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EFFECT OF GLYCOL ADMINISTERED TO YOUNG BULLS BEFORE TRANSPORTATION ON BEEF QUALITY

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The studies were carried out in 2005 on 21 young Black-and-White bulls. The animals were divided into two groups: experimental (10 bulls) and control (11 bulls). The young bulls from the first group were given 250 mL glycol before transportation.

Forty five minutes after the slaughter of animals, pH of *m. longissimus dorsi* was measured. After 48 h of cooling pH was assayed again and a meat sample was collected from *m. longissimus dorsi* at the last thoracic vertebrae for further analysis.

The samples were analysed for dry matter, protein, fat and ash contents. Water holding capacity (WHC) was also assessed with the use of Grau and Hamm method.

The application of glycol before transportation of young bulls did not affect meat composition, WHC nor *m. longissimus dorsi* pH after slaughter, however pH of *m. longissimus dorsi* decreased significantly after 48 h of cooling.

INTRODUCTION

The quality traits of culinary meat demanded by the consumer are largely affected by preslaughter handling of young cattle [Wichłacz, 1995, 1996]. Inappropriate preslaughter handling of cattle can completely undermine the efforts of slaughter cattle breeders to improve genotype or make feeding rational [Pisula, 1996; Wajda, 1998].

Preslaughter handling of slaughter animals involves a number of stress situations. These include physical strain, mental stress connected with a change of environment and animal handling methods, preslaughter fasting, and changes in temperature and humidity [Węglarz *et al*., 2002]. Stress depletes muscle glycogen reserves, which negatively affects the glycolytic processes in the muscular tissue *postmortem* and affects the colour, pH and tenderness of meat [Węglarz *et al*., 2002].

In many experiments, prior to slaughter animals were given high-energy nutrients in the form of molasses [Wajda, 2001; Wichłacz, 1995, 1996], glucose [Schaffer *et al.*, 1990] and different energy and fat supplements such as oil, lard, tankage grease and rendering scraps [Wajda *et al.*, 1990, 1992/1993; Wichłacz & Wajda, 1994], but improvements in meat quality were not always evident.

In dairy cows during the energy deficit period, breeders often use ruminal infusions of glucose precursors. The most popular preparation is propylene glycol [Kowalski, 2005]. The strong antilipolytic action of glycol alleviates perinatal stress in dairy cows. It is interesting to find out if glycol can have a similar effect in young bulls exposed to stress factors during preslaughter handling.

The aim of the present study was to determine the effect of administering propylene glycol before transportation on meat quality of Black-and-White × Holstein-Friesian bulls.

MATERIAL AND METHODS

The study was carried out in 2005 with 21 Black-and-White × Holstein-Friesian young bulls. Bulls were kept untethered and fed a total mixed ration (TMR) containing maize silage, grass haylage, cereal straw and concentrate. In addition to the TMR, animals received maize pulp after the morning feeding. Bulls were allowed unlimited access to water and mineral salt licks.

Prior to transportation to the slaughterhouse, bulls were randomly divided into 2 groups: control (K) – 11 animals and experimental (D) – 10 animals.

Directly before transportation, propylene glycol was administered to the bulls from the experimental group with an applicator used on the farm to administer glycol to periparturient cows.

Bulls were transported to a slaughterhouse about 45 km from the farm (transportation took approximately 1.5 h). After transportation, body weights of the bulls were determined. Before slaughter, the animals were kept in small groups and were provided access to water.

Forty five minutes *postmortem* pH of the *musculus longissimus dorsi* was determined with a pH MASTER appara-

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TABLE 1. Body weight and pH of *muculus longissimus dorsi*.

Trait		D n = 10	K n = 11	Significance between the groups
Body weight	$\overline{x}$	534.67	549.91	ns
	Sd	64.16	56.32	
pH after slaughter	$\overline{x}$	6.56	6.65	ns
	Sd	0.24	0.13	
pH after 48 h	$\overline{x}$	5.51	5.61	*
	Sd	0.05	0.12	

ns – differences not significant; *- differences statistically significant at p≤0.05; ** - differences statistically significant at p≤0.01

TABLE 2. Chemical composition of *musculus longissimus dorsi* and water-holding capacity (WHC).

Trait		D n = 10	K n = 11	Significance between the groups
Dry matter (%)	$\overline{x}$	25.73	26.07	ns
	Sd	0.83	0.77	
Protein (%)	$\overline{x}$	22.64	22.24	ns
	Sd	0.77	0.81	
Fat (%)	$\overline{x}$	1.95	2.20	ns
	Sd	0.06	0.07	
WHC (cm^2/g)	$\overline{x}$	21.62	23.66	ns
	Sd	3.58	3.29	

ns – differences not significant; *- differences statistically significant at p≤0.05; ** - differences statistically significant at p≤0.01

tus (Dramiński, Olsztyn). The degree of muscle tissue acidity was determined again after 48 h.

To analyse meat quality, slices of the *m. longissimus dorsi* were taken at the last thoracic vertebrae. Meat samples were placed in a labelled plastic bag and transported at +2°C to +4°C to a laboratory of the Department of Cattle Breeding of the University of Technology and Agriculture in Bydgoszcz.

The meat samples were analysed for: dry matter content, protein content, fat content, and water holding capacity (WHC).

Dry matter content was determined by drying the samples in an electric air dryer at 378 K (105°C) and calculating the difference in weight before and after drying. Protein content was determined with the Kjeldahl method, and fat content using a Soxhlet apparatus [Krełowska-Kułas, 1993].

Water holding capacity was evaluated according to Grau and Hamm [Tyburski *et al.*, 1997].

Numerical data were analysed by Statistica 5.1 software using one-way analysis of variance. Significant differences between means were verified using the Duncan's multiple range test.

RESULTS AND DISCUSSION

As a result of glycol administration to the bulls in the experimental group, a lower pH of the *m. longissimus dorsi* was noted 45 min *postmortem* compared to the control group, yet the differences were not significant.

Preslaughter handling of animals had a significant effect on lowering the pH value of the *m. longissimus dorsi* after 48-h cooling in the carcasses of animals from experimental groups compared to the carcasses of control animals (Table 1).

Despite significant differences, the meat of bulls of both groups had a pH of normal meat. According to Wichłacz [1995], normal meat pH ranges from 5.4 to 5.8.

Dąbrowska [2002], who investigated the effect of giving Black-and-White bulls high-energy supplements containing propylene glycol for periparturient cows (Ketomix), noted significantly higher pH in the *m. longissimus dorsi* of animals receiving the supplement compared to the muscle of the control bulls. This result may be due to the fact that Ketomix was administered for 7 days before slaughter but not on the day of slaughter.

Mojto *et al.* [1994], who gave bulls a propylene glycol preparation for 5 days before slaughter, did not find any significant changes in pH of *m. longissimus dorsi*. Similar to the studies of Dąbrowska [2002], Mojto *et al.* [1994] did not administer the preparation on the day of slaughter.

Jones *et al.* [1992] did not find any changes in the meat pH of bulls using an electrolyte solution with glucose.

According to Dąbrowska [2000], preslaughter treatment of animals had a significant effect on reducing the meat pH of bulls receiving electrolytes (5.71) compared to the control group (5.76) and animals receiving intravenous injections of glucose (5.74).

The results of *m. longissimus dorsi* composition are given in Table 2.

Analysis of meat samples showed a slightly lower fat content of the *m. longissimus dorsi* of bulls from the experimental groups. The lower fat content of the meat of bulls

from the experimental groups resulted in a lower dry matter content, yet the differences were not statistically significant. A similar relationship was observed by Daszkiewicz and Wajda [2001], Młynek *et al*. [2000], and Oler *et al*. [2004].

Studies by many authors [Mielnik *et al.*, 1980; Trela *et al*., 2002, 2004; Tyszkiewicz, 1994; Wajda, 1996; Wichłacz *et al*., 1996; 1998] demonstrated that culinary meat with desired physical parameters and good taste should be characterised by the optimum content of intramuscular fat (1%) in the *m. longissimus dorsi*. This conforms with the trends in healthy human nutrition to limit the consumption of animal fats [Daninos, 1996]. Doroszewski [1972] considered 2% animal fat as a normal level in beef, whereas Tomkielski [1990] showed that the 2-4% content of fat in the *m. longissimus dorsi* does not deteriorate the organoleptic qualities of meat.

As body weight increased, a slight increase in dry matter of *m. longissimus dorsi* was observed. A similar tendency was observed by Młynek *et al*. [2000] – dry matter content was 25.8% in bulls fattened to 550 kg body weight and 28.3% in bulls fattened above this weight.

No significant effect of the treatment factor on the protein content of *m. longissimus dorsi* was observed. The lower protein content of *m. longissimus dorsi* was noted by Dąbrowska [2000], Chaberski [2003] and Oler *et al*. [2004].

In our study, lower water holding capacity was observed in the experimental group in relation to the control group, with no significant differences (Table 2).

CONCLUSIONS

1. Administering the bulls with propylene glycol significantly lowered pH of meat 48 h *postmortem*.
2. Providing the bulls with high-energy supplements prior to transportation had no effect on the composition of *longissimus dorsi* muscle.

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WPŁYW PRZEDUBOJOWEGO PODAWANIA GLIKOGENU PROPYLENOWEGO NA JAKOŚĆ MIĘSA BUHAJKÓW

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Badania przeprowadzono w 2005 roku na 21 buhajkach cb x hf, które podzielono na dwie grupy: doświadczalną (10 szt.) i kontrolną (11 szt.). Buhajkom z grupy doświadczalnej bezpośrednio przed transportem podano 250 mL glikolu propylenowego w celu dostarczenia łatwo przyswajalnej energii.

45 minut po uboju zwierząt oznaczono pH *musculus longissimus dorsi*. Po 48 godzinnym chłodzeniu ponownie określono pH oraz pobrano próbkę mięsa do badań analitycznych z *musculus longissimus dorsi* na wysokości ostatnich kręgów piersiowych.

W pobranych próbkach oznaczono zawartość suchej masy, białka, tłuszczu i popiołu. Oznaczono również zdolność do utrzymania wody własnej metodą Graua i Hamma.

Stwierdzono, że podanie glikolu propylenowego przed transportem buhajków nie wpłynęło w sposób istotny na skład mięsa, zdolność wiązania wody własnej i odczynu mięsa po uboju, natomiast istotnemu obniżeniu uległo pH oznaczone po 48 godzinnym wychładzaniu mięsa.