Scientific Papers. Series D. Animal Science. Vol. LXIII, No. 2, 2020
ISSN 2285-5750; ISSN CD-ROM 2285-5769; ISSN Online 2393-2260; ISSN-L 2285-5750

INFLUENCE OF HERBAL SUPPLEMENTS ON THE PRODUCTIVITY AND SLAUGHTER QUALITIES IN FATTENING PIGS

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Abstract

A scientific experiment with twenty fattening pigs from the Danube White breed was conducted in Agricultural Institute - Shumen. The animals were separated into two groups of ten, and were fed and reared in individual boxes. The experiment began with an average live weight of 55.300 kg for the control group and 55.800 kg for the trial group. Throughout the rearing period, the animals received compound feed containing 15.5 g Crude Protein (CP), 0.71 g Lysine, 0.67 g calcium and 0.60 g phosphorus. To the feed of the experimental group were added herbal supplements 20 g/per capita daily with the following composition: 50% rosehip flour, 30% nettle leaves, 10% weeds grass, 5% dandelion, 5% hawthorn. The aim of this experiment was to establish the influence of herbal supplements on the productivity, slaughter qualities, chemical composition and physical properties of m. Longissimus dorsi meat in fattening pigs. In conclusion, we established that the herbal supplement has influenced the fat thickness in the shoulder (30.00 mm and 19.40 mm, P=0.027) and back (17.40 mm and 32.00 mm, P=0.016).

***Key words**: fattening pigs, hawthorn, herbs, nettle leaf, rosehip, slaughter qualities, weeds grass.*

INTRODUCTION

The use of herbs and their healing effect has been known since ancient times. For a long time, knowledge about them has not only been down to their macro and microscopic description, but to the discovery of the reasons for their medicinal properties, i.e. the study of biologically active substances in them (Boeva, 2011; Marin et al., 2016).

According to the World Health Organization, healing plants are considered those plants, including leaves, stems, rhizomes, peels, flowers, fruits, grains or seeds, which contain substances which can be used for therapeutic purposes (Bohlin and Bruhn, 1999).

Many of them have been used as feed supplements in pig breeding for stimulating animal growth (Huang et al., 2010; Yan et al., 2010; Ao et al., 2011; Yan et al., 2011; Yan et al., 2012).

They have a positive effect on the secretion of digestive enzymes (Wenk, 2003; Cho et al., 2006; Huang et al., 2010).

The interest of numerous scientists in herbs and plant extracts has been connected to their antimicrobial, antioxidant and stimulating effect on the digestive system (Singh et al., 2002).

Urtica incisa contains a significant amount of biologically active compounds. For example, nettle leaves are sources of terpenoids, carotenoids and fatty acids, as well as various essential amino acids, chlorophyll, vitamins, tannins, carbohydrates, sterols, polysaccharides, isolectins and minerals. Extracts from the above ground parts of the nettle are rich sources of polyphenols, while the roots contain oleanolic acid, sterols and sterile glycosides. Due to the variety of phytochemicals and their proportions, nettle shows noticeable activity against both Gram-positive and Gram-negative bacteria. These properties make nettles suitable for a number of possible applications, including functional foods, nutritional supplements and pharmacological preparations (Dorota et al., 2018).

The most important and comprehensively studied bioactive components of the *Taraxacum* are chlorogenic acid (CGA), cichoric acid (CRA), taraxasterol (TS) and sesquiterpene lactones (SEL). These components have great potential as anti-diabetic pharmaceuticals and nutritional products for the regulation of diabetes. They also have the potential to be used as functional food.

The dandelion contains the bitter substance taraxacin, Cetearyl Alcohol, lactocerol, caoutchouc, inositol, choline, saponins, tannins, organic acids, triterpenes, resinous and slimy substances (Fonyuy et al., 2016).
Hawthorn fruits (*Crataegus pinnatifida* Bge. Var. Major) are rich in pectic polysaccharides and are used from centuries in China as food and an herb (Guo et al., 2019). They contain nutrients and antioxidant compounds. The antioxidant activity of the hawthorn fruits is strongly connected to the total content of polyphenols, flavonoids and triterpenoid acids (Liu et al., 2019).
Polygonum aviculare has a wide range of effects. It can be applied in treatment of different types of cancer, vascular and liver diseases. In its fresh or dried state, the herb can be used in treating problems with the gastrointestinal tract.
It has hematopoietic and urinary effects, increases blood pressure and ventilatory capacity of the lungs. It is known for its beneficial effects on respiratory disorders and inflammation in the bladder area. (https://diagnozata.bg/билкова-енциклопедия).
Over the past few years, medical interest in the *Rosa canina* has increased as a result of recent research into the use and treatment of several diseases, including skin, hepatotoxicity, kidney disorders, diarrhea, inflammatory disorders, arthritis, diabetes, hyperlipidemia, obesity and cancer.
The plants' therapeutic potential is based on its antioxidant effects connected to its phytochemical content, which includes ascorbic acids, phenolic compounds, fatty acids, etc. (Ines et al., 2017).
The aim of the experiment was to establish the influence of the herbal supplement (50% rosehip flour, 30% nettle leaves, 10% weeds grass 5% dandelion, 5% hawthorn) on the productivity, health, slaughter qualities, chemical composition and physical properties of *m. longissimus dorsi* meat in fattening pigs.

MATERIALS AND METHODS

A scientific experiment with twenty fattening pigs from the Danube White breed was conducted in Agricultural Institute – Shumen. The animals were separated into two groups of ten (control and trial groups), and were fed and reared in individual boxes.
The experiment began with an average live weight of 55.300 kg for the control group and 55.800 kg for the trial group.
Throughout the rearing period, the animals received compound feed containing 15.5 g crude protein (CP), 0.71 g lysine, 0.67 g calcium and 0.60 g phosphorus. To the feed of the experimental group were added herbal supplements 20 g/per capita daily with the following composition: 50% rosehip flour, 30% nettle leaves, 10% weeds grass, 5% dandelion, 5% hawthorn.
Throughout the experiment (the following indicators were controlled: feed intake – daily; average daily gain – at the beginning and at the end of the experiment, individually; feed consumption per kg gain – for the entire trial period; health – daily.
After reaching the certain slaughter live weight, the animals were slaughtered. After a 24-hour cooling period a slaughter analysis was done and carcass measurements were established according to the Regulations on Breeding Value, Productivity and Ranking of Breeding Pigs (1996).
The meats' chemical composition was determined according to methods by Sandev (1979).
The physical properties of the meat were determined by the following methods: the pH in the meat was determined according to the method described by Pozharskaya et al. (1964), the color of the meat was determined at three places on both sides of the two-centimeter cut, done perpendicular on the muscle fibers (24 h post mortem), after which values averaged.
Color reading was performed with a Spectocolorimeter "Specol" at a wavelength of 525 nm - according to Pinkas (1981). Muscle fiber thickness and weight loss from meat roasting were determined by the methods described by Otto (1959, 1963, 1964). Water holding capacity (WHC) was estimated by the amount of free water by the method of Grau and Hamm (1952).
Results were calculated according to the methods of the variation statistics.

RESULTS AND DISCUSSIONS

Pigs from both groups were fed with compound feed, compliant and prepared according to their weight development (Table 1).

Table 1. Experiment scheme

Group I (Control – 10 animals)	Group II (Trial – 10 animals)
Compound feed	Compound feed
-	Herbal supplement 20 g per day per animal

The trial group was given herbal supplement with their feed (Table 2).

Table 2. Compound feed for pigs from 55 to 110 kg live weight

Components	%
Corn	25.00
Wheat	51.88
Wheat bran	8.00
Bioconcentrate-14	15.00
Synthetic lysine, 98%	0.12
Total	100.00
Content in 1 kg feed:	
OE, MJ	12.52
Crude protein, %	15.5
Lysine, %	0.71
Methionine + cystine, %	0.51
Threonine, %	0.47
Tryptophan, %	0.16
Crude fats, %	1.97
Crude fibers, %	4.11
Ca, %	0.67
P, %	0.60

Both groups practically had the same intake of compound feed, exchange energy, crude protein, lysine and other nutrients (Table 3).
The differences in average daily gain, feed consumption and nutrients per kg of gain between the control and trial groups were so minimal that they can be ignored. This indicated that the herbal combination used had no significant effect on these features. Our results were similar to those of Oh et al. (2007), who also found that when feeding broilers, there was no significant difference in final body weight, weight gain, feed intake and conversion of compound feed containing antibiotics, 1.0% dandelion supplement.

Table 3. Feed intake, average daily gain and feed consumption results for 1 kg of gain

Traits	**Groups**	
	1	2
Intake per day		
Feed, kg	3.545	3.535
OE, MJ	44.74	44.62
Crude protein, g	64.2	64.0
Lysine, g	3.4	3.4
Average daily gain, kg	1.084	1.050
Consumption for 1 kg of gain:		
Feed, kg	3.286	3.391
OE, MJ	41.47	42.80

Table 4 indicates the clinical analysis results. It shows that the results for the meat and fat indicators in the halves, as well as the yield are practically the same for both groups.
Statistically significant differences were found in the distribution of fat in the carcasses. The pigs in the trial group had less fat at the shoulders (19.40 mm) than those in the control group (30.00 mm, P = 0.027). At the same time, the back fat thickness (BFT) was thinner in control animals - 17.40 mm versus 32.00 mm, P = 0.016. Hanczakowska et al. (2007), in an experiment with 42 fattened pigs, also found that nettle extract in feed had an effect on slaughter indicators.
Correlation coefficients (Table 5) indicate that there is a connection (R=0.78 and R=0.80) between the independent trait – herbal supplement and the dependent traits – back fat thickness and fat at the shoulders.
From the regression analysis, it can be seen that the proportions of the variability of the features have been largely covered by the regression equation, which is evident from the coefficients of determination - R2 = 0.61 and R2 = 0.63; which is a good scope for explaining the differences between the groups. The regression coefficients were B =-10.60 and B =14.60, respectively, with a high degree of statistical significance (P = 0.007 and P = 0.006).

Table 4. Slaughter analysis results

Traits	Groups		P
	1	2	
Live weight, kg	110.00	109.00	0.071
Carcass weight, kg	74.175	72.940	0.171
Half, kg (left)	37.678	37.070	0.289
Half, kg (right)	36.497	35.870	0.350
Half - meat, kg	30.589	29.408	0.179
Half - fat, kg	5.912	6.462	0.157
Slaughter output, %	67.50	66.992	0.288
Shoulder fat thickness, mm	30.00	19.40	0.027
Back fat thickness, mm	17.40	32.00	0.016
Stook x1	24.2	25.6	0.318
Stook x2	23.6	25.6	0.324
Stook x3	18.2	19.0	0.406
Mean (three measurements) C, K, L	23.668	25.666	0.320
Area MLD, cm2	42.10	39.22	0.178
Head, kg	2.618	2.740	0.253
Neck shop, kg	5.213	4.833	0.278
- meat, kg	4.469	4.09	0.261
- fat, kg	0.744	0.743	0.498
Fore ham, kg	6.528	6.232	0.044
- Meat with bone, kg	5.907	5.492	0.040
- Fat, kg	0.621	0.740	0.146
Breast part, kg	4.999	4.924	0.439
- Meat with bone, kg	4.164	4.056	0.401
- Fat, kg	0.835	0.868	0.364
Belly, kg	7.623	7.700	0.420
- Meat with bone, kg	6.186	5.724	0.041
- Fat, kg	1.437	1.976	0.018
Real ham, kg	10.065	9.804	0.180
- Meat with bone, kg	8.312	8.432	0.276
- Fat, kg	1.753	1.372	0.060
Tallow	0.522	0.763	0.008
Loin	0.36	0.42	0.184
Shin, kg	1.187	1.194	0.463

Table 5. Correlation coefficients, determination and regression

Traits	R	R^2	Invariable	B	P
Live weight, kg	0.11	0.01	111.00	-1.00	0.759
Carcass weight, kg	0.31	0.09	75.410	-1.230	0.387
Half, kg (left)	0.22	0.05	38.290	-0.610	0.543
Half, kg (right)	0.17	0.03	37.120	-0.630	0.629
Half - meat, kg	0.39	0.15	31.770	-1.180	0.266
Half - fat, kg	0.43	0.18	5.360	0.550	0.220
Slaughter output, %	0.11	0.01	68.01	-0.51	0.755
Shoulder fat thickness, mm	0.78	0.61	40.60	-10.60	0.007
Back fat thickness, mm	0.80	0.63	2.80	14.60	0.006
Stook x1	0.17	0.03	22.80	1.40	0.638
Stook x2	0.19	0.04	21.60	2.00	0.596
Stook x3	0.10	0.01	17.40	0.80	0.782
Mean (three measurements) C, K, L	0.21	0.05	21.67	2.00	0.552
Area MLD, cm2	0.31	0.10	44.98	-2.88	0.376
Head, kg	0.28	0.08	2.500	0.120	0.426
Neck shop, kg	0.28	0.08	5.600	-0.380	0.442
- meat, kg	0.30	0.09	4.850	-0.380	0.407
- fat, kg	0.01	0.00	0.750	0.00	0.983
Fore ham, kg	0.47	0.23	6.830	-0.300	0.166
- Meat with bone, kg	0.61	0.37	6.320	-0.410	0.062
- Fat, kg	0.46	0.21	0.510	0.110	0.184
Breast part, kg	0.06	0.00	5.080	-0.070	0.868
- Meat with bone, kg	0.10	0.01	4.270	-0.100	0.784
- Fat, kg	0.11	0.01	0.810	0.030	0.756
Belly, kg	0.08	0.01	7.550	0.080	0.823
- Meat with bone, kg	0.64	0.41	6.640	-0.460	0.046
- Fat, kg	0.78	0.60	0.900	0.540	0.008
Real ham, kg	0.27	0.07	10.320	-0.260	0.444
- Meat with bone, kg	0.14	0.02	8.200	0.120	0.698
- Fat, kg	0.61	0.37	2.140	-0.380	0.064
Tallow	0.84	0.71	0.290	0.240	0.002
Loin	0.40	0.16	0.300	0.060	0.253
Shin, kg	0.03	0.00	1.180	0.010	0.925

Fore ham (6.528 kg versus 6.232 kg, P=0.044) and meat from it (5.907 kg versus 5.492 kg, P=0.040) had higher values in pigs from the trial group. The same statistical significance was also observed in the meat (6.186 kg versus 5.724 kg, P=0,041) and fat in the belly (1.437 kg versus 1.976 kg P=0.018). The ratio of meat to fat in the belly between the two groups was different. We observed a significant and strong connection, respectively, between the study factor and the dependent variables - R = 0.64 and R = 0.78. The model generally explains the variability of dependent traits with coefficients of determination - R2 = 0.41 and R2 = 0.60.

Real ham of the pigs in the first group was 10.065 kg, and for the pigs in the second, 9.804 kg. This difference was not statistically proven. The meat in the real ham was 8.312 and 8.432 kg, respectively. A statistically significant difference was found in the fat in the real ham – 1.753 versus 1.372 kg (P = 0.060), respectively, for the 1st and 2nd groups. The results indicated that the lower weight of real ham in the trial group was due to the lower quantities of fat.

Significant differences were not observed between the groups in relation to the physicochemical content of *m. Longissimus dorsi* (Table 6) and the results can be practically considered as identical.

Table 6. Physicochemical composition (% of *m. Longissimus dorsi*)

Traits	Groups			
	1	Sx	2	Sx
Moisture (total)	75.55	1.28	75.24	0.81
Dry matter	24.45	1.28	24.76	0.81
Protein	20.76	0.97	20.98	0.66
Min. substances	1.10	0.04	1.11	0.03
Fat	2.58	0.32	2.67	0.20
Water retention	33.13	0.31	33.11	0.92
Color	23.65	0.42	22.98	0.71

CONCLUSIONS

The herbal supplement has affected the thickness of fat in the shoulder (30.00 mm and 19.40 mm, P=0.027) and back (17.40 mm and 32.00 mm, P=0.016) in fattened pigs in the control and trial groups.

Statistical significance was also observed in the meat (6.186 kg versus 5.724 kg, P=0.041) and fat in the belly (1.437 kg versus 1.976 kg P=0.018).

The herbal supplement (30% nettle leaves, 5% dandelion, 5% hawthorn, 10% weeds grass, and 50% rosehip flour) in a 20 g/day dose had no significant influence on productivity traits, chemical composition and physical meat qualities of *m. Longissimus dorsi* of fattened pigs.

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