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The application of ultrasonography (USG) technique for assessment of muscularity of Berrichon du Cher and Polish Merino lambs at the age of 70 days

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Abstract: *The application of ultrasonography (USG) technique for assessment of muscularity of Berrichon du Cher and Polish Merino lambs at the age of 70 days.* The research was conducted on 106 Polish Merino lambs in 2010–2013 and 221 Berrichon du Cher lambs in 2008–2013 (except 2009). The research took place in GRH Żydowo near Gniezno. Animal muscularity was tested by USG technique on *mld* muscle cross section. Based on obtained results, the effect of type of birth, sex, father origin and class of scrapie resistance and double-factor interactions were statistically insignificant impact (except interactions sex × year of birth on round of "eye" of loin) on muscularity traits of Polish Merino and Berrichon du Cher lambs, highly statistical significant effect of the year of birth on USG measurement traits $p \leq 0.01$ (except spread width of "eye" of loin in Polish Merino breed). No effect of scrapie resistance class for muscularity traits indicates the possibility of freely conduct breeding work towards increasing resistant to scrapie genetics, without a negative impact on muscularity of lambs of both breeds. Strongly influence of year of the research as an environmental factor on the level of muscularity of lambs of both breeds at the age of 70 days has been shown, rather than the type of birth, sex, father origin or class of genetic resistance to scrapie.

Key words: sheep, ultrasonography technique, "eye" of the loin, muscle measurements

INTRODUCTION

Ultrasonography technique can be used to estimate the level of muscularity of the lambs (Przybylak et al. 2008, Knapik et al. 2009, Niżnikowski et al. 2010a, b, Knapik 2011). Thanks that reason the assessment of muscularity of lambs could be done with high repeatability of results. This technique was also used to compare muscularity between genetic combinations of lambs and giving the possibility to use this method for assessing the level body conformation (Niżnikowski et al. 2010a, b).

Considering the use of USG technique, it was decided to take measurements *mld* muscle at age of 70 day in Polish Merino lambs and Berrichon du Cher lambs. The aim was to examine the effect of some important factors taken into breeding work on the tested muscularity traits using ultrasonography technique.

MATERIAL AND METHODS

The research was conducted on 106 Polish Merino lambs in 2010–2013 and 221 Berrichon du Cher lambs in 2008–2013 (except 2009). The research took place in GRH Żydowo near Gniezno. The animals were selected for the renovation of the herd during the selection work carried out in both sexes. Both ewes and rams were born as singles, twins or triplets. The animals were kept in building during whole year and fed according to the norms (Osikowski et al. 1993). Mating season was conducted in period of May – June for Polish Merino and for Berrichon du Cher the mating season was conducted in period August – September. Basing on the breeding books the data of origin of father was collected: in case of Polish Merino Sheep (Polish or German) as well as Berrichon du Cher (Polish or France). In 2004 the German Mutton Merino rams were imported to Poland and included to Polish Merino breed genotype at no more than 50%. In 2005 and 2012 Berrichon du Cher rams were imported from France.

In both breed's offspring the genotype of prion protein was examined according to the method by Niżnikowski et al. (2013) and the class of frequency resistant to scrapie were specified (DEFRA 2006).

In Polish Merino breed following genotypes were observed: in class G1 (ALRR/ALRR), in class G2 (ALRR/ /AFRQ, ALRR/ALHQ, ALRR/ALRQ), in class G3 (ALRQ/ALHQ, ALRQ/ /ALRH, ALRQ/ALRQ), in class G4 (VLRQ/ALRR) and in class G5 (VLRQ/ /AFRQ, VLRQ/ALRQ).

In Berrichon du Cher breed following genotypes were observed: in class G1 (ALRR/ALRR), in class G2 (ALRR/ /ALHQ, ALRR/ALRH, ALRR/ALRQ), in class G3 (ALRQ/ALRQ, ALRQ/ALHQ) and in class G5 (VLRQ/ALHQ).

The USG measurement (using Honda 2000 device) were done on the *mld* muscle on live lambs at 70 day of age. The USG measurement allowed to establish the live parameters of muscularity: height, spread width, round and area of "eye" of loin, as well as the fat over the "eye" of the loin.

The statistical analysis was depended on the breed according to the statistical model included following variation sources: the year of birth, sex, type of birth, the origin of father, the class of genetic resistance to scrapie and selected double-factor interactions. The Duncan test was used to evaluate the effect of the year on examined traits (Ruszczyc 1981). The statistical calculations were done in SPSS software (version 21 for Windows). The results are shown in tables.

RESULTS AND DISCUSSION

The effect of chosen factors and interactions on muscularity traits of Polish Merino breed was presented in Table 1. The effect of the year of birth was observed in majority USG measurement traits ($p \leq 0.01$) (except spread of "eye" of loin). The effect of interaction (sex × birth of

TABLE 1. The effect of factors and interactions on measurement traits on *mld* muscle cross section by USG technique at the last thoracic vertebra on Polish Merino lambs at the age of 70 days (n = 106)

Traits	Factors					Interactions			$\bar{x}$	SE
	year of birth	type of birth	sex	orgin of father	scrapie genotype class	sex × type of birth	year of birth × type of birth	sex × year of birth		
mld "eye" hight (mm)	NS	NS	NS	NS	NS	NS	NS	NS	21.475	0.476
mld "eye" width (mm)	**	NS	NS	NS	NS	NS	NS	NS	54.390	0.765
fat over the "eye" of the loin (mm)	**	NS	NS	NS	NS	NS	NS	NS	1.257	0.067
mld "eye" round (mm)	**	NS	NS	NS	NS	NS	NS	*	136.930	1.882
mld "eye" area (cm^2)	**	NS	NS	NS	NS	NS	NS	NS	8.824	0.241

Statistical significance at: ** $p \leq 0.01$; * $p \leq 0.05$; NS – no significance effect.

year) was observed for round of „eye" of loin ($p \leq 0.05$). The statistical significant effect of the rest of variation sources on the USG measurement was not observed. The effect of chosen factors and interactions on muscularity traits of Berrichon du Cher was presented in Table 2. In this case only the effect of the year of birth was observed in all USG measurement traits ($p \leq 0.01$).

The effect of year of birth on USG measurement traits was presented in Tables 3 and 4. In 2012 year were the best conditions for both breed. The greatest values of measurement were reported in that year. This indicates a significant influence of environmental conditions on the body composition of both examined breeds. This study confirms the results of Niżnikowski et al. (2010a, b) made in various breeds of sheep also using USG techniques.

Due to the fact that USG measurement has a great relationship with slaughter value its very helpful to estimate live body conformation during a selection (Przybylak et al. 2008, Knapik et al. 2009, Knapik 2011).

No effect of type of birth on muscularity was not a characteristic trend for lambs (Niżnikowski et al. 2010a, b). It is known phenomenon catching body weight in lambs from twins compared to single. Everything points to the fact that the achievement of this level of body conformation was at the age of 70 days for lambs from twins in environmental conditions GHR Żydowo, as well as

TABLE 2. The effect of factors and interactions on measurement traits on *mld* muscle cross section by USG technique at the last thoracic vertebra on Berrichon du Cher lambs at the age of 70 days (n = 106)

Traits	Factors					Interactions			$\bar{x}$	SE
	year of birth	type of birth	sex	orgin of father	scrapie genotype class	sex × type of birth	year of birth × × type of birth	sex × year of birth		
mld "eye" hight (mm)	**	NS	NS	NS	NS	NS	NS	NS	18.795	0.329
mld "eye" width (mm)	**	NS	NS	NS	NS	NS	NS	NS	54.916	0.614
fat over the "eye" of the loin (mm)	**	NS	NS	NS	NS	NS	NS	NS	1.611	0.055
mld "eye" round (mm)	**	NS	NS	NS	NS	NS	NS	NS	134.497	1.49
mld "eye" area (cm^2)	**	NS	NS	NS	NS	NS	NS	NS	7.969	0.194

Statistical significance at: ** $p \leq 0.01$; * $p \leq 0.05$; NS – no significance effect.

sustainable impact of these conditions on the development of muscle in lambs from different sexes.

The aim of import Merino Mutton rams from Germany and Berrichon du Cher rams from France was to indicated relatively low genetic distance of both breed breeding in our country. No effect of origin of father on the live body composition was inconsistent with the results of Niżnikowski et al. (2010a). The author reported that the lambs coming from the cross with Berrichon du Cher rams imported from France had lower thickness of fat over the "eye" of the loin. It should be noted that these results only applied to one year of research and a smaller number of animals used in combination with long-term test results described in this paper.

The impact of class resistance to scrapie on the muscularity showed no statistically significant effect in both breeds. That results was inconsistent with results of Wiśniewska et al. (2009), moreover it was very positive in case of examined sheep.

Both breeds are selected to increase the frequency of resistant to scrapie.

No effect of genotype of the prion protein gene PRNP on the muscularity points to the possibility of breeding work in this direction without having a negative impact on the muscularity. Generally, muscularity of lambs of both sexes and breeds was more influenced by environmental factors than the type of birth, sex, father's genotype or class resistance to scrapie.

TABLE 3. The effect of year of birth on measurement traits on *mld* muscle cross section by USG technique at the last thoracic vertebra on Polish Merino lambs at the age of 70 days

Traits	Duncan test	Year of birth			
		2010	2011	2012	2013
		Number of lambs (n)			
		26	28	25	27
mld "eye" hight (mm)	LSM	20.585	20.683	22.537	23.334
	SE	1.164	0.742	0.720	0.667
mld "eye" spread (mm)	LSM	52.376^{A}	53.828^{B}	$63.579^{A,B,C}$	$49.348^{B,C}$
	SE	1.870	1.191	1.157	1.071
fat over the "eye" of the loin (mm)	LSM	1.166^{D}	1.093^{E}	1.248^{F}	$1.730^{D,E,F}$
	SE	0.165	0.105	0.102	0.094
mld "eye" round (mm)	LSM	132.702^{G}	135.845^{H}	$152.340^{G,H,I}$	130.030^{I}
	SE	4.601	2.931	2.846	2.634
mld "eye" area (cm^2)	LSM	7.693^{J}	8.592^{K}	$10.787^{J,K,L}$	9.022^{L}
	SE	0.589	0.375	0.364	0.337

A–L – statistical significance at $p \leq 0.01$.

TABLE 4. The effect of year of birth on measurement traits on *mld* muscle cross section by USG technique at the last thoracic vertebra on Berrichon du Cher lambs at the age of 70 days

Traits	Duncan test	Year of birth				
		2008	2010	2011	2012	2013
		Number of lambs (n)				
		50	72	25	32	42
mld "eye" hight (mm)	LSM	17.645^{A}	17.485^{B}	17.025^{C}	$23.854^{A,B,C}$	$20.177^{A,B,C}$
	SE	0.557	0.809	0.814	0.785	0.532
mld „eye" spread (mm)	LSM	54.907^{D}	58.156^{E}	$51.992^{E,F,a}$	$62.197^{D,F,G}$	$48.192^{D,E,a,G}$
	SE	1.040	1.512	1.520	1.466	0.994
fat over the "eye" of the loin (mm)	LSM	1.479^{H}	$1.487^{I,b}$	1.321^{J}	$2.104^{H,I,J}$	$1.865^{H,b,J}$
	SE	0.093	0.135	0.135	0.130	0.088
mld "eye" round (mm)	LSM	134.525^{K}	$141.209^{c,L}$	$128.325^{c,M}$	$150.596^{K,M,N}$	$119.919^{K,L,N}$
	SE	2.522	3.668	3.686	3.556	2.412
mld "eye" area (cm^2)	LSM	7.677^{O}	$7.981^{d,P}$	$6.582^{d,R}$	$10.832^{O,P,R,Q}$	7.588^{Q}
	SE	0.329	0.478	0.480	0.463	0.314

A–Q – statistical significance at $p \leq 0.01$, a–d – statistical significance at $p \leq 0.05$.

CONCLUSIONS

The obtained results led up to following statements and conclusions:

1. The effect of type of birth, sex, father origin and class of scrapie resistance and double-factor interactions were statistically insignificant impact (except interactions sex x year of birth on round of "eye" of loin) on muscularity traits of Polish Merino and Berrichon du Cher lambs.
2. The effect of the year of birth affected USG measurement traits $p \leq 0.01$ (except spread width of "eye" of loin).
3. No effect on scrapie resistance class for muscularity traits indicates the possibility of freely conduct breeding work towards increasing resistant to scrapie genetics, without a negative impact on muscularity of lambs of both breeds.
4. Strongly influence of year of the research as an environmental factor on the level of muscularity of lambs of both breeds at the age of 70 days has been shown, rather than the type of birth, sex, father origin or class of genetic resistance to scrapie.

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Streszczenie: *Wykorzystanie techniki USG w ocenie umięśnienia jagniąt ras merynos polski i Berrichon du Cher w 70. dniu życia.* Badaniami objęto 106 jagniąt rasy merynos polski w latach 2010–

–2013 oraz 221 jagniąt rasy Berrichon du Cher w latach 2008–2013 (z wyłączeniem 2009 roku, w którym prac nie prowadzono) w GRH Żydowo pod Gnieznem. Zwierzęta poddano ocenie umięśnienia techniką USG, wykonując pomiary na przekroju poprzecznym mięśnia *mld*. Na podstawie przeprowadzonych prac badawczych stwierdzono: nieistotny wpływ typu urodzenia, płci i pochodzenia po ojcu oraz klasy oporności na trzęsawkę i interakcji dwuczynnikowych (z wyłączeniem wpływu interakcji płeć × rok urodzenia na pomiar obwodu przekroju poprzecznego mięśnia *mld*) na cechy umięśnienia jagniąt rasy merynos polski i Berrichon du Cher mierzone techniką USG; bardzo istotny wpływ roku doświadczenie na cechy umięśnienia mierzone techniką USG (za wyjątkiem wysokości „oka" polędwicy u rasy merynos polski); brak wpływu klasy oporności na trzęsawkę na cechy umięśnienia wskazuje na możliwość swobodnego prowadzenie pracy hodowlanej w kierunku zwiększenia opornych na trzęsawkę uwarunkowań genetycznych, bez negatywnego wpływu na poziom umięśnienia jagniąt obu ras. Wykazano zdecydowanie większy zakres oddziaływania roku doświadczenia, a więc czynnika środowiskowego, na poziom umięśnienia jagniąt obu ras w wieku 70 dni niż typu urodzenia, płci, pochodzenia po ojcu czy klasy oporności genetycznej na trzęsawkę.

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