Bulgarian Journal of Agricultural Science, 21 (No 3) 2015, 668-673
Agricultural Academy

THE EFFECT OF WINTERING CONDITIONS ON THE BODY WEIGHT AND CARCASS QUALITY OF FARM-RAISED FALLOW DEER (*DAMA DAMA*)

P. JANISZEWSKI, T. DASZKIEWICZ and J. CILULKO
Univeristy of Warmia and Mazury, Faculty of Bioengineering, 10-719 Olsztyn, Poland

Abstract

JANISZEWSKI, P., T. DASZKIEWICZ and J. CILULKO, 2015. The effect of wintering conditions on the body weight and carcass quality of farm-raised fallow deer (*Dama dama*). *Bulg. J. Agric. Sci.,* 21: 668–673

Farm-raised fallow deer are a source of meat characterized by a high nutritional value and high processing suitability. A variety of treatments can be applied to modify the final quality of carcasses obtained from farmed fallow deer and red deer. The objective of this study was to demonstrate that limited exposure to adverse weather conditions in the winter contributes to higher body weight gains and superior carcass quality in young farmed male fallow deer.

The results of our study indicate that wintering under shelter limits exposure to adverse weather conditions in the winter and has a positive effect on body weight gains and carcass dressing percentage in farm-raised fallow deer. During a six-month experiment, the average body weight of control group fallow deer increased by only 2.43 kg, compared with 6.88 kg in the experimental group (at similar initial body weights in both groups). Highly significant differences between groups were found in the weight of four out of the five analyzed carcass cuts. Significant differences between groups were observed with regard to the percentage share of four carcass parts too. The lean meat content of the neck, shoulders and legs was highly significantly higher in experimental group animals.

Key words: fallow deer, deer farming, slaughter value

Introduction

Venison from deer is characterized by a wide range of positive attributes (Hoffman and Wiklund, 2006; Morgante et al., 2003; Polak et al., 2008; Wiklund et al., 2003). It can be obtained from hunted and farmed animals (Hoffman and Wiklund, 2006; Romanzin et al., 2010). The quality of carcasses of hunter-harvested animals can be only minimally improved, and possible treatments are limited to preliminary processing after harvest, such as castration, evisceration and chilling (Janiszewski and Daszkiewicz, 2010). The quality of carcasses of farm-raised deer is affected by the diet (Volpelli et al., 2002, 2003), slaughter conditions (Jago et al., 1997; Pollard et al., 2002), castration (Mulle et al., 1996) and other factors (Drew, 1985; Smith and Dobson, 1990; Wiklund et al., 2001).

The objective of this study was to demonstrate that limited exposure to adverse weather conditions in the winter contributes to higher body weight gains and supreme carcass quality in young farmed male fallow deer.

E-mail: janisz@uwm.edu.pl

Materials and Methods

The experiment was performed in a private commercial farm deer in north-eastern Poland, keeping around 1500 fallow. A total of 40 males were randomly selected for the study. The average age of the deer at the beginning of the experiment was six months. The animals were divided into two groups of 20 individuals each:

- experimental group – kept in a shelter built of wooden boards, with access to a run yard of 0.1 ha enclosed with wooden boards to the height of 2.5 m. The animals were kept in the shelter to minimize the effects of adverse weather conditions.
- control group – kept in a typical paddock with an area of approximately 5 ha without shelter. The group stayed with the basic herd of around 60 animals.

Both groups were fed identical diets composed of a cereal mixture (ca. 0.5 kg/animal) and haylage (*ad libitum*). The animals had *ad libitum* access to water and mineral licks (blocks).

The experiment was carried out in two stages between 15 December 2010 and 24 October 2011.

Stage I – evaluation of body weight gains over the winter

Both groups were weighed six times, once a month on the following dates:

I -15 December 2010,
II - 19 January 2011,
III - 26 February 2011,
IV - 26 March 2011,
V - 26 April 2011,
VI - 30 May 2011.

The animals were weighed on an electronic scale (with an accuracy of 0.1 kg) connected to a mechanical holding device which was applied to immobilize the animals during the weighing procedure. At the end of this stage (30 May 2011), experimental group fallow deer were released into the paddock where both groups of animals were kept together until slaughter.

Stage II – carcass measurement and cutting

All animals were slaughtered on the farm on the 12th October 2011 in line with the regulations in force. They were fasted for 24 hours prior to slaughter. After slaughter, hide was removed from the carcasses, and other non-edible parts were separated: lower limb sections and the head which were weighed on an electronic scale with an accuracy of 0.1 kg. The following cuts were dressed based on standard (BN-84 /9241-10) and the guidelines given by Janiszewski (2009):

- loin – by cutting in the front along the ribs, perpendicular to the spine between the second and the third rib, and in the back along the line separating the leg;
- ribs – by separating the legs, the saddle and the shoulders;
- neck – by cutting between the first cervical vertebra and the base of the skull in the cranial direction and along the line separating the saddle in the caudal direction;
- shoulders – by performing a semi-circular cut through the muscles connecting forelimbs and the chest cavity;
- legs – by cutting between the second to last and the last lumbar vertebrae, along the spine line at the top; the upper section of the hind limb is classified as part of the leg.

The cuts were weighed, deboned and the percentage share of meat and bones in each cut was determined.

The experiment was performed upon the prior approval of the Local Ethics Committee; decision number UWM 90/2009.

Statistical analysis

The results were processed statistically in the Statistica 8.0 application. The analyzed traits were described by determining arithmetic means, standard deviations and the significance of differences between means. The experiment was performed in a one-factorial orthogonal design to determine the effect of wintering conditions on body weight and carcass quality.

Results and Discussion

Body weight gains

At the beginning of the experiment (December), control and experimental group fallow deer were characterized by similar body weights at 25.78 kg and 26.12 kg, respectively (Figure 1). In the successive six months, clear differences in body weight gains were observed between the two groups.

The body weights of control group males increased in the first two months of the experiment (January, February), and they decreased to the value noted at the beginning of the experiment in the third month of the study (March). An increase in body weights was noted in successive months (April, May), and the rate of growth was similar to that observed at the beginning of the study. The body weights of control group fallow deer increased by only 2.43 kg (8.62%) over the six-month period.

The body weights of control group animals varied on a seasonal basis. The above could be attributed to seasonal fluctuations in the appetite levels of farm-raised deer. During the winter, fallow deer consume smaller amounts of feed and at greater time intervals due to the natural light cycle which regulates the animals' activity levels. According to Bobek et al. (1984), seasonal differences in the body weight of deer are also affected by smaller quantities and lower quality of feed as well as harsh weather conditions in the winter.

In the experimental group, a drop in the body weights of fallow deer was observed already after the first month (January) of the experiment (Figure 1). The above could be attributed to stress resulting from relocation to an unknown environment. In the months that followed, the body weights

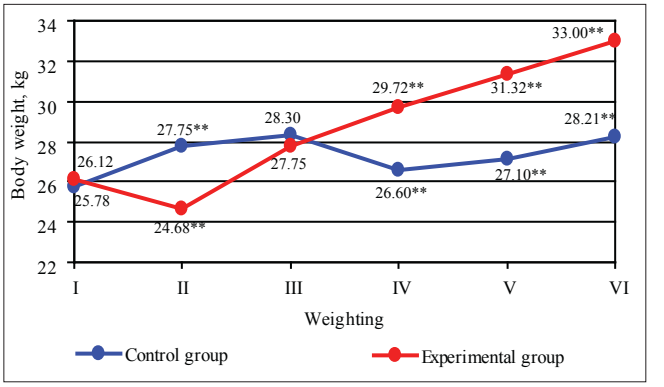

Fig. 1. Changes in body weight (kg) of control and experimental group fallow deer

* - P ≤ 0.05; ** - P ≤ 0.01

of experimental group animals increased steadily to reach an average of 33.00 kg at the end of the study. The body weights of experimental group fallow deer increased by 6.88 kg (20.85%), and the resulting difference was 12.23% higher than in the control group.

The final body weights of 11-month-old fallow deer were lower than those noted by Bruggeman and Schwark (1989) in a study of one-year-old bucks which reached 41.00 kg as well as by Wunsch and Schwark (1994), in whose work the average final body weight of animals was 40.10 kg. In this experiment, the body weights of 7-month-old bucks were consistent with those reported for similarly aged animals raised in an Australian farm (Mulley and English, 1985).

Carcass dressing percentage

The average carcass weight of fallow deer slaughtered at the age of 16 months was 27.09 kg in the control group and 31.19 kg in the experimental group, and the difference between the two groups was highly significant. The carcass dressing percentage was determined at 51.32% in the control group and at 52.34% in the experimental group (Table 1).

Fallow deer from the experimental group were characterized by higher ($P<0.05$) live weight and, consequently, higher ($P<0.05$) carcass weight. The carcass dressing percentage of experimental animals was also 1% higher in comparison with control ($P<0.05$).

In a study by Drozd et al. (1996), the carcass dressing percentage of 16-month-old farm-raised male fallow deer was similar (51.41%) to that noted in control group animals in our experiment. According to Mulle and English (1985), the carcass weight of 15-month-old fallow bucks raised in an Australian farm reached 48 kg, and the carcass dressing percentage of animals slaughtered at the age of 20 months reached 65%. In the work of Volpelli et al. (2002), 18- and 30-month-old male fallow deer raised in a farm had the body weight of 41.6 kg and 53.3 kg, respectively. In the above study, cold carcass weight was determined at 23.7 kg and 32.0 kg, respectively. Carcass dressing percentages were higher than those noted in our experiment, reaching 56.8% in 18-month-old males and 59.9% in 30-month-old fallow deer. Hoog et al. (1990) determined the dressing-out proportion of one-year-old and two-year-old male fallow deer at 54-55% and noted that castration had no significant influence on the above values.

Weight of non-edible carcass components

The average weight of all non-edible carcass components was higher in the control group than in the experimental

Table 1
Live weight, carcass weight and carcass dressing percentage (animals - 16 months old)

Specification	Control group		Experimental group	
	$\overline{x}$	S	$\overline{x}$	S
Live weight, kg	52.78^{B}	6.01	59.59^{A}	4.41
Carcass weight with skin, head and legs, kg	27.09^{B}	3.17	31.19^{A}	2.16
Carcass dressing percentage, %	51.32^{b}	5.88	52.34^{a}	3.55

a b - $P \leq 0.05$, A B - $P \leq 0.01$

Table 2
Weight and percentage share of non-edible carcass parts

Specification	Control group		Experimental group	
	$\overline{x}$	S	$\overline{x}$	S
Carcass with skin, head and legs, kg	27.09^{A}	3.17	31.19^{B}	2.16
%	100	10.83	100	10.69
Skin, kg	3.20^{b}	0.42	2.56^{a}	0.55
%	11.81^{b}	1.55	8.21^{a}	1.66
Leg, kg	1.13^{B}	0.08	0.98^{A}	0.08
%	4.17^{b}	1.21	3.14^{a}	0.22
Head, kg	2.32^{B}	0.16	2.03^{A}	0.16
%	8.56	0.51	6.51	0.50
Total non-edible parts, kg	6.65^{B}	0.39	5.57^{A}	0.43
%	24.54^{B}	1.99	17.86^{A}	1.42

a b - $P \leq 0.05$, A B - $P \leq 0.01$

group, and the noted difference was statistically significant (Table 2). In the experimental group, the total weight of non-edible components was 5.57 kg, which accounted for 17.86% of the total carcass weight. In the control group, the respective values were 6.65 kg and 24.54%. The weight and percentage share of non-edible carcass parts in both deer groups are presented in Table 2.

In the study by Volpelli et al. (2002) the head accounted for 4.75% to 4.55% in 18- and 30-month-old males (respectively), and the above value was lower than those noted in this experiment. In the cited study, the percentage share of the skin reached 6.70% and 6.86%, respectively, and it was also below the values noted in our work.

Weight of carcass cuts

Carcass weight without skin and non-edible components was determined at 20.44 kg in the control group. It was 5.18 kg higher in the experimental group, and the difference was highly significant. In the study by Slamecka et al. (2004), the carcass weight of farm-raised fallow deer aged 15-17 months reached 23.62 kg, and the above result ranked between the values noted in both groups of our experiment.

Highly significant differences were found between groups in the weight of four out of the five analyzed carcass cuts. Significant differences between groups were observed with regard to the percentage share of four carcass parts too (Table 3).

The average loin weight was 4.05 kg in the experimental group, where meat had a 73.58% share, whereas in the control group, the loin weighed only 3.10 kg, of which meat accounted for 70.97% (Tables 3 and 4). In the work of Slamecka et al. (2004), loin weight was similar to that noted in our control group at 3.25 kg with at 69.54% meat content of this cut. Different results were reported by Drozd et al. (1996) in whose experiment meat had a high 80.74% share of the loin.

The average weight of the neck was higher in the experimental group (3.33 kg) than in the control group (2.22 kg), but the percentage share of meat in this cut was similar in both groups (65.17% and 65.32%, respectively). Somewhat higher values were reported by Drozd et al. (1996) at 67.94% and Slamecka et al. (2004) at 67.64%.

Similarly to the above cuts, the weight of the shoulder was also higher in the experimental group. In the study by Drozd et al. (1996), the meat content of the shoulder reached 78.56%, which was similar to the values noted in our experimental group (78.95%) but higher than in the control group (76.68%). Slamecka et al. (2004) observed a lower proportion of meat in the shoulders at 74.63%.

Leg weight reached 10.16 kg in the experimental group and 8.28 kg in the carcasses of fallow deer which were kept under typical farm conditions. The percentage content of meat in that cut was determined at 78.05% and 77.29% in experimental and control groups, respectively. The above values are lower than the findings of Drozd et al. (1996) in whose study, meat had an 80.74% share of fallow deer legs. In the work of Slamecka et al. (2004), the legs of farm-raised fallow deer weighed 9.73 kg and were characterized by more than an 80% meat content.

The only difference which was not statistically significant between the two groups was the average weight of the ribs which was higher in experimental group animals. The differences in the proportion of the ribs between groups were significant at 0.05.

Table 3
Weight and percentage share of primal cuts from fallow deer carcasses

Specification	Control group		Experimental group	
	$\bar{x}$	S	$\bar{x}$	S
Carcass without skin, head or lower leg sections, kg	20.44^{A}	2.24	25.62^{B}	2.61
%	100.0	10.52	100	10.17
Loin, kg	3.10^{A}	0.43	4.05^{B}	0.38
%	15.21^{a}	2.00	15.80^{b}	1.45
Ribs, kg	3.64	0.95	3.90	0.51
%	17.65^{a}	5.06	15.24^{b}	1.99
Neck, kg	2.22^{A}	0.36	3.33^{B}	0.25
%	10.91^{a}	1.68	12.99^{b}	1.00
Shoulder, kg	3.20^{A}	0.36	4.18^{B}	0.23
%	15.69^{a}	1.68	16.31^{b}	0.90
Leg, kg	8.28^{A}	1.01	10.16^{B}	0.65
%	40.54	4.25	39.66	2.54

A B - $P \leq 0.01$; a, b, - $P \leq 0.05$

Table 4
Meat and bone content of primal cuts

Specification	Control group		Experimental group	
	$\overline{x}$	S	$\overline{x}$	S
Loin				
Meat, kg	2.20^{a}	0.24	2.98^{b}	0.30
%	70.97^{a}	7.31	73.58^{b}	7.42
Bones, kg	0.90^{a}	0.09	1.07^{b}	0.12
%	29.03^{a}	2.72	26.42^{b}	2.95
Ribs				
Meat, kg	2.32^{a}	0.24	2.78^{b}	0.27
%	63.74^{A}	6.56	71.28^{B}	6.91
Bones, kg	1.32^{a}	0.14	1.12^{b}	0.13
%	36.26^{A}	3.83	28.72^{B}	3.31
Neck				
Meat, kg	1.45^{A}	0.19	2.17^{B}	0.25
%	65.32	7.26	65.17	7.50
Bones, kg	0.77^{A}	0.12	1.16^{B}	0.13
%	34.68	4.62	34.83	3.90
Shoulder				
Meat, kg	2.45^{A}	0.29	3.30^{B}	0.36
%	76.56^{a}	8.43	78.95^{b}	9.01
Bones, kg	0.75^{a}	0.11	0.88^{b}	0.09
%	23.44^{A}	3.20	21.05^{B}	2.15
Leg				
Meat, kg	6.40^{A}	0.75	7.93^{B}	0.76
%	77.29	9.02	78.05	7.47
Bones, kg	1.88^{A}	0.21	2.23^{B}	0.28
%	22.71	2.53	21.95	2.76

A B - $P \leq 0.01$, a, b, - $P \leq 0.05$

Conclusions

The results of our study indicate that wintering under shelter limits exposure to adverse weather conditions in the winter and has a positive effect on body weight gains and carcass dressing percentage in farm-raised fallow deer.

During a six-month experiment, the average body weight of control group fallow deer increased by only 2.43 kg, compared with 6.88 kg in the experimental group (at similar initial body weights in both groups).

Highly significant differences between groups were found in the weight of four out of the five analyzed carcass cuts. Significant differences between groups were observed with regard to the percentage share of four carcass parts too. The average percentage meat content of the ribs, shoulders and loin was highly significantly higher in experimental group animals.

References

BN-84/9241-10. Branżowa Norma. Mięso z dziczyzny. Tusze, półtusze, ćwierćtusze i elementy z dziczyzny mrożone (Pl).

Bruggemann, J. and H. J. Schwark, 1989. Growth of fallow deer. *Monatshefte fur Veterinarmedizin*, **44** (15): 523 – 527.

Bobek, B., K. Morow and K. Perzanowski, 1984. Ekologiczne podstawy łowiectwa. *PWRiL* Warszawa, 314 pp. (Pl)

Drew, K. R., 1985. Meat production from farmed deer. In: *Biology of deer production. The Roy. Soc. N. Z. Bull*., **22**: 285-290.

Drozd, L., T.Gruszecki and M. Szymanowski, 1996. Wstępna ocean tusz jeleni i danieli pochodzących z chowu fermowego. *Annales UMCS Sectio EE*, **43**: 269-273 (Pl).

Hoffman, L. C. and E. Wiklund, 2006. Game and venison – meat for modern consumer. *Meat Sciences*, **74**: 197-208.

Hogg, B. W., L. M. Catcheside and G. J. K. Mercer, 1990. Carcass composition in male Fallow deer: age and castration effects on dissected tissue distribution. *Animal Production*, **51**: 405-413.

Jago, J. G., R. G. Harcourt and L. R. Matthews, 1997. The effect of road-type and distance transported on behavior, physiology and carcass quality of farmed red deer (*Cervus elaphus*). *Applied. Animal Behaviour Science*, **51**: 129-141.

Janiszewski, P., 2009. Use of selected traits for carcass quality assessment in the red deer (*Cervus elaphus*) harvested in the hunting grounds of north-eastern Poland. Dissertations and monographs. *Wydawnictwo Uniwersytetu Warmińsko – Mazurskiego*, Olsztyn, 102 pp (Pl).

Mojto, J., O. Palanska, V. Kartusek and E. Bezakova, 1993. Kvalita masa ratitovej zveri z volnej prirody. *Polnohospodarstvo*, **39** (1): 54-60 (Cz).

Morgante, M., R.Valusso, P. Pittia, L.A. Volpelli and E. Piasentier, 2003. Quality traits of fallow deer (*Dama dama*) dry-cured hams. *Italian Journal of Animal Science*, **2**: 557-559.

Mulley, R. C. and A. W. English, 1985. The effects of castration of fallow deer (*Dama dama*) on body growth and venison production. *Animal Production*, **41**: 359-361.

Mulley, R. C., A. W. English, J. M. Thompson, R. M. Butterfield and P. Martin, 1996. Growth and body composition of entire and castrated fallow bucks (*Dama dama*) tread with zeranol. *Animal Science*, **63**: 159-165.

Polak, T., A. Rajar, L. Gasperilin and B. Zlender, 2008. Cholesterol concentration and fatty acid profile of red deer (*Cervus elaphus*) meat. *Meat Science*, **80**: 864-869.

Pollard, J. C., R. P. Littlejohn, G. W. Asher, A. J. T. Pearse, J. M. Stevenson-Barry, S. K. McGregor, T. R. Manley, S. J. Duncan, C. M. Sutton and K. L. Pollock, 2002. A comparison of biochemical and meat quality variables in red deer (*Cervus elaph*us) following either slaughter at pasture or killing at a deer slaughter plant. *Meat Science*, **60**: 85-94.

Romanzin, M., A. Amici, C. Casolo, L. Esposito, P. Lupi, G. Marsico, S. Matiella, O. Olivieri, M. P. Ponzetta, C. Russo and M. T. Marinucci, 2010. Meat from wild ungulates: ensuring quality and hygiene of an increasing resource. *Italian Journal of Animal Science*, **9**: 318-331.

Slamecka, J., P. Hell, J. Mojto and J. Gasparik, 2004. Results of butchering of fallow deer being bred in farms. *Folia Venatoria*, 34: 115-125.

Smith, R. F. and H. Dobson, 1990. Effect of preslaughter experience on behaviour plasma cortisol and muscle pH in farmed red deer. *Veterinary Record*, **2** (17): 155-158.

Volpelli, L. A., R. Valusso and E. Piasentier, 2002. Carcass quality in male fallow deer (*Dama dama*): effects of age and supplementary feeding. *Meat Science*, **60** (4): 427-432.

Volpelli, L. A., R. Valusso, M. Morgante, P. Pitta and E. Piasentier, 2003. Meat quality in male fallow deer (*Dama dama*): effects of age and supplementary feeding. *Meat Science*, **65**: 555-562.

Wiklund, E., J. M. Stevenson-Barry, S. J. Duncan and R. P. Littlejohn, 2001. Electrical stimulation of red deer (*Cervus elaphus*) carcasses – effect on rate of pH-decline, meat tenderness, colour stability and water-holding capacity. *Meat Science*, **59**: 211-220.

Wiklund, E., T. R Manley, R. P. Littejohn and J. M. Stevenson-Barry, 2003. Fatty acids composition and sensory quality of *Musculus longissimus* and carcass parameters in red deer (*Cervus elaphus*) grazed on natural pasture re fed a commercial feed mixture. *Journal of the Science of Food and Agriculture*, **83**: 419–424.

Wunsch, U. and H. J. Schwark, 1994. Wachstum, Korpermase und Schlachtkoper zusammensetzung beimannlichem Damwild. *Archiv Tierzucht*, Dummerstorf, **37** (2): 173 – 184.

Received July, 7, 2014; accepted for printing February, 20, 2015.