

GRAŻYNA ŚWIDERSKA-KOLACZ<sup>1</sup>, ADAM KOLAŃTAJ<sup>2</sup> and JOLANTA KLUSEK<sup>1</sup>

### **The Effect of the Slaughter Method, Inbred, Age and Race on the Glutathione Level in some Organs of Rabbits (short communication)**

#### **Summary**

Seventy day old New Zealand rabbits had a significantly higher level of glutathione /GSH/ in the liver, kidney and muscle than the animals aged 140 days. The random and inbred mated New Zealand rabbits revealed higher its concentration than those of the Bay Black breed.

Injection of 10% MgSO<sub>4</sub> solution caused an increase of glutathione level in the studied liver, kidney and muscle.

**Key Words:** rabbit, glutathione, age, inbred

#### **Zusammenfassung**

**Titel der Arbeit:** Einfluss von Schlachtmethoden, Inzucht, Alter und Rasse auf die Glutathionkonzentration in Leber, Niere und Muskel bei Kaninchen (Kurzmitteilung)

Es wurden 180 Kaninchen der Weißen Neuseeländischen (NZB) und Bay Black Rasse (BBB) im Alter von 70 und 140 Tagen hinsichtlich der Glutathionkonzentration (GSH) in einzelnen Organen untersucht. Die jüngeren Tiere erreichten in Leber, Niere und Muskel höhere GSH Werte als die älteren Tiere. Die NZB wiesen eine höhere NZB auf als die Tiere der BBB. Bei Inzuchtieren beider Rassen wurde eine höhere GSH nachgewiesen. Eine 10 %ige MgSO<sub>4</sub> Injektion vor der Schlachtung bewirkte eine Erhöhung des Glutathionniveaus in den untersuchten Organen.

**Schlüsselwörter:** Kaninchen, Glutathionkonzentration, Alter, Inzucht

#### **Introduction**

Glutathione /GSH/ has an essential influence on the directions and intensity of some metabolic processes (ASSMANN et al., 1998; BRAY and TAYLOR, 1993; FOX et al., 1996; SEN, 1997; SMITH et al., 1996; SUZUKI et al., 1998 ).

As the role of GSH in organism is significant, the aim of this study was to determine its content in organs of the model animals, such as rabbits, depending on breed, age, mating as well as the slaughter method.

#### **Material and Methods**

The study was performed on 120 rabbits of the New Zealand White breed. The animals were 70 day old and 140 day old, weighed 0.8-1.2 kg and 2-2.0 kg suitable, mated inbred (the parents : brother x sister, father x daughter, mother x son) and random, and 60 rabbits of Black Bay breed, aged 140 days, weighed 2.0-2.5 kg also mated randomly and by inbreeding. The animals were kept in standard cages in ventiled farm room of temperature 18°C and 50:50 dark/light in the Department of Genetics and Methods of Animal Improvement of the Academy of Agriculture in Cracow.

The animals were fed standard industrial granulated fodder for rabbits, a diet consisting of 15 % protein and hay ad libitum according to farm system of feeding. They had the access to water too. The all individuals had the good veterinary nurse. The animals of first subgroup were killed by breaking their spinal cord with strong blow (classical method) while in the second subgroup by injection of 2 ml/kg b.w. 10 % solution of MgSO<sub>4</sub> to the ear vein. After the administration of MgSO<sub>4</sub> or the blow the animals were allowed to bleed. The control subgroups were the rabbits slaughtered by the „classical method”.

After slaughter, always in the time 10<sup>00</sup>-12<sup>00</sup> a.m. tissue slices of liver, kidney and muscle /musculus longissimus dorsi at the height of the last rib/ were homogenized in a glass Potter homogenizer cooled to 4°C in 10 ml of 0.25 M sacharose containing 10 mM EDTA. Homogenates were centrifuged for 15 minutes in a Janetzki K-24 centrifuge under 12 000 g./min.

After deproteinization by 10% trichloroacetic acid in supernatant the level of glutathione by the ELLMAN method (1959) was determined. The substrates were produced by Serva Company.

Extinction values were recorded on a Specol photometer at the wavelength 412 nm. The results obtained were calculated statistically according to the test-Student.

## Results

Table 1 shows that 70 day old animals of the New Zealand group had a statistically

Table 1

The level ( $\bar{x} \pm S_d$ ) of GSH in the liver, kidney and muscle (nM/g of tissue) of classically killed mated inbred and random New Zealand rabbits aged 70 and 140 days, n in each subgroup=15

Age	Mating	Liver	Kidney	Muscle
70 days	Random	1451±204.0 <sup>1,7,8</sup> 100%	755.7±59.0 <sup>2,7,15</sup> 100%	427.3±76.9 <sup>3,8,15</sup> 100%
	Inbred	1368.8±161.6 <sup>4,9,10</sup> 94.3%	754.5±66.1 <sup>5,9,16</sup> 99.8%	398.4±47.8 <sup>6,10,16</sup> 93.2%
140 days	Random	803.8±26.0 <sup>1,11,12</sup> 100%	440±93.8 <sup>2,11,17</sup> 100%	240±60.8 <sup>4,12,17</sup> 100%
	Inbred	779.7±73.9 <sup>4,13,14</sup> 97.0%	418.9±80.9 <sup>5,13,18</sup> 95.03%	189.9±51.6 <sup>6,14,18</sup> 79.0%

1-1,...6-6 the statistically confirmed differences between 70 day old and 140 day old animals;

7-7,...18-18 the statistically confirmed differences between organs;

Table 2

The level ( $\bar{x} \pm S_d$ ) of GSH in the liver, kidney and muscle (nM/g of tissue) of 70 day old New Zealand rabbits, mated inbred and random, killed classically and by 10% MgSO<sub>4</sub> injection; n in each subgroup=15

Mating	Slaughter	Liver	Organs Kidney	Muscle
Random	Classical method	1451.4±204 <sup>1</sup> 100%	755.7±59.0 <sup>2</sup> 100%	427.3±76.9 <sup>1</sup> 100%
	MgSO <sub>4</sub>	1901.5±161.5 <sup>1</sup> 131.0%	1061±117.6 <sup>2</sup> 140.5%	596.9±83.6 <sup>1</sup> 139.7%
Inbred	Classical method	1368.8±161.6 100%	754.5±66.1 <sup>3</sup> 100%	398.4±47.8 <sup>3</sup> 100%
	MgSO <sub>4</sub>	1485.5±273.8 108.5%	1020.1±53.9 <sup>3</sup> 135.2%	558.9±72.6 <sup>3</sup> 140.3%

1-1...5-5 the statistically confirmed differences between the groups of rabbits killed classically and MgSO<sub>4</sub> administratio

higher level of GSH than 140 day old ones. GSH level in the liver, kidney and muscle was somewhat higher in the random than in the inbred animals. The GSH level was statistically higher in the liver than kidney and muscle and higher in the kidney than in the muscle.

Table 2 and 3 inform that of the GSH level in all of studied organs was higher after magnesium sulfate administration. Besides, NZ animals had in all organs the higher GSH concentration than BB rabbits.

Table 3

The level ( $\bar{x} \pm S_d$ ) of GSH in the liver, kidney and muscle (nM/G of tissue) of 140 day old, mated inbred and random New Zealand and Black Bay Bred rabbits, killed classically and by 10% MgSO<sub>4</sub> injection; n in each subgroup=15

		Random		Inbred	
		Classic method	MgSO <sub>4</sub>	Classic method	MgSO <sub>4</sub>
New Zealand	Liver	803.8±26.0 <sup>1</sup>	1301±200.6 <sup>1,10</sup>	779.7±73.9 <sup>2</sup>	1092.8±198.2 <sup>1,1</sup>
		100%	161.9%	100%	140.2%
	Kidney	440.8±93.8 <sup>3,8</sup>	801.8±198.3 <sup>1,11</sup>	418.9±80.9 <sup>4,13</sup>	536.8±58.5 <sup>4,13</sup>
		100%	182.2%	100%	128.2%
	Muscle	240.3±60.8 <sup>5,9</sup>	319.3±54.2 <sup>5,12</sup>	189.9±51.7 <sup>6</sup>	234.4±97.7 <sup>6,16</sup>
		100%	132.9%	100%	124.0%
Black Bay Breed	Liver	789.9±72.0	858.5±86.9 <sup>10</sup>	703.7±63.7	723.8±57.7 <sup>14</sup>
		100%	108.8%	100%	102.9%
	Kidney	197.7±60.5 <sup>8</sup>	206.9±70.9 <sup>11</sup>	205.0±64.9 <sup>7,13</sup>	247.4±34.4 <sup>7,13</sup>
		100%	105.0%	100%	121.3%
	Muscle	182.5±27.3 <sup>9</sup>	201.9±34.1 <sup>12</sup>	151.1±33.1	186.4±32.8 <sup>16</sup>
		100%	110.9%	100%	118.7%

1-1.....7-7 the statistically confirmed differences between the values for the classic and MgSO<sub>4</sub> method.  
8-8.....16-16 the statistically confirmed differences between the races.

### Discussion

The results obtained revealed in the majority of cases the significant changes of GSH concentrations under the influence of the slaughter method, the kind of mating, age and breed. These phenomena can suggest the existence of a differentiated metabolism rate in the studied organs depending on age, breed, the degree of relationship. It may be determined by adaptation possibilities too, because the organs studied are functionally different (JOCELYN, 1972; ŚWIDERSKA-KOŁACZ and KOŁATAJ, 1994). In the animal cells the glutathione level seems to be dependent of age (LENARTOWICZ et al., 1996).

It is known, younger animals have a higher metabolism rate, and the glutathione is, amongst others, connected with their higher red-ox potential in the cells (BRAY and TAYLOR, 1993; BROWN, 1994; FOX et al., 1996). Our experiment would confirm this suggestion because the 70 day old rabbits had a higher level of thiol groups than 140 day old ones.

The earlier studies of KOŁATAJ et al. (1979) revealed that in the content of sulfhydryl compounds in the blood and some organs of hens and chickens were inter-breed differences. New Zealand rabbits from our experiment had a higher level of glutathione than the animals of the Bay Black breed. In all the studied organs of inbred rabbits was the level of thiol groups lower than in the randomized animals. It is known that the homozygosity in animals is not favourable. It may be due amongst others, that

lower glutathione level in the inbred rabbits may be interpreted in the connection with the inbred relationship.

An analysis of stress caused by „classical” slaughter and narcosis by 10% solution of  $MgSO_4$  revealed a higher level of glutathione after  $MgSO_4$  injection. Probably it is the result antistress action of  $Mg^{2+}$  ions (EVANS et al., 1996; LEHR, 1981; SEELIG, 1980;). The role of  $Mg^{2+}$  in defensive processes as an antistress and antitoxic factor was discussed by DURLACH (1991). It has been found that  $Mg^{2+}$  has an effect on the release of neurotransmitters, counteracting the effect of calcium.  $Mg^{2+}$  ions weaken probably stress reaction by participation in intracellular degradation of catecholamines too.

Application of  $MgSO_4$  as a slaughter medium has proved that it is more favourable than the classical method of hitting the neck by a bar. In the case of slaughter by narcosis the animal is only subjected to injection  $MgSO_4$  to the ear vein conducted in a possibly mild and stress-free way. During „classical” slaughter the animal is turned down by the head, suspended in the air. It receives a blow in the neck and it is subjected to a strong stress action from the side of central nervous system and peripheral stressors. Besides, after the blow occur preagonal tetanic convulsions, prolonged muscle contractions which are not favourable for the subsequent consume quality of meat because they change the picture of muscle glycolyse processes.

In connection with these suggestions we would like to propose the  $MgSO_4$  administration in the conditions of slaughter without the stress.

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Author's addresses

Dr. GRAŻYNA ŚWIDERSKA-KOŁACZ, Dr. JOLANTA KLUSEK

Department of Genetics, Pedagogical University in Kielce

Konopnickiej 15

25-406 Kielce

Poland

Prof. Dr. ADAM KOŁĄTAJ

Institute of Genetics and Animal Breeding,

Polish Academy of Sciences, Jastrzębiec

05-551 Mroków

Poland

## Buchbesprechung

### Beiträge zur Jagd- und Wildforschung, Bd. 24

M. STUBBE (Hrsg.)

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Zu beziehen durch: Geschäftsstelle der Gesellschaft für Wildtier- und Jagdforschung e.V.,  
Schkeuditzerstr. 33, D-04430 Burghausen, DM 38,- + Versandkosten

Es liegt der 24. Band dieser traditionsreichen Schrift vor, welche über neue Methoden und Ergebnisse aus wildbiologischer Forschung unter Einschluss landeskultureller und ökologischer Probleme, geschützte Tierpopulationen u.a. berichtet. Wiederum werden in aktuellen Beiträgen Ergebnisse zur Wildbewirtschaftung und Jagdforschung vorgestellt. Die aus dem In- und Ausland berichtenden 36 Beiträge, basierend auf der Grundlage fundierter Forschungsergebnisse, umfassen ein weites Themenspektrum. Sie enthalten Hinweise wie mittels standortgerechtem Handeln eine optimale Synthese von Ökologie und Ökonomie möglich ist. Es finden sich Beiträge über die jagdwirtschaftliche Praxis, den Natur- und Waldschutz oder tierbestandserhaltende und fördernde Nutzungsstrategien.

Der Einführungsbeitrag sowie ein Beitrag aus Ungarn beschäftigen sich mit dem Thema großräumiger Wildbewirtschaftung als Maßnahme zum Erhalt von Biodiversität. In diesem Zusammenhang sei auch auf die Beiträge über die Zielstellung der Arbeitsgemeinschaft Rotwild/Deutschland und einen Bericht über erste Ergebnisse des landesweiten Monitoringsystems zur Kontrolle der Wilddichte in den Rot- und Damwildbewirtschaftungsgebieten Thüringens hingewiesen. Bemerkenswert und für die aktuelle Diskussion bereichernd ist der Beitrag zur Polemik „naturgemäß“. Mehrere Arbeiten widmen sich der Wild- und Waldökologischen Raumplanung u.a. aus Deutschland, der Schweiz und Ungarn, auch unter dem Aspekt des zu beachtenden Wirkungsgefüges „Wald-Wild-Mensch“. Im zentralen Blickpunkt dieses Bandes steht das Rotwild. Die Themen beinhalten Fragen der Altersstruktur und ihrer Bestimmung, der Bestandsentwicklung und Bestandssicherung in verschiedenen Territorien, die großräumige Abstimmung der Hege und Bejagung, Überwinterung und Schälschäden, den Zusammenhang von Genetik, Umwelt und Wachstum, Verhaltensbeobachtungen bis zum Rotwildmanagement. Eine weitere Gruppe von Beiträgen ist dem Damwild gewidmet. Berichtet wird z.B. über Populationsumsatz und Lebensraumgröße oder Raumnutzung durch Damwild aus unterschiedlichen Territorien. Einzelbeiträge von weiteren Tierarten wie Muffelwild, Niederwild, Grosstrappe, Rotfuchs, Dachs und Marderhund beinhalten u.a. Fragen der Lebensraumgestaltung und Bestandsschätzungen. Den Abschluss des Buches bildet eine bemerkenswerte, umfangreiche Arbeit über die Wasservogeljagd und den Wasservogelschutz unter dem Aspekt der Nachhaltigkeit. Die Vakantseiten des Buches enthalten u.a. eine Laudatio, Tagungsankündigungen und -berichte, Rezensionen und Buchangebote.

Dieses interessante, breitgefächerte und lesenswerte Buch enthält wichtige Basis- und Hintergrundinformationen für eine wissenschaftlich begründete Wild- und Waldbewirtschaftung sowie eine waidgerechte Jagd ebenso, wie aktuelle Informationen über den Schutz und den Nutzen von Wildressourcen. Neben Biologen, Ökologen, breiten Kreisen der Jägerschaft, Land- und Forstwirten, Tierärzten, land- und forstwirtschaftlich ausgerichteten Institutionen ist dieses Buch allen Naturfreunden zu empfehlen.

ERNST RITTER, Dummerstorf