

EVALUATION OF THE EFFECT OF PECTIN PREPARATION ADDITION ON THE REPRODUCTION RESULTS OF DAMS AND THE GROWTH OF THEIR OFFSPRING

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Abstract. The research material consisted of 87 Suffolk ewes divided into control (1) and experimental (2) groups. Both groups were fed farm feeds according to DLG standards. Animals from the experimental group were given an addition of the nutritional pectin concentrate with an immunological effect (KO) produced on the basis of apple pectins. Dams were given approx. 10 g per animal per day of the preparation mixed with concentrate every 7 days during tupping, every 3 days during pregnancy and everyday during the rearing of lambs. Lambs were reared with their dams. From 14 days of age their diet was supplemented with the evaluated preparation mixed with oat meal and then with concentrate at the amount of 10% of a given feed. Reproduction results of 87 ewes including fertility, prolificacy, rearing of lambs and reproduction indices were evaluated. Based on the body weight of lambs at 2 days after birth and at the age of 1 month, 56 and 90 days, as well as on the daily body weight gains in the individual examined periods, the evaluation of the growth of the offspring being reared was performed. In the statistical analysis of the obtained results, Student's t-test (addition of preparation) was applied. It was found that dams from both groups were characterised by similar and very low fertility (54.7–58.2%). The applied pectin preparation significantly ($P \leq 0.01$) affected the value of the prolificacy index of the examined sheep. In this respect, the ewes from experimental group were over 32 per cent better than the ewes from the control group. Similar tendency was observed for the rearing of lambs and the values of reproduction indices. The offspring of both groups of dams weighed at 2 days after birth had similar body weight. From 1 month of age a significant advantage of lambs from experimental group was observed both in respect of body weight and daily body weight gains. At the last weighing at 90 days of age, lambs given the KO preparation were significantly heavier ($P \leq 0.01$) than their age mates from group 1. In the whole experiment, lambs from group 2 were characterised by approx. 26 g higher body weight gains ($P \leq 0.05$) compared to lambs from group 1 and the values of the growth rate indices for animals in both groups were similar.

Keywords: growth of lambs, pectins, reproduction, Suffolk

INTRODUCTION

In animal production there are many stress causing situation associated i.a. with the contact of a newborn with new environment, separation from a dam, improper zoohygienic conditions of buildings, change of feeding. It may lead to the disturbance of the bacterial flora balance in the digestive tract in favour of the pathogenic flora [Toborowicz 2001], and consequently to the inhibition of the development, worse feed conversion and reduced body weight gains [Szulc et al. 1983, 1991, Lachowski 1995, 2001, Lipecka and Szymanowska 1990]. This can be prevented by i.a. an introduction of the preparations of probiotic character, e.g. pectins, to the intestinal environment of animals [Toborowicz 2000].

Pectins are the main binding component in the cell walls of plants and fruits. In the plant material, pectins occur in connection with cellulose and such substances are called protopectin, which makes up the binder of cell walls. Particularly large amounts of pectin substances occur i.a. in the fruit of currant, gooseberry bush and in apples. Pectin is a preparation obtained under industrial conditions, containing water-soluble pectin substances isolated from plant material [www.pektowin.com.pl]. They occur in the form of macromolecular compounds (polysaccharides) made up of galactose, arabinose and D-glucuronic acid, in which over 50% of carboxyl groups have been esterified with methanol [Muralikrshma and Taranthan 1994].

Pectins have anti-bacterial, absorptive, anti-atherogenic and antihaemorrhagic properties, regulate defecation and passage of the intestinal contents, reduce inflammations and eliminate digestive disorders [Bartnikowska 1997, Hasik et al. 1997, Veldman et al. 1997, Schneeman 1998].

Pectins applied for the treatment and prophylaxis of diarrhoea form the protective layer for the mucous membrane of intestines preventing it from the multiplication of pathogenic bacteria. Due to the capability of swelling, they retain large amounts of water, making the intestinal content viscous and smooth and help to normalize the flow of intestinal contents [Spliller 1994, Solan 2007, www.rozanski.gower.pl].

In the present study an attempt was made to evaluate the effect of the pectin preparation addition on the reproduction results of dams and growth of their offspring.

MATERIAL AND METHODS

The research material consisted of 87 breeding Suffolk ewes kept on a farm in the West Pomeranian Province, divided into two groups: control – 1 and experimental – 2. Both groups were fed farm feeds and the feed requirement and the composition of feed rations were established on the basis of the tables of nutritive value of feeds and the standards of ruminants feeding [DLG 1997]. Three feed rations were used (period of tugging, pregnancy and feeding of lambs) intended for dams with body weight of 70 kg, prolificacy of 170% and body weight of lambs at birth of 4 kg. Animals from the experimental group were given the addition of the nutritional pectin concentrate with an immunological effect (KO) produced on the basis of apple pectins by TBP Piotr Bobiński company. Chemical composition of the evaluated preparation is presented in Table 1.

Table 1. Chemical composition of the pectin preparation (KO)

Tabela 1. Skład chemiczny preparatu pektynowego (KO)

Parameter Parametr	Units Jednostki	Value Wartość
Dry matter Sucha masa	%	89.72
Ash	%	4.47
Popiół	g · kg ⁻¹ DM	49.82
Fibre	%	34.06
Włókno	g · kg ⁻¹ DM	379.62
Protein	%	5.55
Białko	g · kg ⁻¹ DM	173.32
Fat	%	7.11
Tłuszcz	g · kg ⁻¹ DM	79.25
NFE	%	28.53
BAW	g · kg ⁻¹ DM	317.99

Ten grams per dam daily of the preparation, mixed with concentrate (crushed cereal meal or middlings) every 7 days during tupping period, every 3 days during pregnancy and everyday during rearing of lambs were given.

The six-week tupping was started in the middle of September. In the first month, the in-hand mating service was applied and in the remaining period the group mating was performed.

Lambs were reared with their dams. Colostrum and milk of dams were their sole feed until 14 days of age and from 14 to 30 days of age animals were fed *ad libitum* oat meal and good-quality meadow hay. From 30 days of age to the end of experiment lambs were fed according to DLG standards [1997] the following feeds: oat and horse bean meal, dried sugar beet pulp, meadow hay, carrot, farm-made concentrate mixture (containing approx. 155 g of crude protein and 9.7 MJ ME per 1 kg). From 14 days of age, lambs from dams from experimental group were given an addition of the KO preparation mixed with oat meal, and then with concentrate mixture. Each time the evaluated preparation accounted for 10% of a given feed.

Reproduction results of 87 ewes were evaluated determining their fertility, prolificacy, rearing and reproduction indices. Based on the body weight of lambs at 2 days after birth and at the age of 1 month, 56 and 90 days, the daily body weight gains in individual examination periods were determined and the evaluation of the growth of offspring being reared was performed.

In the statistical analysis of the obtained results Student's t-test (addition of preparation) was applied using Statistica®PL statistical software.

RESULTS AND DISCUSSION

The main breeding goals set to the Polish sheep farming concentrate mainly on the improvement of prolificacy and nursing ability of ewes, obtaining high growth rate of lambs as well as better feed conversion and carcass of good quality [The programme of

genetic improvement of sheep stock until 2010, 1996, Gruszecki et al. 2000, Niżnikowski 2004 a, b]. Table 2 presents the results describing reproduction of the evaluated ewes and rearing of their offspring.

Table 2. Reproduction results of the evaluated ewes and rearing results of their offspring
Tabela 2. Wyniki rozrodu ocenianych macierek i odchowu ich potomstwa

Specification Wyszczególnienie	Units Jednostki	Group – Grupa	
		control 1 kontrolna 1	experimental 2 doświadczalna 2
Number of mated ewes Liczba macierek stanowiących	n	34	53
Number of lambing ewes Liczba macierek wykończonych	n	20	29
Total number of lambs born Liczba jagniąt urodzonych ogółem	n	31	47
Number of lambs born alive Liczba jagniąt żywo urodzonych	n	26	47
including – w tym: ewes – maciorki	n	15	25
ram lambs – tryczki	n	11	22
single lambs – pojedynki	n	4	9
twins – bliźnięta	n	22	38
Miscarriages and stillbirths Poronienia i martwe urodzenia	n	5	0
Lambs surviving until 7 days of age Przeżywalność jagniąt do 7. dnia	%	93.31	97.87
Losses of lambs in the experimental period Upadki jagniąt w okresie doświadczenia	n	6	2
including – w tym: until 7 days of age do wieku 7. dni	%	23.08	4.25
from 7 to 33 days of age od 7. do 33. dnia życia		2	1
from 33 to 90 days of age od 33. do 90. dnia życia		7.69	2.13
from 7 to 33 days of age od 7. do 33. dnia życia		4	1
from 33 to 90 days of age od 33. do 90. dnia życia		16.67	2.17
Fertility Płodność	%	58.82	54.72
Infertility Jałowość	%	100.0	93.03
Prolificacy Plenność	%	41.18	45.28
Rearing of lambs Odchów jagniąt	%	100.00	109.96
Reproduction index Wskaźnik użytkowości rozplodowej	%	130.00 ^A	162.07 ^A
		100.00	124.67
		76.92 ^a	95.74 ^a
		100,00	124.47
		58.82 ^A	84.90 ^A
		100.00	144.34

Statistical significance of differences at AA – $P \leq 0.01$; aa – $P \leq 0.05$.

Statystyczna istotność różnic przy: AA – $P \leq 0,01$; aa – $P \leq 0,05$.

The analysis of the data presented in Table 2 allows us to conclude that dams from both groups were characterised by very low fertility. However, the applied pectin preparation significantly ($P \leq 0.01$) affected the value of prolificacy index. In this respect, ewes from the experimental group had over 32% higher index than did the animals from the control group. Similar relationship was observed for the rearing of lambs. The losses of lambs for the whole period of experiment can be regarded as low. More losses (by approx. 19%) were found in the control group. The value of the reproduction index, which is a resultant of fertility of sheep, was significantly higher ($P \leq 0.01$) in the group of ewes given the addition of the evaluated preparation.

Comparing the obtained results of the reproduction performance of examined sheep with the analogous data published by the Polish Sheep Farming Association [2007–2009] for Suffolk breed, it can be seen that only in respect of prolificacy and rearing of lambs, ewes from group 2 had higher values of both these indices compared to the native Suffolks. The remaining reproduction indices (particularly for group 1) assumed lower values.

The obtained results are similar to those given by Pieniak-Lendzion et al. [1994] for the imported and non-acclimatized breeding material of Suffolks. For these sheep, infertility, prolificacy, rearing and reproduction performance amounted to 40.9–47.8%, 123.0–141.7%, approx. 70% and 56.5–87.5%, respectively. The authors concluded that such poor fertility could have been caused by new (different) habitat conditions of the farms, where the imported sheep were placed.

The reproduction results of the present study coincide with those estimated for the same flock for the years 2007–2009 by Sidorkiewicz [2009]. Also in this case, very low values of the indices of fertility (56.2–86.2%), rearing of lambs (83.6–86.2%) and reproduction (0.64–0.70) were found.

According to Gruszecki et al. [2000], fertility of sheep of breeds maintained in Poland is, in general, unsatisfactory. This concerns in particular prolificacy, which remains in the range 120–140%. If the value of 1.3 lambs reared from one ewe of the foundation stock is considered to be poor reproduction performance, then the highest value of the analogous index in the conducted experiment did not exceed a threshold of 0.85. Under Polish conditions, it is assumed that the sheep husbandry can only be profitable if 1.5 lambs are obtained from dam sheep [Seremak-Bulge 1992]. According to Martyniuk [1995], high prolificacy in relation to the farm potential causes higher losses of lambs during the periparturient and rearing periods. This can result from i.a. periparturient complications, infections, unfavourable environmental conditions, insufficient care by dams, their age, body weight and prolificacy as well as the body weight of newborn lambs [Patkowska-Sokoła and Barczyńska 1985, Nowakowski 1986, Lipecka et al. 1990, 1999 a, 1999 b, Lipecka and Szymanowska 1995]. Significant decrease in the number of miscarriages and losses of lambs during the rearing period was observed as a result of applying an addition of the Yea-sacc¹⁰²⁶ yeast biopreparation in feeding in-lamb and suckling ewes [Lachowski and Marek 1999, Lachowski 2001]. The improvement of the reproduction performance of other species of animals was noted as a result of using other probiotics such as: Lacto-sacc, Biogen, Acid-Pack 4-Way [Cole 1990, Jasek et al. 1992, Jacyno et al. 1996].

It can be considered that much work has been done in respect of the improvement of reproduction traits in sheep maintained in our country. However, the opinion by Lipecka and Pięta [1992] that the achievements of the breeders in the world are much greater, seems still justified. Table 3 presents the results describing the growth of the offspring of the evaluated ewes.

Table 3. Analysis of the growth of offspring from the evaluated ewes
Tabela 3. Analiza wzrostu potomstwa ocenianych maciurek

Specification Wyszczególnienie	Group – Grupa					
	control 1 kontrolna 1			experimental 2 doświadczalna 2		
	n	\bar{x}	s	n	\bar{x}	s
Body weight, kg: Masa ciała, kg:						
– second day after birth – 2. dzień po urodzeniu	26	4.5	0.69	47	4.7	0.72
– at the age of 1 month – w wieku 1. miesiąca	24	11.7 ^a	1.89	46	13.2 ^a	1.92
– at the age of 56 days – w wieku 56. dni	20	17.8 ^a	1.84	45	19.3 ^a	2.01
– at the age of 90 days – w wieku 90. dni	20	25.4 ^A	2.15	45	27.9 ^A	2.92
Daily body weight gains, g: Przyrosty dobowe, g:						
– from birth to 1 month of age – od urodzenia do 1. mies.	24	257.1 ^A	49.8	46	303.6 ^A	42.4
– from 1 month to 56 days – od 1. mies. do 56 dnia	20	234.6	36.6	45	234.6	40.8
– from 56 to 90 days – od 56. dnia do 90. dnia	20	223.5 ^a	30.7	45	252.9 ^a	29.9
– from birth to 90 days – od urodzenia do 90. dnia	20	237.5 ^a	32.8	45	263.6 ^a	39.8
Growth rate index, %: Wskaźnik tempa wzrostu, %:						
– from birth to 90 days – od urodzenia do 90. dnia	20	139.8	16.1	45	142.3	17.9

Explanations as in Table 2.
Objaśnienia jak w tab. 2.

Based on the conducted research, it was found that the mean body weight of lambs from both groups measured at 2 days after birth was similar. From the first month of life, a significant advantage of lambs from experimental group was observed, both in respect of body weight and daily body weight gains. At the last weighing, at 90 days of age, lambs given an addition of the KO preparation were significantly heavier ($P \leq 0.01$) than their age mates from group 1. As for the daily body weight gains, the greatest significant ($P \leq 0.01$)

advantage of lambs from group 2 was observed in the first period of animals' life, i.e. from birth to the age of 1 month. In the whole experiment, lambs from group 2 obtained approx. 26 g higher body weight gains ($P \leq 0.05$) compared to lambs from group 1. However, this did not affect the growth rate of animals from both groups. The value of this index measured from birth to 90 days of age was 139.8% and 142.3% for group 1 and 2, respectively. Relatively low values of standard deviation indicate high uniformity of the offspring of the evaluated ewes in respect of both analysed traits.

Comparing the obtained results with data published by the Polish Sheep Farming Association [2007–2009] for the Suffolk breed, it should be stated that body weight as well as daily body weight gains of the evaluated lambs – regardless of the group – were lower. According to Efner [1981], lamb at the age of 28 days should have body weight of 12–16 kg, which indicates good lactation yield of a dam. The analysed lambs obtained only the lower value of that trait, but fulfilled another condition of the appropriate growth made by the cited author, i.e. at the age of 100 days they were 5 times heavier than they had been after birth. There is a very strong relationship between the lactation yield of dams and the growth of their offspring; however, the growth of lambs is more determined by the amount of milk consumed than by its composition [Mroczkowski 1987]. It can be hypothesised that the better growth of lambs from group 2 was caused by i.a. better lactation yield of dams stimulated by the addition of the evaluated pectin preparation as well as by supplementing the diet of lambs from this group with this preparation.

Results obtained in the present study and concerning body weight, its daily gains and growth rate of lambs during the rearing period can be considered as good (significantly higher in the experimental group), if they are compared with the results of the research on the growth of pure Suffolk [Piechowicz et al. 1992], crossbreds with the share of Suffolk breed [Gruszecki 1990, Szczepański and Czerniawska-Zajac 1990], or the lambs of the synthetic black-headed meat line – 87% of Suffolk genes [Śliwa and Gut 1990].

CONCLUSIONS

Summarizing, it can be concluded that the addition of the nutritional pectin concentrate with an immunological effect (KO) to the feed, significantly ($P \leq 0.01$) affected prolificacy of ewes from the experimental group. A similar tendency was observed for the rearing of lambs. This influenced the reproduction index, which was significantly higher ($P \leq 0.01$) in the group of ewes given the addition of the evaluated preparation. A significant effect of the preparation being given on the growth of offspring was recorded. At the last weighing at the age of 90 days, lambs from group 2 were significantly heavier ($P \leq 0.01$) than their age mates from group 1 (the difference was approx. 2 kg). Also for the whole period of experiment, lambs from group 2 obtained 26.1 g higher body weight gains ($P \leq 0.01$). The feeding model adopted in the present study did not influence the growth rate of the examined lambs. Dietary fiber in human nutrition healthy and diseased.

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OCENA WPŁYWU DODATKU PREPARATU PEKTYNOWEGO NA WYNIKI ROZRODU MATEK ORAZ WZROST ICH POTOMSTWA

Streszczenie. Materiał badawczy stanowiło 87 maciurek rasy suffolk podzielonych na grupę kontrolną – 1 i doświadczalną – 2. Obie grupy żywione były paszami gospodarskimi wg norm DLG. Zwierzęta z grupy doświadczalnej otrzymywały dodatek odżywczego koncentratu pektynowego o działaniu odpornościowym (KO) produkowanego na bazie pektyn jabłkowych. Preparat podawano matkom w ilości ok. 10 g na osob. na dzień wymieszany z paszą treściwą co siedem dni w okresie stanówki, co trzy dni w okresie ciąży i codziennie w okresie odchowu jagniąt. Jagnięta odchowywano przy matkach. Od 14. dnia życia ich dietę uzupełniano o dodatek ocenianego preparatu wymieszanego ze śrutą owsianą, a później z mieszką treściwą w ilości 10% danej paszy. Oceniono wyniki rozrodu 87 maciurek określając ich płodność, plenność, odchow jagniąt i wskaźniki użyteczności rozplodowej. Na podstawie masy ciała jagniąt w 2. dniu po urodzeniu oraz w wieku 1. mies., 56 i 90 dni, a także dobowych przyrostów masy ciała w poszczególnych okresach badawczych dokonano oceny wzrostu odchowywanego potomstwa. W statystycznym opracowaniu uzyskanych wyników zastosowano jednoczynnikową (dodatek

preparatu) analizę wariancji. Stwierdzono, że matki obu grup cechowały się podobną i bardzo małą płodnością (54,7–58,2%). Zastosowany preparat pektynowy istotnie ($P \leq 0,01$) wpłynął na wartość wskaźnika plenności badanych owiec. W tym zakresie maciorki z grupy doświadczalnej były o ponad 32 jednostki procentowe lepsze od owiec z grupy kontrolnej. Podobna tendencję obserwowano w odniesieniu do odchowu jagniąt oraz wartości wskaźników użytkowości rozrodczej. Zważone w 2. dniu po urodzeniu potomstwo obu grup matek miało zbliżoną masę ciała. Od 1. miesiąca życia obserwowano istotną przewagę jagniąt z grupy doświadczalnej zarówno w zakresie masy ciała, jak i przyrostów dobowych. Przy ostatnim ważeniu, w wieku 90 dni, jagnięta otrzymujące dodatek preparat KO były istotnie cięższe ($P \leq 0,01$) od swych rówieśników z grupy 1. W całym doświadczeniu jagnięta z grupy drugiej cechowały się o ok. 26 g większymi przyrostami ($P \leq 0,05$) w porównaniu z jagniętami z grupy pierwszej, przy czym wartości wskaźników tempa wzrostu zwierząt w obu grupach były zbliżone.

Słowa kluczowe: pektyny, rozród, suffolk, wzrost jagniąt

Accepted for print – Zaakceptowano do druku: 25.04.2011