

INCLUSION OF PEAS AS PROTEIN SOURCES IN THE DIET OF DAIRY GOATS IN ORGANIC BREEDING

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The aim of this paper is to explore the possibility of inclusion grain of peas (*Pisum sativum* spp *sativum*) in the rations of lactating dairy goats in organic breeding. The research was conducted with 14 goats, French Alpine breed. Goats were in the third lactation, average age 4 years and with regard to feeding divided into two groups. The control group of goats (C) was fed with a mixture of concentrated feed (800g/day) and alfalfa hay *ad libitum*, while in the experimental group (E) peas (15% in the mixture) was included in exchange for corn. Weighing and taking the body measurements as well as control milking and sampling of goats milk were conducted at the beginning and end of the research (from 70 to 100 lactation days). In goat milk content of fat, proteins, lactose, dry matter and urea as well as the number of somatic cells and microorganisms were determined. Inclusion of peas in the food of the E group of goats led to a positive impact on the indices of physical development and exterior characteristics as well as achieved greater body mass and smaller losses in the body weight during lactation, but differences between groups were not significant. In the E group compared to the C group of goats higher amount of milk was found but without significant difference, while milk urea concentration was significantly higher, which was to be expected due to better feed rations. With regard to the achieved better production effects in goats fed with the addition of peas (15% in food), we suggest inclusion as a protein source in food of goats in lactation from organic breeding.

Key words: peas; goats; organic breeding; production

ВКЛУЧУВАЊЕ НА ГРАШОКОТ КАКО ИЗВОР НА ПРОТЕИНИ ВО ИСХРАНАТА НА МЛЕЧНИ КОЗИ ОДГЛЕДУВАНИ НА ОРГАНСКИ НАЧИН

Целта на овој труд беше да се испита можноста за вклучување на грашокот во зрна (*Pisum sativum* spp *sativum*) во дажбите на кози во лактација, одгледувани на органски начин. Истражувањето беше изведено врз 14 кози од расата француска алпина. Козите беа во трета лактација, приближно на возраст од 4 години, поделени во две групи според исхраната. Контролната група кози (К) беше хранета со смеса од концентрирана храна (800 g/ден) и сено од луцерка *ad libitum*, додека за експерименталната група (Е) беше додаден грашок (15% во смесата) во замена за пченка. Мерењето на тежината и телесните димензии, како и контролата на млечноста и земањето примероци од млекото се изведени на почетокот и на крајот на истражувањето (од 70 до 1000 лактациски дена). Во козјото млеко беше испитана содржината на масти, протеини, лактоза, сува материја и уреа, како и бројот на соматски клетки и микроорганизми. Вклучувањето на грашок во храната на групата Е на кози доведе до позитивно влијание на физичкиот развој и екстериерните карактеристики, како и до постигнување подобра жива маса и помала загуба во живата маса за време на лактацијата, но разликата помеѓу групите не беше сигнификантна. Кај козите во групата Е, во споредба со групата К, беше забележано повисоко количество на млеко, но без сигнификантна разлика, додека концентрацијата на уреа во млекото беше сигнификантно повисока, што беше и очекувано поради подобрите дажби. Поради постигнатите подобри производни ефекти кај козите хранети со додавање грашок (15%) во храната) ние го препорачуваме неговото вклучување како извор на протеини во храната на козите во лактација одгледувани на органски начин.

Клучни зборови: грашок; кози; органско одгледување; производство

INTRODUCTION

Field peas (*Pisum sativum* ssp. *Sativum*) are a high protein feedstuff that is used as grain for ani-

mal feed. Its use in feeding domestic animals is usually as an alternative to other protein feedstuffs and it is justified because of its high protein content (22–34%). Majority of peas protein consist

globulins and albumin (70–95%) and as forage it has a good balance of essential amino acids. Peas, in addition to protein, is a good source of starch and besides protein it seems to be of very high quality and an economical source of protein and energy in the diets of animals [1]. Cultivation of peas for organic production is very important because with nodule bacteria it enriches soil with significant amounts of fixed nitrogen from the atmosphere that results in green fertilization [2]. In addition, its use in animal feeding of organic breeding to satisfy the needs for protein has a greater importance [3]. Soybean and its by-products are main source of animal protein in the diet, but in recent years it is excluded from the diets of animals from organic breeding because it is more polluted with genetically modified organisms [4] that are in organic production strictly prohibited. Nowadays field pea cultivars are very low in anti-nutritive substances and it is possible to use them as a grain without harmful effects on productivity and health of animals [5, 6]. A small number of studies on the use of peas in the feeding of small ruminants are carried out [7, 8, 9] and are mostly aimed on the use of peas as a substitute for soybean. In combination with cereals peas is commonly used with barley because it has a rapid rate of degradation of starch which can be balanced with slight degradation of starch from peas [5]. Due to lower levels of sulfur amino acids, but also significant lysine content, the pea grain is quality upgrade of diet based on cereals [10].

The aim of the present study is to explore the possibility of inclusion of peas in the diet of lactating goats from organic breeding.

MATERIALS AND METHODS

The study was carried out with 14 goats, French Alpine breed, during the winter season of feeding, on an organic family farm. Goats were in 3rd lactation, average age 4 years, healthy and in good condition. Goats were, due to feeding, divided into two groups. The first group of goats (control) was fed with mixture of concentrates (50% barley, 30% corn, 10% wheat and 10% sunflower meal, 13.90% crude protein and 7.28 MJ NEL/kg) in the quantity of 800g/day/goat and alfalfa hay *ad libitum* (16.50% crude protein and 4.14 MJ NEL/kg). In the same grain mixture of the experimental group, at the expense of corn, field peas was included (120 g/day/goat, or 15% of the

mixture) and alfalfa hay *ad libitum*. In litter, goats had 1.5 goat kids in average, who were suckling until the age of 65 days. Rearing and feeding of goats was in accordance with the Regulations of organic livestock production [11]. Goats were weighed at the beginning (70 days of lactation \pm 5 days) and at the end of the study (100 days of lactation \pm 5 days). At the same time the body measures of goats were taken. Body condition score was assessed according to Santucci and Maestrini [12] with grades from 1 to 5, while the indices of anamorphosis and body proportions were calculated according to Chiofalo et al. [13]. Milk yield was measured at evening and morning milking. After that, determination of fat, proteins, lactosis and dry matter of milk were done by the infrared spectrometric method (HRN ISO 9622:2001). The total number of somatic cells (SS) in milk was determined by the fluoro opto electronic method (HRN EN ISO 13366–2:2007). Microbiological analysis of milk was done by the flow cytometry epifluorescent method (IDF 161A: 1995). Urea milk content was done by the color spectrophotometric method. The amount of milk produced per goat was determined on the basis of the milk volume in milliliters and its recalculation of the mass by using a conversing factor, which is 1.030 for goats [14]. The research results were analyzed by the LSD-test in the computer program [15] and expressed as arithmetic mean (mean) and standard deviation (sd). Significance of differences was expressed at the level ($P < 0.05$).

RESULTS AND DISCUSSION

Table 1 presents the exterior characteristics and indices of goats' development in organic breeding fed with the addition of peas.

The inclusion of peas in the diet of goats from the experimental group had positive influence on the indices of physical development and exterior characteristics and achieved greater weight and less weight losses of goats during lactation (Table 2), but differences between groups were not significant. Addition of cereals in diets often gives lower body weight gain than those fed with the addition of legumes grain-peas [16, 17]. The replacement of cereal grain by legumes, in general, raises consumption and feed conversion, weight gain and wool growth, which explains their high proportion of metabolic energy and nitrogen content [18]. Achieved losses in body weight of

lactating goats are in accordance with the previous research and knowledge about the metabolism in lactating goats [19]. Morand-Fehr et al. [20] and Badamana et al. [21] concluded that the goats per kidding in the first month of lactation lose 1 kg of the body weight per week, and in the next month, 0.5 kg/week. Body weight losses of goats from the control group were in agreement with these studies. However, the experimental group of goats had less weight losses, which are probably the reason of the higher quality diet and the later stage of lactation. Hadjipanayiotou [22] found that goats in the middle of lactation which produce 2.5 kg of milk, corrected on milk fat, require diets that con-

sist 16% of crude protein. Most of these authors concluded that the mobilization of body reserves of fat and protein occurs in the early stages of lactation in goats, which even do not have to be closely associated with changes in the body weight. Lanza et al. [23] presented that crude proteins from peas, as in other legume seeds, have a low level of avoiding ruminal degradation and high digestibility, which could be a disadvantage in providing of proteins in diets of high dairy goats. Loe et al. [24] pointed out that the qualitative substitute of corn with peas is possible in feeding lambs at the rate of 450g/kg DM.

Table 1
Exterior characteristics and development indices of goats in organic farming

Indicators	Groups (mean ± sd)		Significance (P value)
	Control	Experiment	
Withers height, cm	67.43 ± 1.92	68.93 ± 3.25	0.443
Carcass length, cm	64.71 ± 4.11	69.79 ± 5.57	0.131
Chest circumference, cm	85.14 ± 6.30	85.43 ± 5.87	0.859
Chest width, cm	14.07 ± 5.89	15.86 ± 1.57	0.490
Shin-bone circumference, cm	8.40 ± 0.38	8.14 ± 0.27	0.197
Body condition score	3.00 ± 0.50	3.24 ± 0.24	0.561
Anamorphosis index	107.96 ± 15.17	107.75 ± 15.89	0.985
Body proportion index	66.23 ± 7.08	66.83 ± 11.58	0.883

Table 2
Body weight and gains of goats during the research

Indicator	Groups (mean ± sd)		Significance (P value)
	Control	Experiment	
Initial body weight, kg	46.39 ± 5.60	47.16 ± 8.20	0.764
Final body weight, kg	44.69 ± 5.29	46.29 ± 9.34	0.619
Total gain, kg/animal	-1.70 ± 1.86	-0.87 ± 2.17	0.448
Gain, g/day	-56.67 ± 62.09	-29.05 ± 72.41	0.448

Analyzing the Table 3 it is evident that the higher amount of milk was determined, but with no significant difference ($P < 0.05$), while the urea content in milk of goats fed with the addition of peas compared to those fed with cereal grains was significantly higher ($P < 0.01$), which was expected because of the better diet. Other parameters of the

chemical composition of milk, as well as somatic cells and microorganisms were not different.

In Australia with inclusion of 3.5 kg/day ground pea replacing the barley grain in low-producing dairy cows, an increased milk yield by 0.9 kg/day was found [25]. In most studies conducted by replacing corn with soybeans or peas in the diets of ruminants had no effect on milk pro-

duction [26, 27, 28, 29] but the chemical composition of milk in a smaller number of studies in terms of fat and urea differed. The study by Liponi et al. [30] using peas in feed of lactating ewes

showed a similar chemical composition of milk, but lower protein content compared to the sheep fed with added soybean meal or bean fodder.

Table 3

The amount and chemical composition of goat milk

Indicators	Groups (mean ± sd)		Significance (P value)
	Control	Experiment	
Milk amount, kg/day	1.99 ± 0.59	2.21 ± 0.44	0.165
Dry matter, %	11.72 ± 0.60	11.32 ± 0.93	0.374
Protein, %	2.75 ± 0.29	2.76 ± 0.33	0.988
Fat, %	3.58 ± 0.42	3.36 ± 0.63	0.447
Lactosis, %	4.38 ± 0.19	4.21 ± 0.13	0.094
Dry matter without fat, %	8.14 ± 0.44	7.96 ± 0.43	0.577
Urea, mg/dl	17.36 ± 2.97	32.14 ± 5.95	0.001
Number of somatic cells, SC/ml	747285.71 ± 445405.33	804957.14 ± 645652.96	0.881
Number of microorganisms, cfu/ml	6857.14 ± 6414.27	6142.86 ± 2544.84	0.801

In the study by Volpelli et al. [28] a significant increase in urea was found in the milk of cows fed peas in groups which may lead to better degradability of extruded peas protein fractions. Bonomi et al. [9] when feeding lactating goats with addition of 5 and 10% of pea meal in partial substitution of soybean meal and maize meal, found that it does not affect the milk production and health status of goats.

According to Renna et al. [8] peas can be effectively used as a source of protein in exchange for soybeans in low or high productive dairy sheep. The authors found no significant differences in the quantity and chemical composition of sheep milk, neither in the number of somatic cells and bacteria in milk. Antunovic et al. [31] found similar amounts and chemical composition of goat milk from organic breeding.

CONCLUSION

With regard to determined little bit better production performance of lactating dairy goats from organic production fed with diets supplemented with 15% of peas, its inclusion in diets is justified.

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