg Hg^{2+}. Our results demonstrate that the influence of Hg^{2+} on the activity of antioxidant enzymes in *S. bovis* and *S. ruminantium* is different, which points to different ways of mercury detoxification.

THE RENAL FUNCTION OF LAMBS FED A LOW PROTEIN DIET AFTER LONG-TERM ADMINISTRATION OF VASOPRESSIN

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The effects of long-term administration of 1-desamino-D-arginine vasopressin (dDAVP, Adiuretin-SD, Ferring, Prague) on renal function were studied in young growing lambs. Subcutaneous injection of 10 μg dDAVP twice daily started two weeks after the birth of lambs and lasted for six months. Animals were kept on low protein diet six weeks before the measurements of renal function. The clearance experiments carried out two days after the last injection of dDAVP showed that renal urea reabsorption was significantly higher (30.04 ± 5.5 vs. 48.03 ± 5.41 $mol.min^{-1}$, $P < 0.05$) concomitantly with the increased plasma urea level (1.51 ± 0.06 vs. 2.21 ± 0.07 $mmol.l^{-1}$, $P < 0.001$) in dDAVP treated group. Long-term treatment with a vasopressin analogue did not influence the glomerular filtration rate (26.58 ± 4.12 vs. 27.11 ± 2.58 $ml.min^{-1}$, NS) and urine flow rate (0.53 ± 0.06 vs. 0.64 ± 0.09 $ml.min^{-1}$, NS). It is suggested that an increased plasma urea level in dDAVP treated lambs favours the larger recycling of endogenous urea nitrogen to digestive tract. The increased renal reabsorption capacity for urea in lambs after the six month treatment with vasopressin is supported by modified morphological development of the kidneys (Bizub V., Leng L., Res. Vet. Sci., *62*, 1997: 189.)

UTILIZATION OF HISTOCHEMISTRY IN VETERINARY MEDICINE

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By introduction of quantitative methods of evaluation histochemistry has become one of the fundamental directions in different branches of research. Enzyme studies offer very good information on the metabolic profile of the object of investigation under both physiological and pathological conditions. To prove enzymes as active substances and also for the determination of their activity mainly the light microscope is used. On the basis of detailed quantification of enzymatic activities and knowledge of their localization in the cells, such a group of enzymes can be chosen which directly reflects the functional conditions of the organs under investigation. Examination of the digestive tract under physiological conditions and during the malabsorptional syndrome by means of histochemical methods a marked decrease of lactase, aminopeptidase M, alkaline phosphatase, dipeptidylpeptidase IV and acid phosphatase could be stated in the diseased intestine. In mastitic dairy cows increased alkaline phosphatase, glucose-6-phosphatedehydrogenase, lactate dehydrogenase, acid phosphatase and β-glucuronidase were observed mainly in the epithelial cells. The results of our observations could be directly utilizable in biological research, in the common veterinary and medical field and also in the diagnosis of preclinical pathological changes.

MELATONIN PRODUCTION IN EMBRYONIC CHICK PINEAL CELLS TREATED WITH PHOSPHODIESTERASE INHIBITOR IBMX

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In the pilot study the effects of two 3-isobutyl-1-methyl-xanthine (IBMX) concentrations (5.10^{-4} and 5.10^{-5} $mol.l^{-1}$) on melatonin production in pineal glands isolated from 19-day-old chick embryos were tested during both the dark and light phases of the LD (12 : 12) cycle. For the subsequent experiments only the higher dose was used, since this one was more

effective. In the first experiment the effects of 3, 6, 9 and 12 hour treatment with IBMX on melatonin production of cultured pineal cells were measured. IBMX was supplemented to the medium at the end of the dark phase of the LD cycle, or subjective dark phase of DD or LL, respectively. Embryonic chick pineal cell melatonin production was significantly increased after 6h IBMX treatment in dark phase of LD cycle. The increase in melatonin production after the 3, 9 and 12 hours treatment with IBMX in comparison with control did not reach the level of statistical significance. All durations of IBMX treatment stimulated melatonin production in both DD and LL conditions. In the second experiment the effect of IBMX on melatonin production and cAMP efflux and accumulation after 6h treatment during the light phase of LD was studied. Significantly higher melatonin production after IBMX treatment during light phase of LD cycle was accompanied by a significant increase of cAMP efflux and higher accumulation of cAMP in cells. Our data suggest that IBMX increases melatonin synthesis in cultured pineal cells isolated from 19-day-old chick embryos.

INFLUENCE OF LOW MOLECULAR PHENOLS ON VFA PRODUCTION

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The experiment was carried out *in vitro* and fistulated sheep were used as a source of inoculum. The 100ml serum bottles were used for fermentation of meadow hay at 39 °C during 96 hours. The rumen content was mixed with McDougal's buffer (1 : 1) and added into the bottles (34 ml) containing 0.25 g of hay. In each incubator control test bottles contained rumen fluid without substrate. In other bottles meadow hay without additive or with one of the following phenolic compound was used: p-hydroxybenzaldehyde (PHBA), syringaldehyde (SA), vanillin (V) and vanillic (VA), syringic (SYA), hydroxycinnamic (HCA), ferulic (FA) and coumaric acids (CA) at the amount of 1, 5 and 10 mmol. The VFA were determined by gas chromatography using crotonic acid as an internal standard on Perkin-Elmer equipment. The results showed that total VFA were significantly decreased with 10 mmol of V and CA and enhanced with 10 mmol of SA. Acetate was enhanced with SA in all concentrations and with V in 10 mmol. Propionate was increased with V in all concentrations and with CA in 10 mmol. SA depressed P in all cases. VA and SA decreased iB only in 10 mmol. Butyrate was increased with SA at all concentrations and with HCA in 5 and 10 mmol but 10 mmol of V decreased it. Iso-valerate was decreased with all additives except PHBA, SYA and HCA. Valerate decreased after V, SA in 5 and 10 mmol and was enhanced after 1 and 5 mmol of VA and 10 mmol of V and CA. In conclusion it can be said that PHBA, SYA and FA had no effect on VFA production. The more effective were V and SA.

PHYSIOLOGICAL ASPECTS OF REGULATION AND CONTROL OF SHEEP *CORPUS LUTEUM* AND THEIR PRACTICAL USE

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The weight of ovaries and the blood serum concentration of progesterone were determined as well as the number of follicles visible on the surface in relation to the presence of *corpus luteum* on the ovary in the autumn period after Cloprostenol application. The ovaries of 43 sheep of the Tsigai breed were examined at the age of 2–4 years. The animals were divided into five groups. First group (I) was the control ($n = 6$). In the luteal phase of sexual cycle the animals of groups II to V were applied i.m. 125 g of cloprostenol in Oestrophan inj. Spofa preparation. The animals were killed at the intervals of 24, 48, 72 and 120 hours (h) from the preparation application. The ovaries after the fixation were weighed and *corpus luteum* was histologically investigated. Tertiary follicles on the surface were counted. In group I we demonstrated the significantly higher weight of ovaries with *corpus luteum* (CL) as compared with ovaries without CL ($P < 0.001$). The weight of ovaries with CL dropped significantly within 48 hours after luteolysis as compared with control ($P < 0.001$) and the difference in the ovary weight according to CL incidence disappeared almost completely. In comparison with groups III and IV, the weight of ovaries in ewes of group V increased statistically significantly ($P < 0.01$). This finding is a result of development of new CL after a passed ovulation. The concentration of progesterone was found to decrease rapidly from 8.43 mmol per l measured past before the second administration of D-cloprostenol (0th h) to 4.10 mmol per l 6 h after treatment, 1.65 nmol per l 6 h after treatment and 0.20 nmol per l 19 h after treatment.

METABOLISM OF PECTIN AND GLUCOSE IN RUMINAL BACTERIA

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Metabolism of pectin and glucose was studied in *Butyrivibrio fibrisolvens* 787 and *Lachnospira multiparus* ATCC 19207. Both substrates differed considerably in the composition of fermentation end-products in cultures of pectinolytic bacteria. Production of acetate was increased when bacteria were grown on pectin. A corresponding fall in production of other metabolites was found. Production of cell dry matter was higher in cultures supplied with glucose. The activity of aldolase (marker of the glycolysis) was high on both substrates. No activities of phosphoketolase (marker of the phosphoketolase metabolic route) and phosphogluconate-dehydrase/ketodeoxyphosphogluconate aldolase (markers of the Entner-Doudoroff

pathway) were found out. Thus, pectin monomers seem to be metabolized via glycolysis. Reasons of different metabolite profiles on pectin and glucose remain unclear.

PREIMPLANTATION EMBRYO DEVELOPMENT IN ICR MICE AFTER STREPTOZOTOCIN TREATMENT

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To investigate the significance of impaired insulin secretion on preimplantation embryo development, outbred ICR female mice were injected with a single dose of streptozotocin 130 mg (low) and 160 mg (subdiabetic).kg^{-1} 14–17 days before fertilization. Preimplantation embryos were collected on day 3 of pregnancy, four-eight cell embryos were cultured *in vitro* 48 h (day 5) and their cell number was estimated. After spontaneous ovulation the significantly different distribution pattern in comparison with controls was detected only in preimplantation embryos isolated from subdiabetic (160 mg.kg^{-1} streptozotocin) mice. Furthermore in this group after *in vitro* 48 h cultivation the incidence of degenerated embryos significantly increased. Analysis of cell number distribution in embryos after cultivation *in vitro* indicated the significant delay in cell proliferation in both experimental groups (130 and 160 mg.kg^{-1} streptozotocin) in comparison with control mice. After superovulation only a significant difference was found in the distribution pattern of embryos isolated on day 3 of pregnancy from subdiabetic (160 mg.kg^{-1} streptozotocin) mice. It could be concluded that in outbred ICR mice lower streptozotocin treatment (130 mg.kg^{-1}) influenced only cell distribution of *in vitro* cultured embryos after spontaneous ovulation. In ICR mice marked changes in preimplantation embryo development were detected only after subdiabetic (160 mg.kg^{-1}) streptozotocin treatment and during *in vitro* cultivation delayed effects of impaired insulin secretion resulted in the increase of embryo degeneration at the time after the third mitotic cleavage.

INHIBITORS OF SERINE PROTEASES AFTER SUPEROVULATION STIMULATION OF EWES

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The hormonal stimulation of ewes to superovulation has been accompanied by changes not only in the hormonal levels P_4, E_2 but also in antiproteolytic activities (AA) of blood plasma and follicular fluid. The significance of these changes depends on the breed (Merino, Tsigaja, Wallachian) and status (nongravid, gravid 1–2 months), in follicular fluid on the size of follicles, and on the methods of stimulation. 2 000 IU PMSG increased values AA of follicular fluid ($P < 0.001$), at the same time, values AA in follicles > 10 mm were higher. Mean values of AA in blood plasma were not increased significantly and there probably exist some local mechanisms in the ovary, which control the balance between proteolytic and antiproteolytic activities in every ovarian cycle.

CATECHOLAMINES AND MONOAMINE OXIDASE ACTIVITY IN SOME HYPOTHALAMIC STRUCTURES OF SHEEP AFTER HORMONE STIMULATION

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The influence of hormonal preparations of FSH at a dose 450 IU on the levels of catecholamines (norepinephrine, dopamine and epinephrine) and the activity of their degradation enzyme monoamine oxidase (MAO) in the hypothalamic regions regulating the reproductive system of sheep (area preoptica, eminentia mediana, corpus mammillare) and pineal gland were investigated in the oestrous period employing radiochemical methods. The administration of FSH resulted in a significant ($P < 0.001$) increases of dopamine levels in the area preoptica and corpus mammillare in the hypothalamus of sheep as compared to control groups with synchronized oestrus. Hormonal stimulation with FSH increased the levels of hypothalamic norepinephrine in the areas studied and these difference were significant in the eminentia mediana ($P < 0.05$) and corpus mammillare ($P < 0.05$). Significant ($P < 0.001$) changes in epinephrine levels were found in the corpus mamillare and area preoptica ($P < 0.005$). Our results indicate that the administration of FSH caused the most pronounced decrease of MAO activity in corpus mamillare ($P < 0.001$), where a significant increase in catecholamine occurred. The pineal gland reacted to the hormonal preparation by decreased levels of norepinephrine and dopamine ($P < 0.001$) and by an increase in MAO activity ($P < 0.001$). We suggest that FSH administration affects catecholamine levels and MAO activity in the studied areas of the brain of sheep by means of a feedback mechanism.

THE LEVELS OF CATECHOLAMINES IN THE BLOOD PLASMA OF SHEEP AFTER HORMONAL STIMULATION

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The effect of hormonal stimulation with FSH injection at the doses 360 IU and 480 IU FSH on the levels of plasma catecholamines (dopamine, norepinephrine and epinephrine) was studied by radioenzymatic methods during synchronized oestrus cycles of the sheep. Catecholamines were determined in the blood plasma before and 24, 48, 96 a 120 hours after

application of FSH. It follows from the results that the levels of plasma dopamine increased significantly ($P < 0.001$) 24 and 48 hours after FSH application. Furthermore, the levels of dopamine during the other time intervals observed compared with those of controls before hormonal stimulation, remained at a higher levels. A lower dose of the hormone 360 IU had a more pronounced effect on changes in the levels of plasma dopamine. Norepinephrine did not exhibit any significant changes in comparison with the plasma levels of dopamine in the sheep after hormonal stimulation with FSH. A statistically significant increase in plasma norepinephrine was recorded 24 hours after administration of FSH. During the other time intervals observed, its levels did not differ from the control values. Plasma epinephrine showed a significant increase 24 and 48 hours after FSH application but not later. The effect of FSH on plasma catecholamine levels was not dose-dependent and their increase was pronounced especially in the period of ovulation.

HEALTH ASPECTS OF UTILIZATION OF DEEP LITTER SYSTEMS WITH APPLICATION OF BIOTECHNOLOGICAL PREPARATIONS

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In order to decrease the negative influence of large-capacity technologies in farm on the environment, agricultural waste-water treatment plants were built on the farms. Wastewaters from animal farms are treated in these plants in such a way that in the first stage of treatment the solid and liquid fractions of slurry are separated on vibrating screens or belt presses. The liquid fraction is subsequently treated in several stages by the biological aerobic method and is discharged to a recipient. The solid fraction of slurry is stored on field dung hills or waste disposal sites and is subsequently applied to agricultural land. The disadvantages of the technologies mentioned include their high investment and operational costs. This problem can be resolved by utilization of deep litter using biotechnological preparations. Saw dust or short-cut straw is used as a substrate. At present, this system is used on more than 80 agricultural farms in Slovakia for housing pigs but also for poultry. In comparison with the litterless systems, the system mentioned provides large space for animals which can enjoy soft and warm bedding and live in conditions resembling more the natural way of keeping (deep-rooted behaviour) and the cannibalism is decreased. Very important aspect is the decrease in the production of ammonia and other toxic gasses in the animal house. From the point of view of the environment it is important that the production of wastes decreases together with more than 70% decrease in production of ammonia, decrease in the typical odour and the litter is turned to a high quality product by the end of the productive cycle.

INFLUENCE OF PHYSIOLOGICAL STATUS ON METABOLIC PROFILE IN COW BLOOD

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The aim of our work was to investigate the correlation between the physiological status of cows and biochemical indices in their blood which characterize various links of metabolism in their body. The total protein content and relative contents of separate fractions in blood serum, glucose, free fatty acids, separate free amino acids, carbamide, triacylglycerols, phospholipids and cholesterol concentrations and its fatty acid content were investigated at the 8th month of pregnancy and at the 1st and 7th month of lactation. It has been established that protein, triacylglycerol, phospholipids, cholesterol, carbamide, glucose, free fatty acids, free amino acids levels in the blood of pregnant cows were significantly lower than the same indices of lactating cows. This data suggest the increase of nitrogen retention in cow body during pregnancy, and the influence of transplacentaric transport of glucose, free fatty acids and free amino acids on their plasma concentrations is significantly higher at the beginning of lactation than at its end. These data demonstrate the enhancement of lipolysis in adipose tissue and proteolysis in skeletal muscles of cows during intensive lactation. The above data also suggest considerable differences in various free amino acids contents, and in concentration of some fatty acids in separate lipid classes in cow blood plasma.

RESTRICTION ENDONUCLEASES OF RUMEN BACTERIUM *SELENOMONAS RUMINANTIUM*

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Analysis of restriction and modification activities has revealed high diversity of nucleolytic activity within the natural population of *S. ruminantium*. At least 12 different restriction profiles, indicating the presence of the different specificity nucleases have been observed. Site specific endonucleases were detected in 17 out of 45 strains tested. In other strains a different level of non-specific activity was detected. Plasmid DNAs in size from 0.9 to more than 25 kbp were detected in 60% of strains analyzed. The presence of different specificity endonucleases, as well as differences in plasmid profiles of isolates possessing identical specific activity indicate that the population of *S. ruminantium* within the rumen of individual animals consists of at least 10 different clones. Several groups of isolates were identified on the basis of site-specific nucleolytic activity observed. The largest one consists of the isolates possessing activity identical with *Sru*I restriction endonuclease. Other groups comprised a smaller number of isolates, six of them were represented by single isolate only. Site-specific activities (endonucleases) characterized include *Ase*I isoschizomers, as well as *Stu*I and *Eco*RI, *Pst*I, *Nae*I, *Nsi*I isoschizomers to date unobserved in this microorganism. The most frequently the GTCGAC recognizing restriction and/or

modification systems were detected in *S. ruminantium* isolates. *Pst*I isoschizomers were detected in 3 tested strains. In at least two other strains the *Pst*I isoschizomeric restriction modification systems were accompanied by at least another one restriction and modification system with different specificity. Presence of identical restriction and modification systems in both subspecies of *S. ruminantium*, as well as occurrence of PstI isoschizomers in various combinations, indicate the possible role of mobile genetic elements in the spreading of genes coding for these system in ruminal ecosystem.

METABOLISM OF TWO STRAINS OF *BIFIDOBACTERIUM GLOBOSUM* FROM THE RABBIT CAECUM

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Two strains of *Bifidobacterium globosum* were isolated from caecal contents of rabbits. Both strains fermented glucose, galactose, pentoses and starch. Neither of the strains fermented alditols and inulin. Their ability to ferment disaccharides other than maltose was limited. Bifidobacteria did not hydrolyze gelatin and did not decompose amino acids. Nitrovin, bacitracin, monensin, avoparcin, salinomycin and virginiamycin at 10 mg/l inhibited the growth. Several fermentation parameters differed in growth on glucose and starch. The production of formate and ethanol was increased with glucose. A corresponding fall in lactate was observed. Cellular carbohydrate content was higher after growth on starch. On the other hand, cells of bifidobacteria grown on starch tend to contain less protein. Bifidobacteria were grown in a complex medium with 10% caecal extract. The carbon recovery exceeding 100% indicated incorporation of cell biopolymer precursors, present in the medium.

THE EFFECT OF CADMIUM ON CHANGES OF QUALITATIVE INDICES OF EGGS

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The effect of cadmium on egg weight after long-term administration in a flock of laying hens has been studied. In view of the fact that a response of poultry to Cd exposure in production indices has been expected, we aimed, among other things, at the observation of the effect of the above-mentioned xenobiotic on the weight of produced eggs. The results suggest that basic foods of poultry nature are influenced mainly by the degree of feed mixture contamination. Because of consumers' health protection, it is necessary to take effectual measures to direct the elimination factors at these commodities. Laying hens were divided into eight groups as follows: Experimental groups 1, 3, and 5 (0.3; 0.6; 6.0 $mg.kg^{-1}$ $CdCl_2$, respectively); groups 2, 4, and 6 with the same Cd concentrations and supplemented with vitamin D_3. K1 was the control group and K2 was control group supplemented with vitamin D_3. Significant changes after Cd administration were recorded in the egg weight. In all observed groups with different Cd supplementation as well as with vitamin D_3 supplementation the egg weight was significantly lower at the end of the experiment. It should be pointed out that egg weight was significantly lower also in control groups. In this classification and/or experiment evaluation it may be clearly stated that a significant decrease in egg weight was recorded in groups without vitamin D_3 supplementation. Thus, it is a new piece of knowledge that Cd administration significantly decreases the egg weight. It is a beneficial fact that this effect of Cd may be eliminated by vitamin D_3 supplementation.

ONTOGENETIC PECULARITIES OF LIPID SYNTHESIS IN CATTLE LUNGS

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The respiratory function of animal lungs is closely tied with lipid metabolism because of a key position of specific phospholipid-phosphatidylcholinedipalmitate in the lung surface ultrastructure. The content of separate classes of lipids and their free fatty acid content in animal lungs during prenatal and postnatal period of ontogenesis differ considerably, but physiological and biochemical mechanisms of such differences appearance are not sufficiently elucidated. Hence the aim of our work was a comparative study of synthesis intensity of separate lipid classes in the lungs of 9 months old fetus and adult cattle *in vitro* using C^{14} labelled palmitic, stearic, oleic and linolenic acids as precursors of lipid synthesis. It has been established that palmitic and stearic acids are utilized by fetal lungs and lungs of adult animals in lipid synthesis approximately to the same degree. Oleic acid is more intensively utilized in lipid synthesis in fetal lungs and linolenic acid in lungs of adult animals. The degree of incorporation of fatty acids in adult lung lipid synthesis is diminishing in the order – linolenic, oleic, palmitic, stearic acids, and in fetal lungs in the order – oleic, linolenic, stearic, palmitic acids. In phospholipids, triacylglycerols and cholesterol ethers synthesis in adult lungs are utilizated correspondingly 41.2–59.5; 14.7–26.1; 2.2–9.3 %, and in fetal lungs 24.7–39.6; 14.2–39.3; 1.7–9.3% of total radioactivity of studied fatty acids. The data obtained demonstrate that changes of separate lipid classes fatty acid content during ontogenesis in cattle lungs are caused by different degrees of utilization of separate fatty acids in lipid synthesis.

CHANGES IN THE HYPOTHALAMUS AND EPENDYME OF THE THIRD VENTRICLE OF THE BRAIN IN SHEEP AFTER SUPEROVULATION

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Our attention was directed to the changes in neurosecretion and the study of changes in the cellular nucleus volume of neurons of *nucl. supraopticus, nucl. infundibularis* and *nucl. tuberomamillaris* in sheep after hormonal stimulation. Twenty eight sheep in the anestrous period were used. They were synchronized with Agelin and hormonally stimulated with serum gonadotrophin, Oestrophan and Folistiman. The ependymal lining was studied by the scanning electron microscope. In the rostral hypothalamus the neurosecretory structures (NSO) are slightly stimulated to the increased neurosecreta production after hormonal influence. The more pronounced changes occur in the central hypothalamus (NARC). No qualitative changes were found in the caudal hypothalamus (NTM) in the nucleus analysed. The evaluation of the karyometric analysis, i.e. the changes in the volumes of hypothalamic nuclei observed, is in correlation with neurosecretion. The ependyma in anestrous is monolayer, cubic up to cylindrical. After hormonal stimulation its focal repletion occurs in the suprachiasmatic and infundibular area. A local proliferation of the tanycyte ependyma occurs in the recessus infundibuli. Ependymocytes desquamate and release themselves into the cerebrospinal fluid. As the ependyma in the central area of hypothalamus reacts very sensitively to all processes connected with the sexual activity under physiological conditions, the action of administered hormones found a response in it likely only secondarily through the hypothalamus or ovaries.

EFFECT OF BIFIDOBACTERIA MILK CULTURE ADDITIVE ON FERMENTATION PROCESSES IN THE RUMEN OF CALVES

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We performed two physiological experiments in calves (age 4 and 8 weeks) during liquid nutrition. Young bulls were kept individually in balance cages, and they were divided into 2 groups according to live weight and age. Both groups of animals were fed the milk feed mixture – MFM of identical composition and the biological milk concentrate – BMC (10^6 active microflora of Bifidobacteria and Lactobacillus) – 100 g BMC substituted 1 l MFM. Calves in experiment I got 8 l of drink, in experiment II 6 l. Lucerne hay and feed mixture for raising and fattening of calves – TKŠ were given to both groups *ad libitum*. Rumen fluid was sampled by an esophageal tube at two subsequent days. We determined pH – 3 h after morning feeding, ammonia and VFA always 3, 6 and 12 h after morning feeding. The calves which were given the additive of Bifidobacteria and Lactobacilli had significantly ($P < 0.001$) higher pH value (exp. group 6.55 – control group 5.55). There were found no differences in older calves. The values of ammonia in rumen fluid measured in groups I and II kept within the physiological values (20–35%). There were no significant differences between the groups. Significant differences between the groups of calves in the measured values of VFA were in experiment I – in younger calves. Calves in experimental groups had totally lower ($P < 0.05$) VFA concentration (exp. group 62.05 – control group 80.35), significantly less ($P < 0.001$) propionic (exp. group 8.70 mmol/l, 13.56% out of VFA – control group 16.66 mmol/l, 20.68% out of VFA) and valeric acids (exp. group 1.61 mmol/l, 2.62% out of VFA – control group 4.45 mmol/l, 5.37% out of VFA). Significantly broader ($P < 0.001$) molar proportion of acetic acid to propionic acid (exp. group 5.08 – control group 2.88) was also found in the younger category of calves.

MIKROMAG AND SINGLE-ELEMENT MICROELEMENTAL LICKS USED FOR PREVENTION AND THERAPY OF MICROELEMENT DEFICIENCY IN ANIMALS

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Mikromag a.u.v. is a magnesium microelement premix containing Cu, Mn, Zn, Co, Mo, Se, I and Mg. The dose recommended for prevention is 30 g and for therapy 40 g *pro toto* (or 3.2 and 4.2 g/kg diet DM) for all ruminants. J.M.L. a.u.v. are single-element microelemental licks containing Cu, Mn, Zn, Co, Se and I. JML were offered to 400 dairy cows for 21 days. Biological effectiveness or the influence of JML on saturation of dairy cow organisms with the elements investigated were observed in two indicator materials, namely hair and faeces. The influence of supplementation of ME in the form of JML on reproductive parameters of dairy cows was observed in 600 animals of the same herd. The JML was applied 3 months. On the basis of results obtained at Mikromag application in more than 30 herds in the duration of 5–10 years, it is obvious that the recommended dose of 30 g and the therapeutic dose of 40 g were capable of resolving the problem of ME deficiencies. The results show that the application of JML, although offered for a relatively short time, results in a positive influence on the state of saturation of dairy cow organism with the elements investigated as early as after 3 weeks.The supply of JML resulted in an improvement of % successfulness of the first and of all subsequent inseminations – a decrease in insemination index of heifers and dairy cows was observed. The service period also decreased by about 10 days and the interval decreased below 50 days. The most pronounced was the increase in the number of dairy cows with service period up to 60 days – from 73 to 120 cows. The discontinuation of supply of JML caused worsening of these parameters. The application of JML to

sheep resulted in an increase in wool yield by 6% and the content of wool fat by 3.3% in comparison with the control not supplemented with JML.

EFFECT OF *AD LIBITUM* AND DOSED FEEDING ON FEED INTAKE AND pH VALUES IN RUMEN FLUID OF RED DEER

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Deterioration of living conditions of hoofed game in impaired ecosystems are considered to be one of the main reasons for occurrence of damage to forest stands. Besides the impairment of availability of natural food, the frequent disturbance of game with subsequent disturbance of its natural grazing cycle also plays a negative role. We determined the circadian activity of cannulated adult deer in quiet conditions. We observed 5 to 10 periods of feed intake with subsequent rumination. The game cannot compensate fully the left out feeding periods with greater activity during the night if the daily physiological cycle was disturbed more markedly (interruption of feeding from 7.30 a.m. to 18.30 p.m.). The deer consumed by 35% less meadow hay, or by 21% less hay with additive feed mixture (proportion 3 : 1) during the interrupted feeding compared with *ad libitum* feeding. A significant increase of pH values in rumen fluid occurred in them due to starvation.

THE EFFECT OF DIFFERENT R.C. SEEDS CONTENT IN A DIET OF RATS ON SOME PHYSIOLOGICAL ASPECTS OF EXPERIMENTAL ANIMALS

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Medical products made of natural especially plant sources are always more preferred not only in human but also in veterinary medicine these days. In our soil and climatic conditions the plant *Rhaponticum carthamoides* Willd (R.C.) is the most prosperous. Positive effect of aboveground part of this plant on the increase in weight, health state, physical condition and production has been found in many experiments with various farm animals. In the experiment we have tested R.C. seeds as a possible source for production of extracts or additives for the above mentioned aims. 42 growing rats, race SPF Wistar were used in our experiment divided into 7 experimental groups. Basic feed dose was Larsen diet which was substituted by ground R.C. seeds in different groups as follows: group A – 0%, B – 0.5%, C – 0.75%, D – 1.00%, E – 1.50%, F – 2.0%, G – 100%. The observed indices: 1. growth curve, 2. weight, 3. histological structure of internal organs, 4. health state of animals. During the experiment, which took 30 days, we did not find any difference in the first three observed indices in animals of groups B–F compared with control group A. The fourth observed parameter was much better in groups B–F than in control group (A). Animals of group G which were fed pure R.C. seeds during 30 days experiment started to manifest aggressivity, insomnia, loss of co-ordination and dependence on seed feeding. During 30 days experiment the animals kept the same weight or it was slightly increased. Pathological changes in internal organs were found at dissection.

ENZYMATIC ACTIVITIES IN THE GASTROINTESTINAL TRACT OF CHICKEN

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The activity of 7 hydrolytic enzymes (lactase, maltase, invertase, amylase, cellulase, fructanase, protease) was measured in the chymus of different parts of the digestive tract of the adult chicken broilers fed high grain based diet. Activity of all examined enzymes was rather low in the crop, with the exception of amylase and protease. Activities of lactase were rather low in all compartments of gastrointestinal tract with exception of caecum (4.46 μmol/g/h). Invertase and maltase activities were low in the crop, but they increased in a caudal direction, so their values were highest in jejunal chymus (3.12 and 592.32, resp.) and caecal chymus (5.81 and 25.92, resp.). On the other hand we found out the relatively high amylolytic activity in the crop (10.08 μmol/g/h), in hindgut the values increased, so that the activity in caecum reached 61.44 μmol/g/h. The highest protease activity was found out in jejunal and caecal digesta (118.56 and 53.28, resp.). Surprisingly inulinase activity was found in caecal content and we detected no cellulase activity in digesta.

INTERACTION OF CHITINOLYTIC *CLOSTRIDIUM TERTIUM* WITH RUMEN BACTERIA

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Chitin is a common component of the cell wall of anaerobic fungi and represents a potential growth substrate for chitinolytic bacteria in the rumen. Most of the chitinolytic bacteria isolated in our laboratory were *Clostridium*-like spore producers. The most typical strain, *Clostridium tertium ChK5* degraded colloidal chitin mainly to acetate, butyrate and lactate. This bacterium produced endochitinase in cultures grown on chitin, as well as on N-acetylglucosamine and glucose. Chitobiase was produced only when chitin was the growth substrate. In the anaerobic rumen environment, microbial degradation of

polysaccharides is accomplished by the combined activity of many different bacteria. That was the reason for our study of the fermentation of chitin by *Clostridium tertium ChK5* in co-cultures with nonchitinolytic bacterium *Megasphaera elsdenii LC1* or *Butyrivibrio fibriosolvens L1*. Both these bacteria had a high chitin deacetylase activity and significantly influenced chitin fermentation performed by *Clostridium tertium ChK5*. This influence was not based on the simple effect of removal of potentially inhibitory fermentation products or a consumption of chitin hydrolysis products by the nonchitinolytic bacteria. It seems that different types of interactions (cross-feeding) play a role in chitin degradation.

STIMULATION AND INHIBITION OF MAMMOGENESIS BY STEROID HORMONES AND THEIR ANALOGUES

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The facts that the same steroid molecule may display multi-hormonal/-antihormonal or antagonist and partial agonist activities or may display a clear effect *in vitro*, but is totally devoid of activity *in vivo* suggest that there is not an alternative to special screening tests on living animal. The changes in mammary growth were not routinely used for characterization of newly synthetized steroid molecules. The aim of this study is to describe mammary growth responses in young intact (day 18 of age) and castrated male (adult) and female (ovariectomy at day 25, experiment on adults) C3H mice to steroid hormone agonists and antagonists. Dose-dependent growth changes of the mammary glands determined by a quantitative histology of mammary whole-mount preparations were studied for oestrogens (E), progestogens (P), combinations of E with P, for androgens (A) and glucocorticoids (G) (both in the presence of E plus P). E or P and E plus P stimulated growth was inhibited by anti E, anti P or A or G. The effect of A was inhibited by anti A in males but not in females. These data suggest that mammary gland growth response is a good model for routine *in vivo* screening of biological activities of steroids. (Supported by GA AS CR No A7-045608 and No 505/94/0009.)

THE INFLUENCE OF FORMIC ACID ON ACID-BASE STATE AND THE pH VALUE OF ABOMASAL INGESTA IN CALVES

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The influence of sweet and acidified milk replacer on acid-base state of venous blood was investigated in 18 calves. The level of acid-base balance (pH, HCO_3, pCO_2, BE and pO_2) after feeding (0, 1, 2, 4, 6 hrs) was determined in three groups of calves fed sweet milk (SM) and casein type acidified milk (ACM) and albumin type acidified milk (AAM). The other objective was to determine the changes of pH of abomasal ingesta in time after feeding. In calves fed SM the tendency to metabolic alkalosis with gradual respiratory compensation was confirmed. Acid-base states of calves fed AAM showed a slight metabolic acidosis (pH 7.343 ± 0.03, BE –1.1 ± 1.9 $mmol.l^{-1}$) with partial compensation by metabolic (HCO_3 27.2 ± 0.9 $mmol.l^{-1}$) and less by respiratory (pCO_2 7.76 ± 0.3 $mmol.l^{-1}$) mechanisms of regulation. Calves fed ACM have developed persistent metabolic acidosis (pH 7.312 ± 0.02, BE –3.4 $mmol.l^{-1}$) with partial compensation by both metabolic (HCO_3 22.1 ± 1.3 $mmol.l^{-1}$) and respiratory (pCO_2 5.9 ± 0.4 kPa) mechanisms of the regulation. The dynamics of the pH of the abomasal contents was significantly ($P < 0.001$) lower in acidified milk replacer. The level of abomasal content drops below pH 4.0 two hours after the intake of acidified milk, but five hours after the intake of sweet milk replacer. The dynamics of acid-base state of venous blood of calves most likely correlated with abomasal secretion capacity and the acidifying effect of milk replacer.

THE COMPARISON OF *IN VITRO* FERMENTATION KINETICS ESTIMATED BY DIFFERENT TECHNIQUES

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The techniques reported in this work were used to facilitate the study of the kinetics of forage digestion *in vitro* by measuring gas production. For measuring and comparison of the volume (V) of gas production, dry matter degradability (DMD), total VFA glass syringes (S), flow gasometer (FG) and pressure transducer (PT) methods were used. Rumen fluid and McDougall's buffer (1 : 1) were pumped in 35ml doses into fermentation vessels containing 0.25 g of meadow hay. 1. S method – experiment was carried out with 50 ml syringes and according to a change of the piston position gas production was measured after 2, 4, 6, 12, 24, 36, 48, 60, 72, 84, 96 hours. 2. FG method – 120ml serum bottles were used as fermentation vessels. The volume of released accumulated gas in the serum bottles was measured by commercial flow gasometer. Measuring was conducted after 12, 24, 36, 48, 60, 72, 84, 96 hours. 3. PT method – the measuring system consisted of a three way valve connected to a manometer (to measure pressure in the serum bottles), gas-tight syringe (to measure volume of gas production) and needle (used as a punch to rubber stopper on the serum bottle). When pressures from culture bottles were plotted against their corresponding gas volumes, the linear relationship was obtained. By repeating this gas measurement at regular intervals during the fermentation, it was possible to construct gas accumulation profiles for feed by calculation regression equations for individual bottles.

THE COURSE OF FERMENTATION IN THE CAECUM OF FOXES

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The aim of preliminary studies on 10 foxes was to determine the course of fermentation in the caecum of these animals. The investigations were carried out in the farm conditions where foxes were fed *ad libitum* standard diet. Caecal samples were obtained from foxes immediately after slaughtering. The incubations of fox caecal content, mineral mixture and/or without substrate (sodium formate) were performed in vessels of special type in anaerobic conditions. The following fermentation parameters were determined during 6 hours of incubations: methane (CH_4), carbon dioxide ($C0_2$) and other gases, volatile fatty acids (VFAs), pH, total numbers of bacteria and protozoa, fermentation efficiency (FE) and NGGR factor, hydrogen utilization, microbial „cell yield" and ATP production. The obtained results suggest the following composition of caecal gases : $C0_2$ – 71.2%, N_2 – 21.9%, CH_4– 4.4%, H_2 – 1.9%, H_2S – 0.6%, also high fermentation efficiency (about 80.8%) and microbial „cell yield" (about 85.5 mg).

INFLUENCE OF SYRINGALDEHYDE ON SOME PARAMETERS OF RUMEN FERMENTATION *IN VITRO*

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The objective of these study is to establish the effects of syringaldehyde (SA) and *Saccharomyces cerevisiae* (YS) on the end product of rumen fermentation. Two fistulated sheep were used as a source of inoculum. The fermentation was carried out with 120ml serum bottles. In each incubator (96 hrs), control test bottles contained 35 ml rumen fluid and buffer (1 : 1) with no substrate. In other bottles, meadow hay (0.25 g) with the following combination of additives was used: hay without additive, hay + YS, hay with 1, 5 and 10 mmol SA and hay + YS with 1, 5 and 10 mmol SA. Five replicates were used for each combination including the controls. The cumulative gas was estimated by a transducer method and VFA by gas chromatography. It follows from the results that YS did not influenced the hay degradability, gas, CH_4, and total VFA production, mol % of A, iB, A/B but increased B, iV, V and decreased P. The SA decreased hay degradability in all cases. The total gas production was not changed, only with 10 mmol SA was decreased including the combination with YS. Total VFA was increased with 5 mmol SA and with 5 and 10 mmol SA + YS. Acetate was enhanced in all cases. Propionate and iso-valerate decreased with all supplements except 10 mmol SA + YS, when P was higher. Butyrate was increased with all supplements but not with 10 mmol SA + YS. Iso-butyrate decreased only with 10 mmol SA and SA + YS. Valerate decreased after application of 5 and 10 mmol SA and 10 mmol SA + YS. 2 H recovery decreased with 1 and 5 mmol SA including YS. It can be concluded that YS partly influenced mol % of VFA, SA strongly influenced the levels of all parameters and YS additive had only a moderate effect on SA action.

ROLE OF MELATONIN AND SEROTONIN IN THE CONTROL OF GROWTH HORMONE SECRETION IN THE JAPANESE QUAIL

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In addition to its role in a control of the circadian system melatonin seems to be involved in the modulation of growth and energy retention in birds. These effects can be either direct ones or mediated by interactions of melatonin with the activity of hormonal systems implicated in the growth control. Therefore, the aim of the present study was to find out whether exogenous melatonin may influence growth hormone (GH) secretion in the Japanese quail and whether these effects are mediated through an interaction with the serotoninergic pathway. Single subcutaneous injection of melatonin increased consistently plasma GH concentrations in juvenile Japanese quail after the phase of exponential growth. Melatonin applied in combination with the serotonin agonist (quipazine dimaleate) augmented GH secretion but serotonin antagonist (ketanserin tartrate) was not able to preclude the stimulatory action of melatonin on GH synthesis. Present results confirm the stimulatory action of melatonin on GH secretion in birds. They suggest that the effect of melatonin on GH release is not mediated exclusively through interaction with the central serotoninergic pathway and other possible routes should be studied.

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INFORMACE – STUDIE – SDĚLENÍ

METODICKÉ POZNÁMKY K ETOLOGICKÉMU VÝZKUMU V CHOVU KONÍ

Etologie zaujímá v chovu hospodářských zvířat významný úsek již po řadu desetiletí. V našem chovu koní jsou však etologická pozorování poněkud sporadická. Povětšinou jsou zaměřena na užší tematické otázky, řešené často formou diplomových prací. Četné z nich jsou pro tuto vědní oblast pozitivním přínosem. V mezinárodním měřítku se pozorování v chovu koní zaměřovala většinou na sledování projevů primitivních plemen a divokých koní. Motivací pozorování byla snaha o determinaci sociální hierarchie ve stádě při paralelním sledování některých specifických projevů. Uplatňování různých technologických adaptací v chovu koní kulturních plemen vyžaduje však řešení velmi širokého spektra etologické problematiky s cílem analytického poznání všech projevů koní a hříbat. Tím vyvstává velmi široké metodické spektrum, v kterém mimo sociální etologické pojetí jako určující nabývá na významu i etologie fyziologická. Ucelenému výzkumu projevů koní v hřebčínském chovu se věnoval D u r u t t y a (1993), jehož práce je širším vstupem do této – u nás dosud ne plně doceněné – vědní oblasti. Obecným vysvětlením je do určité míry skutečnost, že chovu koní byla po tisíciletí věnována podstatně větší pozornost než jiným druhům hospodářských zvířat, takže o jejich projevech byly shromážděny četné empirické poznatky. Ty však již po obecně dynamickém rozvoji etologie nepostačí zodpovědět komplex otázek vyplývajících ze současné organizační změny v chovu koní, která se promítá i v technologii chovu.

V návaznosti na význam etologického výzkumu nastiňujeme k úvaze řešení úkolu, který by svým obsahem byl přínosem pro rozvoj etologické fyziologie a měl by konkrétní praktický dopad.

V biologii je aktuální otázkou možnost včasného určení nervového typu jedince ve vztahu k výkonnosti, resp. k užitkové hodnotě. Tato vazba je zvlášť významná u anglického plnokrevníka a klusáků, jejichž hodnota je vzhledem k vysoké komerčnosti dostihového sportu vysoká. Z těchto aspektů zaměřujeme následné schéma metodického pojetí, neboť možnost včasné predikce výkonnosti z typu CNS, byť jen v základních rysech, by byla v dostihovém turfu značným přínosem. Sledování této problematiky by vycházelo ze tří charakteristik: a) z prvních projevů hříběte po narození, b) z růstové dynamiky v průběhu ontogeneze, c) z dosažené výkonnosti.

Tyto tři charakteristiky lze velmi přesně sledovat u anglických plnokrevníků, neboť jejich výkonnost je jasně kvantifikována, zatímco u ostatních teplokrevných koní je při výkonnostních zkouškách – z hlediska potřeb tohoto úkolu – definována jen obecněji, bez možnosti kvalitativní specifikace odpovídající diferenciaci dvou prvních charakteristik.

Ad a) Hříbě se po narození postaví ve většině případů do dvou hodin po narození. Aktivita hříběte, projevující se snahou postavit se již po 15 min po narození a opakovanými pokusy, kterých jsou desítky, se vyčerpává. Jiná hříbata se postaví později, ale většinou po menším počtu pokusů. Právě charakterizování této aktivity s kvalitativním posouzením jednotlivých pokusů o postavení (dosažení jednotlivých výškových zón), s dokumentací času a s celkovou charakteristikou projevů ležících a vztávajících hříbat, by poskytlo podklady pro predikci nervového typu jedince. Pokusy o postavení hříbat mají z hlediska dosahovaných úspěchů u některých jedinců ascendenční tendenci, tedy od prvního zvednutí hlavy až k postupnému zvednutí přední části těla na hrudních končetinách po poslední pokusy končící skutečným postavením se hříběte. U jiných jedinců má však dynamika těchto pokusů jiný trend. Naše předběžné šetření potvrzuje u hříbat velké rozdíly. Právě v těchto projevech se u hříbat výrazněji naznačuje jejich nervový typ, a napozorované projevy umožní jejich kvalitativní diferenciaci.

Ad b) Dynamika růstu a vývinu v průběhu vývoje jedince by byla zjišťována podle hmotnosti, a to vážením v těchto frekvencích: v prvním týdnu každý den, poté do konce druhého měsíce v týdenních intervalech a od věku 3 měsíců až do zařazení do výcviku (tj. cca ve věku 18–20 měsíců) v intervalech měsíčních a stejně tak i v době dostihové kariéry v ročníku dvou- a tříletých. Zvyšování hmotnosti lze vyjádřit např. touto exponenciální funkcí:

$$y = A\,(1 - e^{-k(t - t_o)})$$

kde: A – největší pozorovaná hodnota v dospělosti
k – rychlostní konstanta
t – čas
t_o – časové zpoždění

K sledování hmotnosti koní lze připomenout, že kůň dosahuje maximální výkonnosti v určitém menším rozpětí své optimální tělesné hmotnosti. Proto i stabilita hmotnosti s přihlédnutím k intenzitě tréninku a sledování projevů při předstartovním stavu koní by přispěla k upřesnění charakteristiky jejich nervových typů.

Ad c) Výkonnost by byla hodnocena podle dosažených hodnot Gh, případně i podle jiných kritérií výkonnosti, a to jak v ročníku dvouletých, tak v ročníku tříletých. K upřesnění poznatků o projevech koní by byly využity poznatky trenérů a jezdců.

Srovnání vztahu všech tří proměnných by bylo podkladem k potvrzení (či vyloučení) vazeb mezi nimi. Vzhledem ke specifičnosti problematiky by bylo nutné sledovat větší počet koní vzhledem k jeho možnému snížení v průběhu dostihové kariéry. Rozsah našich plnokrevných hřebčínů (např. v Napajedlích) a testace koní ve stejných podmínkách na jedné dostihové dráze by bylo pro řešení značným přínosem.

Dalším z aktuálních témat může být srovnání výsledků získaných pozorováním divokých koní, primitivních plemen a plemen kulturních, a to z hlediska determinace sociální hierarchie a specifikace některých projevů ve vazbě na aplikovatelnou technologii a podmínky prostředí. Tím by bylo možné specifikovat projevy těchto srovnávaných typů a získat poznatky, které lze zobecnit, nebo naopak které charakterizují jen specifický typ. (Dosud jsou totiž poznatky zobecňovány, i když toto zobecňování není podloženo skutečným pozorováním.) Usměrnily by se tak nevhodné transformace poznatků získaných výzkumy u primitivních plemen nebo u divokých koní. Lze očekávat, že zvláště v sociální hierarchii bude diferenciace u kulturních plemen méně výrazná. Rovněž je nutné vzít v úvahu, že etogram primitivních plemen a zvláště koní divokých je značně ovlivněn formovaným prostředím. K doplnění navrženého tématu k řešení lze ještě poznamenat, že k studiu je účelné využít i dílčí poznatky autora K l e m e n t (1996), zaměřené na analýzy VNČ v projevech koní, kterou otevřel oblast bádání, v našich podmínkách poněkud opomíjenou. Hodnotil orientační pátrací reflexy, obranné motorické reflexy, dotykové kožní receptory a v širším kontextu význam VNČ při výcviku koní a jezdce. I tyto aspekty se tedy různě promítají v etologickém výzkumu a je nutné k nim přihlížet.

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Doc. Ing. Jaromír D u š e k, DrSc.

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Manuscript layout shall correspond to the State Standard ČSN 88 0220 (quarto, 30 lines per page, 60 strokes per line, double-spaced typescript). A PC diskette should be provided with the paper, written in an editor program, preferably T602, and with graphical documentation. Tables, figures and photos shall be enclosed separately. The text must contain references to all these annexes.

The **title** of the paper shall not exceed 85 strokes. Subtitles of the papers are not allowed either.

Abstract is an information selection of the contents and conclusions of the paper, it is not a mere description of the paper. It must present all substantial information contained in the paper. It shall not exceed 170 words. It shall be written in full sentences, not in form of keynotes, and comprise base numerical data including statistical data. It must contain key words. It should be submitted in English and if possible also in Czech or Slovak.

Introduction has to present the main reasons why the study was conducted, and the circumstances of the studied problems should be described in a very brief form.

Review of literature should be a short section, containing only literary citations with close relation to the treated problem.

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In the section **Results** figures and graphs should be used rather than tables for presentation of quantitative values. A statistical analysis of recorded values should be summarized in tables. This section should not contain either theoretical conclusions or deductions, but only factual data should be presented here.

Discussion contains an evaluation of the study, potential shortcomings are discussed, and the results of the study are confronted with previously published results (only those authors whose studies are in closer relation with the published paper should be cited). The sections Results and Discussion may be presented as one section only.

The citations are arranged alphabetically according to the surname of the first author. References in the text to these citations comprise the author's name and year of publication. Only the papers cited in the text of the study shall be included in the list of references. All citations shall be referred to in the text of the paper.

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