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THE EFFECT OF DIFFERENT FACTORS ON GLUTATHIONE PEROXIDASE ACTIVITY IN THE BLOOD AND SEMINAL PLASMA OF RABBIT BUCKS

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Abstract

The authors investigated the effect of different genetic, physiological and environmental factors on glutathione-peroxidase activity in rabbit.

Statistically significant differences were found between the enzyme activities of blood plasma of rabbits from different genotypes.

Slight connections were found between the glutathione-peroxidase activity of blood plasma and the age of the animals as well as season.

Introduction

Glutathione-peroxidase (glutathione:H202 oxidoreductase E.C.1.11.1.9. GSH-Px) is a well known selenium-containing metalloenzyme. As a part of the glutathione redox system it protects the membrane lipids and proteins against oxidative damage (8). There have been many studies to investigate parts of these system in farm animal species. The level of activity was determined in connection with the development stage and also with the aging process (3, 5).

The activity of GSH-Px also also affected by several toxic substances, as well. The GSH-Px activity was investigated in the early stages of development in rabbit blood plasma (6). They found that the enzyme activity showed very high individual variance depending on the health status of the animals. The GSH-Px activity of seminal plasma in the case of rabbit and also its effect on the motility and percent of abnormal sperm cells was also investigated. There have been a number of similarities and divergencies in the results of the experiments which were carried out under varying circumstances (1, 2).

The aim of the present study was to investigate the effect of different genetic, physiological and environmental factors on enzyme activity.

Materian and methods

The investigation was carried out between 4th May 1990 and 8th April 1991 in the rabbitry of the Research Institute of Animal Breeding at Gödöllô. The bucks were placed in individual breeder cages in the building of a reproductive stock. The rabbit buildings were heated during winter season (minimum temperature +15°C), and ventillating was natural. The lighting regime was stabilised artificially to 16L/8D. The animals were fed using pelleted rabbit concentrate (Környe G-51 type). Five Californian and 15 New Zealand white bucks

were studied. The New Zealand white bucks were from three closed breeding lines - called H,G and F - all in the same proportion. Age, body weight gain between 6 and 12 weeks, body weight at 12 weeks of age (as was known from the stock book) were different. There was a non-significant difference between the means of the genotypes in those traits. The semen samples were collected in each alternate second week using an artificial vagina and heating doe. The semen collection was made in first part of the week. In the following two days, the bucks mated with the females normally. The semen samples were stroed at 5°C while the enzyme activity was measured. Blood samples were also taken by venipuncture from the ear vein after qualifying of the semen, and EDTA-Na was used as an anticoagulant. The blood and seminal plasma was separated by centrifugation (1500 g 15 min at +4°C). The glutathione-peroxidase activity was measured in the presence of reduced glutathione and cumene-hydroperoxide as substrates using an end-point direct assay (4). The enzyme activity was expressed in units reflecting the oxidation of reduced glutathione in nmoles per minute at 25°C. The enzyme activity was calculated to the protein content of blood and seminal plasma.

The results were evaluated using a regression analysis and analysis of variance.

Results

The average GSH-Px activities of blood plasma (U/g protein) and seminal plasma (U/ml and U/g protein) are shown on Table 1. No connection was found between the GSH-Px activities of the blood plasma and seminal plasma. There was a close correlation between the activity of seminal plasma expressed to protein and to volume ($y=0.471 +0.14x$, $r=0.628$) as was shown in Fig. 1. The connection is significant at the $P<0.003$ level.

The mean GSH-Px activity in the different genotypes are shown on Table 2. The glutathione-peroxidase activity was affected by the genotypes in the case of blood plasma with a $P<0.001$ level of significance while the seminal plasma enzyme activity was independent of the genotype.

The body weight gain between 6 and 12 weeks of age and the body weight of bucks at 12 weeks of age have no correlation with the GSH-Px activity.

The aging process caused moderate and parallel increases in the GSH-Px activity. The correlation coefficient was $r=0.53$ ($P<0.02$) as shown in Fig. 2.

The effect of season on GSH-Px activity is illustrated in Table 3. The enzyme activity of the blood plasma was significantly ($P<0.01$) lower in winter as compared to all the other seasons. The GSH-Px activity of the seminal plasma (U/ml) was significantly higher ($P<0.01$) in summer and autumn. The seminal plasma enzyme activity (U/g protein) did not display seasonal changes.

Discussion - Conclusions

The investigated enzyme system has an important physiological function and is also connected to some degree

production traits, results are forthcoming only in the case of some other species (7).

The results of the present study provide some new data concerning glutathione-peroxidase activity in rabbit. The results will be of use as a basis for planning and for evaluation of the results of further experiments.

The glutathione-peroxidase activity of blood and seminal plasma is significantly different and generally there is no correlation between them. It can be concluded that the glutathione system of the two different body fluids act separately. For this reason, the effect of different factors on the GSH-Px activity on different tissues and/or organs must be investigated separately.

The differences between enzyme activities in the case of different genotypes show that experiments must be carried out using animals from the same genotype and stock except in the case of experiments of compare genetic differences.

Age has an effect on GSH-Px activity as well. Thus, in further experiments attention should be paid to the age of animals as well.

The moderate effect of season on enzyme activity of seminal plasma and blood plasma is probably caused by the changes in temperature because other environmental factors were maintained at the same levels during the whole period.

References

1. J.G.ALVAREZ, B.F.STOREY (1989): Role of glutation peroxidase in protecting mammalian spermatozoa from loss of motility caused by spontaneous lipid peroxidation, Gamete. Res. 23:77.

2. M.K.HOLLAND, B.T.STOREY (1981): Oxygen metabolism of mammalian spermatozoa. Generation of hydrogene peroxide by epididymal spermatozoa, Biochem J. 198:273.

3. H.KAPPUS (1985): Lipid peroxidation: Mechanism, analysis, enzymology and biological relevance, in: Oxidative stress, ed.: M.SIES, pp. 273:310, London, Acad. Press.

4. B.MATKOVICS, L.SZABÓ, I.VARGA (1988): Examination of glutathion redox system in human blood, Lab. Diagnost. 24.288.

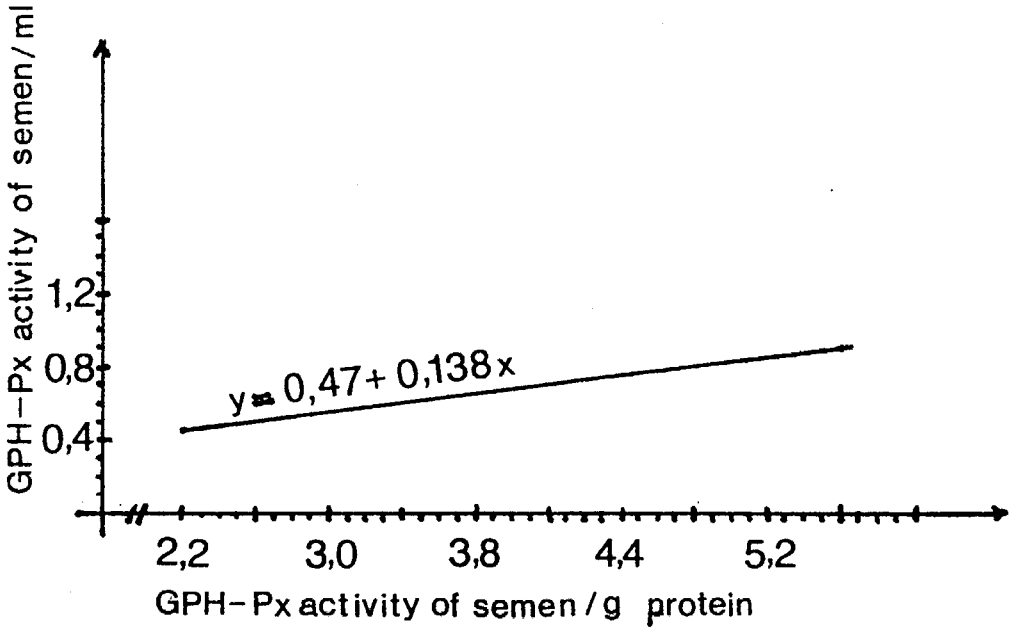
5. M.MÉZES, A.PÁR, P.NÉMETH, T.JÁVOR (1988): Age dependent changes in hepatic lipid peroxidation, Quarterly Bull. Hung. Gastroenterol. Soc. 8. 2. 78.

6. M.MÉZES, A.PUSZTAI, GY.VIRÁG (1986): Effect of postnatal development and chronic enteritis on lipid peroxidation and Vitamin E content of blood of rabbits, 3rd Int. Coll. "The rabbit as a model animal and breeding object", Sec. II., 162-166.

7. M.MÉZES, I.SZALAY, E.VAS (1989): Glutathion metabolism enzymes as possible markers for goose liver selection, In: J.BOUMGARTNER ed. Proc. Int. Symp. Current Problems of Avian Genetics, Smolenice, pp 114-118.

8. J.T.ROTRUCK, A.L.POPE, H.E.GANTHER, A.B.SWANSON, D.G.HAFEMAN, W.G.HOEKSTRA (1973): Selenium: biochemical role as a component of glutathione peroxidase, Science, N.Y. 179:588.

Figure 1. Effect of GPH-Px activity of seminal plasma/g protein on GPH-Px activity of seminal plasma/ml



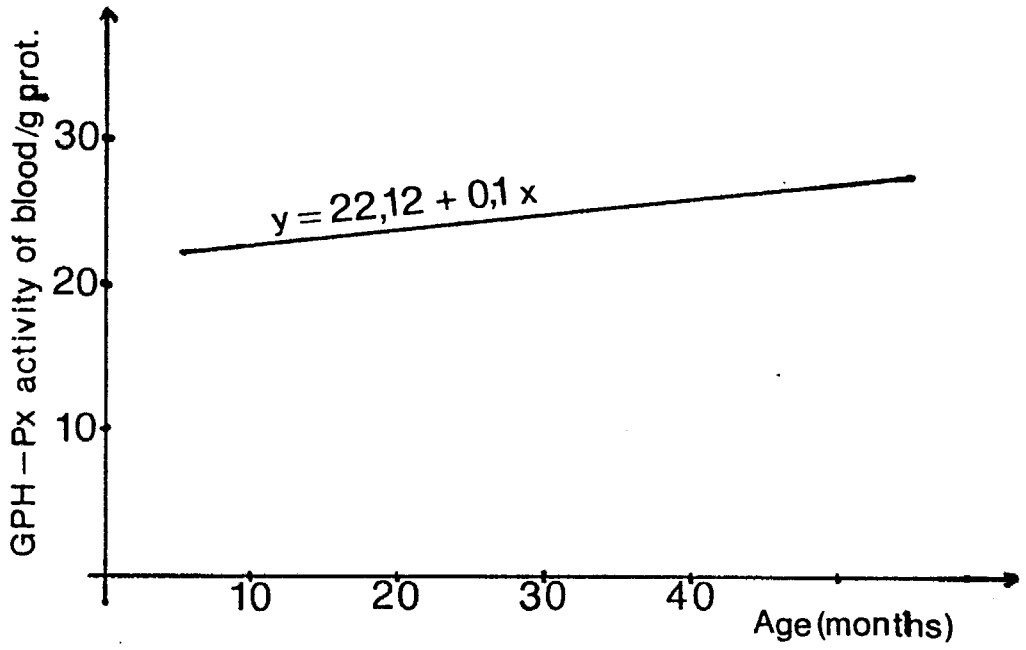


Figure 2. Effect of age on GPH-Px activity of blood plasma/g protein

Table 1.

Average GSH-Px activities of blood and seminal plasma

	$\bar{X}$	±s
Blood plasma (U/g protein)	23.548	2.527
Seminal plasma (U/ml)	1.137	0.273
Seminal plasma (U/g protein)	4.81	1.24

Table 2.

The mean GSH-Px activity in the different genotypes

Trait	Genotype F	G	H	K
GSH-Px activity of blood plasma (U/g protein)	23.92	21.38	23.41	25.49
±s	1.02	2.29	3.16	0.79
Significance, P=0.01	g,k	f,h,k	g,k	f,g,h
GSH-Px activity of seminal plasma (U/ml)	1.18	1.03	1.17	1.17
±s	0.22	0.12	0.33	0.33
Non significant				
GSH-Px activity of seminal plasma (U/g protein)	4.47	4.66	4.69	5.42
±s	0.72	0.57	1.04	1.93
Non significant				

Table 3.

The mean GSH-Px activity in the different seasons

Trait	Season			
	Spring	Summer	Autumn	Winter
GSH-Px activity of blood plasma (U/g protein)	24.25	25.15	25.04	19.76
±s	4.56	9.93	8.52	4.03
Significance, P=0.01	W	W	W	SP,S,A
GSH-Px activity of seminal plasma (U/ml)	0.97	1.29	1.21	1.07
±s	0.52	0.71	0.65	0.53
Significance, P=0.01	S,A	SP,W	SP,W	S,A
GSH-Px activity of seminal plasma (U/g protein)	4.57	4.69	4.79	5.56
±s	2.05	3.21	2.12	2.98
Non significant				