

## Effect of use of herbal feed additive on coccidian invasion level and performance traits in goats

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**Abstract:** *Effect of use of herbal feed additive on coccidian invasion level and performance traits in goats.* The aim of this study was to investigate if use of phytogetic feed additive based of bioactive herbal compounds affected coccidian invasions and production parameters in goats. This research was carried out on a flock of adult Boer goats and their offspring owned by the WULS-SGGW's Sheep and Goat Research Farm in Żelazna. The experimental and control groups were established regarding 14 and 10 does for fecal analysis, respectively as well as 10 and 7 does for milk performance analysis, respectively. Does were at 2–7 lactation and reared 1–2 kids. The addition of herbal feed additive (ADICOX AP) was applied in feeding of experimental group in doze of 200 g per ton of concentrate. Individual fecal samples were collected directly from the rectum from does (beginning and end of trial time) as well as from kids (end of the experiment). The McMaster counting technique and the flotation method was applied for does and kids respectively. The whole experimental time lasted for approx. 3 months since kidding pick and data regarding milk yield of does and body weights of kids were collected in every 2-weeks period. The results indicated addition of ADICOX AP in preventing of coccidiosis in goats caused several observations regarding experimental group such as: i. advantageous course of lactation curve in

milked goats, ii. higher body weights of kids and higher daily gains during first weeks of rearing, iii. significant lower number of oocytes per gram of faeces in adult goats and iv. decrease of highly infected kids. ADICOX AP demonstrated its high usefulness in prevention of coccidiosis in goats. Moreover, the advantageous trends in production traits, both in adult goats and in kids, gave additional benefit, which indicated the possibility of use ADICOX AP in standard breeding practice. Additionally this study also indicated the necessity of searching for naturally based feeding solutions in animal diets which may be helpful in maintaining parasitic infections and could bring better production yields for breeders.

*Key words:* goats, phytoncides, feed additive, coccidiosis, production performance.

### INTRODUCTION

Coccidiosis is a common parasitic disease of the intestinal tracts of animals, which is spread in many farm animal species around the World (Tenter et al., 2002). It is caused by the coccidian protozoa belonging to the genus *Eimeria*. Coccidiosis is very common in goats and

its typical symptom is diarrhea, especially in kids. The disease development is affected by several factors regarding environment, management and animal immunity, emphasizing the age of animals especially (Balicka-Ramisz, 1999; Smith and Sherman, 2009). While in fact most of adult goats are vectors and asymptomatic, kids suffer very often from coccidiosis, including death in extreme incidents (Kaba et al., 2007). This characteristic indicates the particular economic losses in goat breeding demonstrated by lower daily gains and lower body weights of young goats.

Prevention of coccidiosis is based on the pharmaceutical coccidiostatic treatments, which are used as the feed additives in animal nutrition (Olejnik et al., 2009). However, their time of use is officially limited by the EU until the end of 2012 (1831/2003/EC regulation, Anon., 2003). This facts caused the need of stimulating the development of alternative products preventing coccidiosis incidents and one way is to look for the solutions based on the natural active substances.

ADICOX AP (AdiFeed) is the one of such products containing naturally occurring plant ingredients of important biological effects as phytoncides and phytoalexins and may be helpful and efficient to manage coccidiosis in goats and other farm animals as well (Róžański and Drymel, 2010). Due to its innovative solution effects of ADICOX AP addition on the level of coccidia infection and some production traits in goats as milk yield and growth development should be also recognized, although such study were presented in a limited number (Rochfort et al., 2008; Cornale et al.,

2011; Ghosh et al., 2011; Malecky et al., 2011; Ringdorfer, 2011).

## MATERIAL AND METHODS

**Animals.** The experiment was carried out in 2010 on Boer goats owned by the Warsaw University of Life Sciences (Poland) and housed at the Sheep and Goat Research Farm in Żelazna. Flock of 24 adult Boer goats was split into experimental (n = 14) and control (n = 10) groups. Classification of does to the proper group took place during 14 days after kidding for each goat. The does were at 2–7 lactation and they were suckled by 1 or 2 kids. The feeding of goats from the experimental group with the addition of ADICOX AP (dose: 200 g per ton of concentrate) started during the 14-days of preparatory phase and was maintained at the same level during the right experimental time, which has started since 15th day after kidding and lasted for 3 months. Although the ADICOX AP was designated for the does from the experimental group, their kids might have taken this feed additive unintentionally. Diet regarded following fodders of the own-farm production as hay, straw and concentrates and goats were fed accordingly to norms (Kowalski, 2001). Either goats or kids were kept indoors in barn during the experiment.

**Fecal samples and their processing.** Level of coccidia infection was evaluated in adult goats as well as in their kids. Fecal samples were collected directly from the rectum to plastic bags and then stored at 4°C. Fecal samples of does were taken twice during the experiment (at the beginning and at the end), whereas the samples from kids were taken once only at the end of experiment.

Microscopic fecal examination of coccidian infections was based on number of oocytes per gram of faeces (OPG) and it was performed using the McMaster counting egg technique in adult goats. Due to the small amount of faeces from kids the simple flotation method in salt saturated solution was applied (Gundlach and Sadzikowski, 1995). The judging scheme for the flotation method in kids' faeces was given in the Table 1.

#### Milking of does and weighing of kids.

In every two-weeks period, data regarding milking yield of does were obtained accordingly to the method proposed by Konstantinou (1973). At the earliest 7 days after parturition first milking took place. To obtain whole milk from udder, the 5 i.u. of synthetic oxytocine was injected intramuscularly to each milked goat. The machine milking was applied. Moreover body weights of kids were collected during the same time. Data of milking as well as weighting were standardized due to 2-weeks periods regarding

14, 28, 42, 56 and 70 day of lactation and age, respectively.

**Statistical calculations.** The effects of group and phase of experiment as well as the interaction on the OPG in adult goats were estimated with the LSM method using the SPSS v. 14 software [Anon., 2006]. To establish the effect of group in kids the chi-square test was applied. Also LSM method in milk yield analysis considering effects of group, lactation number, litter size and week of lactation as well as chosen 2-factors interactions (group x litter size, group x week of lactation and litter size x week of lactation) was applied. Statistical model regarding effects of group, birth type and sex as well as chosen 2-factors interactions (group x birth type, group x sex and birth type x sex) were used in LSM analysis of performance traits in kids. Statistical differences between experimental groups were evaluated with F-test (Ruszczyc, 1981). Obtained results were shown in Tables and on Figures.

TABLE 1. Judging scheme for the oocytes number determination using the simple floatation method in salt saturated solution

Symbol	Description criteria
+	absence
++	single (1–5 oocytes)
+++	not numerous (5–30 oocytes)
++++	numerous (30–60 oocytes)
+++++	very numerous (more than 60 oocytes)

TABLE 2. Effect of use ADICOX AP on milk field (l/day) in Boer goats (n = 18)

Trait	N	Group	
		Control (A)	Experimental (B)
		7	11
Milk yield (l/day)	LSM	1.561	3.733
	SE	0.904	0.308
	*	b	a

\* statistical significance at: a, b –  $p < 0.05$ .

## RESULTS AND DISCUSSION

**Fecal examination.** Significantly lower number of oocytes per gram of faeces was observed in the experimental group in contrary to the control group in adult goats (Fig. 1). Differences within the level of coccidia invasion were also observed between kids accordingly to the group (Fig. 2). Kids from the control group demonstrated higher frequency of infected animals, whereas approx. 33% of kids from the experimental group did not presented any oocytes in faeces. The

kids from the experimental group were not intentionally fed with the ADICOX additive, although they had free access to concentrate feeders like their mothers did.

Very few studies were focused on describing the effect of use of medical treatments on the coccidian management in goats (Balicka-Ramisz, 1999). However, it was described by Balicka-Ramisz (1999) that occurrence of oocytes in faeces changes within year and their highest level was presented in March-July and mean value was 1950 OPG

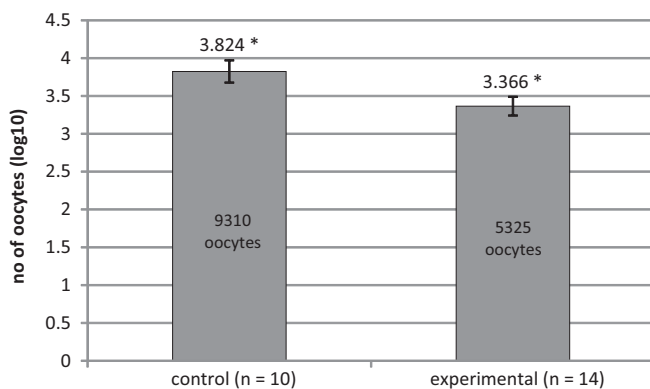


FIGURE 1. Effect of addition of ADICOX AP on the number of oocytes per gram faeces in the adult Boer goats (n = 24, \* – p < 0.05)

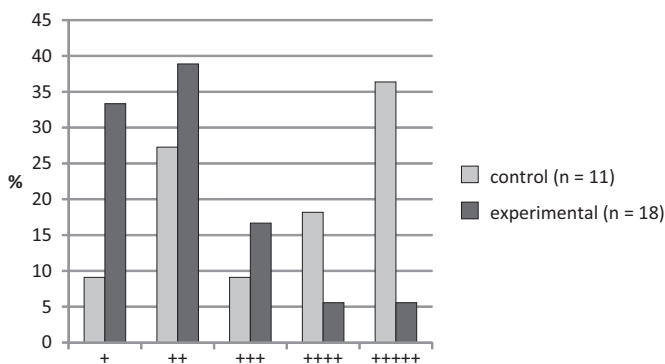


FIGURE 2. Effect of ADICOX AP addition on the coccidian infection level in Boer kids ( $X^2(4) = 15.34$ ; p < 0.01; n = 29)

in adult goats. Own results obtained for kids from control group corresponds indirectly to the high intensity of coccidia invasion in kids at 22 500 OPG during period of spring-summer (March-July) reported by Balicka-Ramisiz (1999), however different technique was used in own studies.

Summing up, obtained results presented lower number of oocytes per gram of faeces in adult goats as well as important decrease of highly infected

kids in experimental group where the phytogetic feed additive was applied.

#### **Production traits – milk yield of does.**

The milk traits were examined on 18 goats: 7 and 11 goats from the control and experimental group, respectively. Use of ADICOX resulted in higher milk yield in experimental group, which was important for rearing abilities of does from this group (Tab. 3). Trends in milk yield during first stages of lactation in both groups were also studied on raw

TABLE 3. Effect of group on standardized body weights and daily gains in Boer kids (n = 29)

Traits		Group	
		Control (A)	Experimental (B)
N		12	17
Standardized body weight (kg) at age of:			
At birth	LSM	3.104	4.213
	SE	0.338	0.214
	*	B	A
14 days	LSM	5.507	6.568
	SE	0.581	0.368
28 days	LSM	8.410	11.026
	SE	0.755	0.479
	*	B	A
42 days	LSM	11.854	13.538
	SE	0.819	0.519
56 days	LSM	15.926	15.105
	SE	1.219	0.773
70 days	LSM	16.762	17.825
	SE	1.686	1.069
Standardized daily gains (kg/day) in periods of:			
0–14 days	LSM	0.172	0.168
	SE	0.032	0.020
15–28 days	LSM	0.207	0.318
	SE	0.044	0.028
	*	b	a
29–42 days	LSM	0.246	0.179
	SE	0.052	0.033
43–56 days	LSM	0.291	0.112
	SE	0.076	0.048
	*	b	a
57–70 days	LSM	0.060	0.194
	SE	0.105	0.067

\*statistical significance at: A, B –  $p < 0.01$ ; a, b –  $p < 0.05$

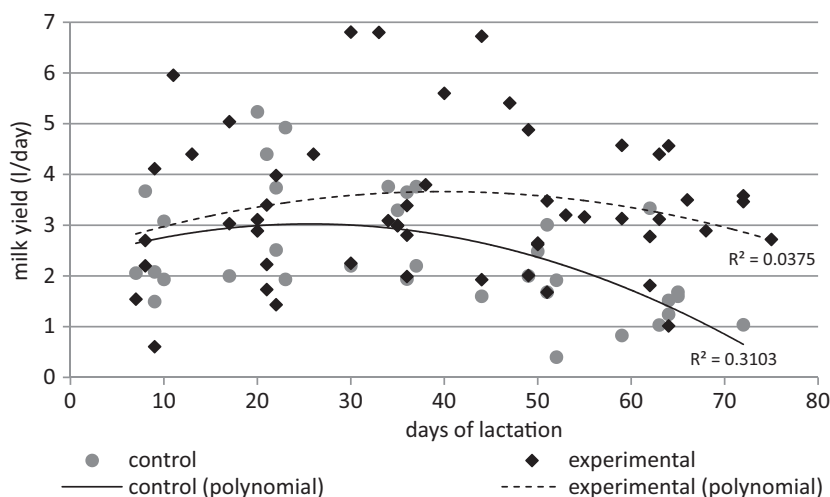


FIGURE 3. Trends in milk yields (l/day) during lactation in the Boer goats (n = 18)

data. That chart (Fig. 3) presented more beneficial lactation curve for does from the experimental group, although these data presents higher dispersion than the control group.

Milk yield plays a very important role in survival and growth of the young, especially in cattle, sheep and goats as well. It was reported that addition of condensed tannin forages (e.g. *L. corniculatus*) in ewes or supplementation of nicotinic acid in dairy cows could increase milk yield (Rochfort et al., 2008). Other studies described absence of effect of supplementation of garlic and juniper berry in dairy cows (Yang et al., 2006). Such studies on goats are poorly documented. However study of Malecky et al. (2009) indicated that use of monoterpene blend oils in diet expressed absence of effect on milk yield in milk goats.

**Production traits – body weight and growth performance of kids.** Body growth development of kids was examined on the group of 29 kids: 12 and 17

belonging to the control and experimental groups, respectively. The weighing of kids took place at the same time as milking controls of does. Kids from experimental groups were statistically heavier ( $p < 0.01$ ) at birth and at 28th day of age (Tab. 3) than kids from the control group. Generally, kids from the experimental group presented higher body weights during the whole experiment and this trend was demonstrated on the Figure 4. Statistically better results of average daily gains (ADG) were observed in kids from the control group during whole research (Tab. 3), excluding the period of 15–28 day, when the kids from experimental group expressed higher ADG. Analysis of raw data also indicated this trend and it was presented on Figure 5. As it was mentioned previously, the milk yield is strongly correlated with growth development of the young ruminants (Rochfort et al., 2008), so this was also approved by the own results.

Some studies corresponds also to the herbal additives used in fattening of

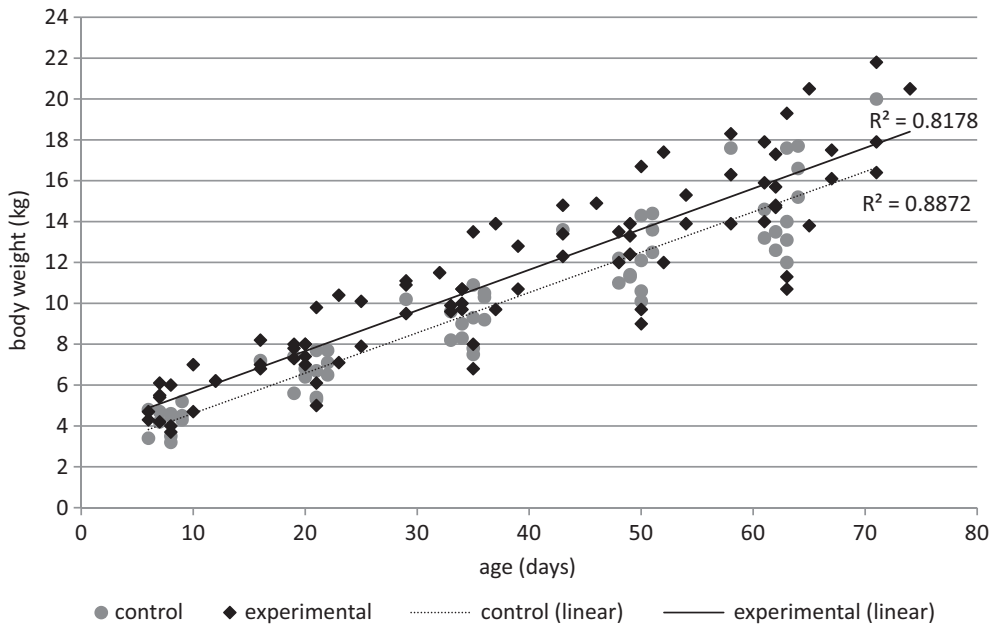


FIGURE 4. Trend in body weight of kids (kg) due to the group and age (n = 29)

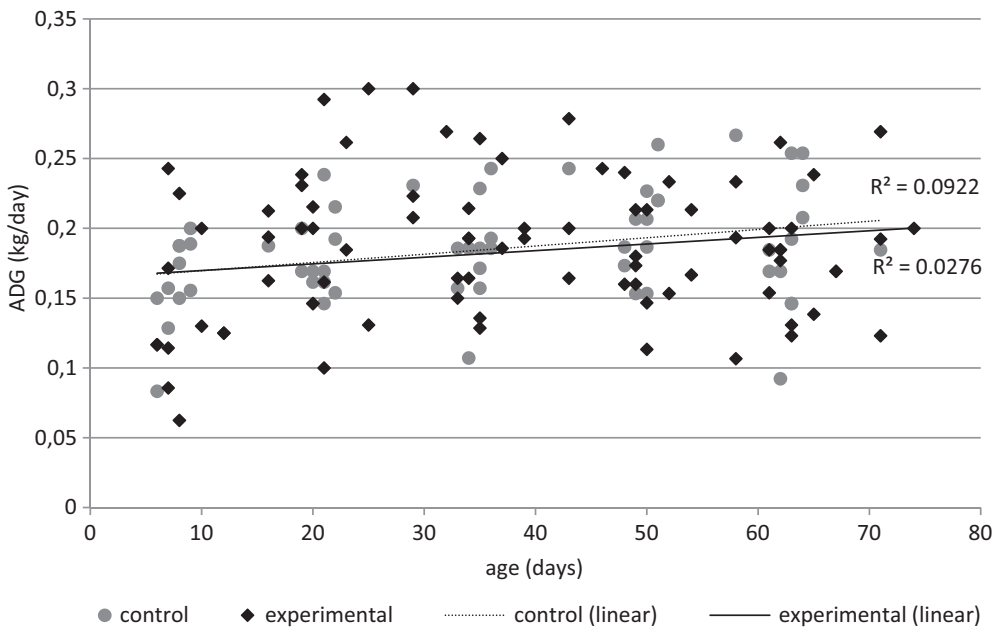


FIGURE 5. Trend in average daily gains – ADG (kg/day) in Boer goat kids due to the group and age (n = 29)

young lambs, calves or finishing bulls. Ringdorfer (2011) reported the absence of effect of use of three types of phyto-genic feed additives on any fattening performance traits as daily gains, dry matter intake or feed conversion in lambs, whereas the statistical ( $p < 0.001$ ) influence of sex was observed. Better results were observed in cattle. Cornale et al. (2011) reported higher ( $p < 0.05$ ) daily gains in finishing bulls after supplementation with plant extracts of ginger (*Zingiber officinale*) and european stoneseed (*Lithospermum officinale*), however these results differed due to breed and farm localization. In the study carried out by Ghosh et al. (2011), use of garlic supplementation in feeding of calves in the pre-ruminant stage caused ( $p < 0.01$ ) higher daily gains, higher feed intake, better quality of faeces and higher costs of feeding.

## CONCLUSIONS

Addition of ADICOX AP in preventing of coccidiosis in goats caused several observations due to the experimental group:

1. Significant lower number of oocytes per gram of faeces in adult goats;
2. Decrease of highly infected kids;
3. Advantageous course of lactation curve in milked goats;
4. Higher body weights of kids and higher daily gains during first weeks of rearing.

The ADICOX AP addition demonstrated its high usefulness in prevention of coccidiosis in goats. Moreover, the advantageous trends in production traits, both in adult goats and in kids, gave

additional benefit, which indicated the possibility of use ADICOX AP in standard breeding practice.

Moreover this study also indicated the necessity of researching for naturally based feeding solutions in animal diets which may be helpful in maintaining parasitic infections and bring better production yields for farmers.

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- paszowych bazujących na bioaktywnych składnikach na poziom zainfekowania kokcydiami oraz na wskaźniki produkcyjne u kóz. Badania prowadzono na stadzie kóz burskich wraz z potomstwem, będącym w posiadaniu Doświadczalnej Fermy Owiec i Kóz, RZD Żelazna, SGGW. Stado kóz podzielono na dwie grupy: doświadczalną i kontrolną, w których uwzględniono odpowiednio w analizie kału 14 i 10 matek, a w analizie cech mlecznych – 10 i 7 matek kozich. Kozę znajdowały się w 2–7 laktacji i odchowywały 1–2 kozłat. W żywieniu grupy doświadczalnej zastosowano dodatek roślinnej mieszanki ziołowej (ADOC PX AP) w dawce 200 g/tonę paszy treściwej. Doświadczenie prowadzono przez 3 kolejne miesiące od szczytu wykotów, rejestrując dane co dwa tygodnie: poziom mleczności kóz oraz masy ciała kozłat. W żywieniu kóz użyto pasz pochodzących z gospodarstwa w dawkach wg norm (Kowalski, 2001). Próby kału pobierano indywidualnie bezpośrednio z odbytu, przy czym u kóz dorosłych próbki pobierano dwa razy (na początku oraz na końcu doświadczenia), a u kozłat tylko przy zakończeniu doświadczenia. Stopień zainfekowania kóz dorosłych określono metodą McMastera, podczas gdy u kozłat zastosowano metodę flotacji w nasyconym roztworze NaCl. Przeprowadzone badania pozwoliły zauważyć, że zastosowanie preparatu ADICOX AP w profilaktyce kokcydiozy u kóz spowodowało w grupie doświadczalnej: 1) uzyskanie wyższej produkcji mleka u kóz matek, 2) uzyskanie wyższych mas ciała kozłat oraz wyższych przyrostów masy ciała w trakcie początkowego okresu odchowu, 3) istotne zmniejszenie liczby oocyst w 1 g kału u kóz dorosłych, oraz 4) korzystne oddziaływanie na zmniejszenie stopnia zainfekowania kokcydiami u kozłat. Na podstawie przeprowadzonych badań można stwierdzić wysoką przydatność preparatu ADICOX AP w profilaktyce kokcydiozy u kóz. Ponadto polepszenie cech produkcyjnych stanowi dodatkowy atut przemawiający za wprowadzeniem tego dodatku do standardowego użycia. Niniejsza praca wskazuje także na możliwość poszukiwania takich dodatków paszowych opartych na naturalnych składnikach, które mogłyby zarówno pomóc w opanowaniu infekcji pasożytniczych, jak i podnosić wyniki produkcyjne u zwierząt hodowlanych.

**Streszczenie:** *Wpływ stosowania ziołowego dodatku paszowego na poziom inwazji kokcydii oraz na wskaźniki użytkowe u kóz.* Celem badawczym było określenie wpływu roślinnych dodatków

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