OXIDATIVE STRESS IN HUMAN AND VETERINARIAN MEDICINE: CAUSES, CONSEQUENCES AND BIOMARKERS

GARCÍA-TALAVERA GONZÁLEZ, LAURA
GRAU DE VETERINÀRIA CURS 2014-2015
UAB Universitat Autònoma de Barcelona

INTRODUCTION:

Oxidative stress (OE) is a biological process, consequence of an imbalance between radical oxygen species (ROS) production and antioxidant function in living organisms.
That imbalance is due to an **overproduction of ROS** and a **deficiency of antioxidants** (AOX) on the other side.
OE plays a dual role as deleterious and beneficial substances.

PHYSIOLOGICAL PROCESSES AND OXIDATIVE STRESS:

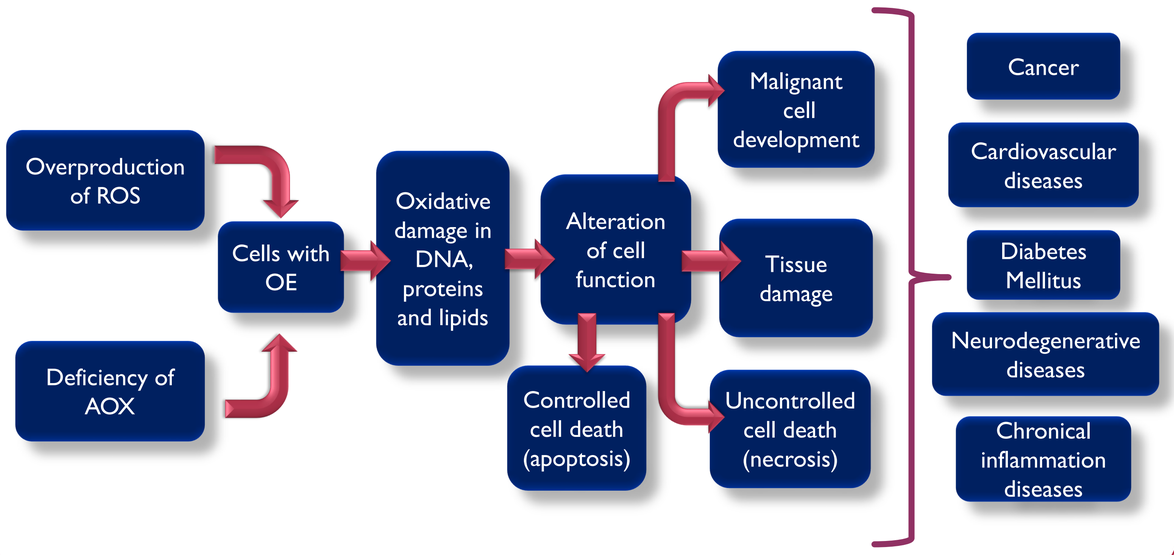
A great number of physiological functions are controlled by redox-responsive signaling pathways in **cell growth** and their **differentiation**.
The function of **macrophages** and other inflammation cells is based on their stimulation with elevated amounts of ROS and tyrosine kinases activation.
Ageing is characterized by **senescence** and **apoptosis** processes in cells which are activated by increasing of ROS levels.

ROS:

Free radicals are molecules which contain one or more unpaired electrons in atomic or molecular orbitals. This unpaired electron gives a considerable degree of reactivity to the particle and make the molecule electrochemically unstable. The accumulation of ROS disturbs the **redox balance** of the cells→ the ability of transfer electrons between molecules (oxidation-reduction).

ROS	Symbol	Characteristics
Superoxide	$O_2^{-\bullet}$	It generates most of ROS. Good reductant, bad oxidant.
Hydroxil	HO•	The most powerful oxidant in biological systems.
Singlet oxygen	$^1O_2$	Molecularly excited oxygen through sunlight and radiation. Highly oxidant.
Hydrogen peroxide	H_2O_2	It originate very reactive ROS when it reacts with transition metals.

PATHOLOGICAL PROCESSES AND OXIDATIVE STRESS:



Experimental study:
Oxidative stress assessment in swine farms by determination of GPX and SOD (biomarkers of OE)

OBJECTIVES:

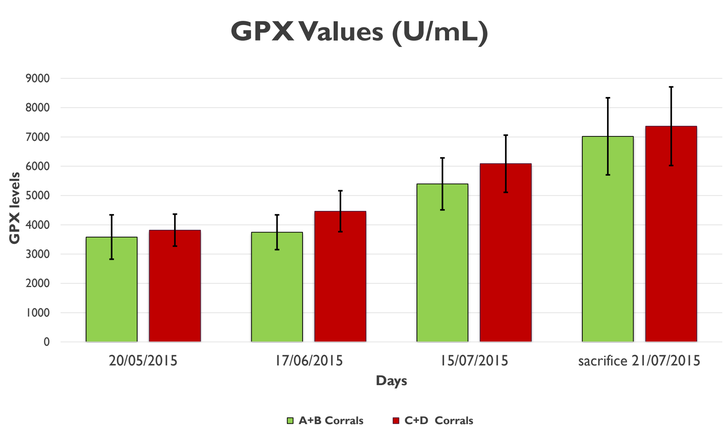
The aims of this study were to see the different effects of management conditions in a swine farm (good/bad conditions) based on biochemical parameters of GPX (glutathione peroxidase) and SOD (superoxide dismutase) which are AOX that increase in presence of OE→ biomarkers of oxidative stress.

MATERIAL AND METHODS:

For this study they were needed 44 pigs distributed equally in 4 corrals (A,B,C,D) Corrals A and B were in good management conditions while C and D were worse. We obtained blood samples for the animals in 4 different days (the last day was done before their sacrifice). The resultant serum of blood centrifugation was analyzed with Ransod and Ransel kits and interpreted with spectrophotometry.

RESULTS:

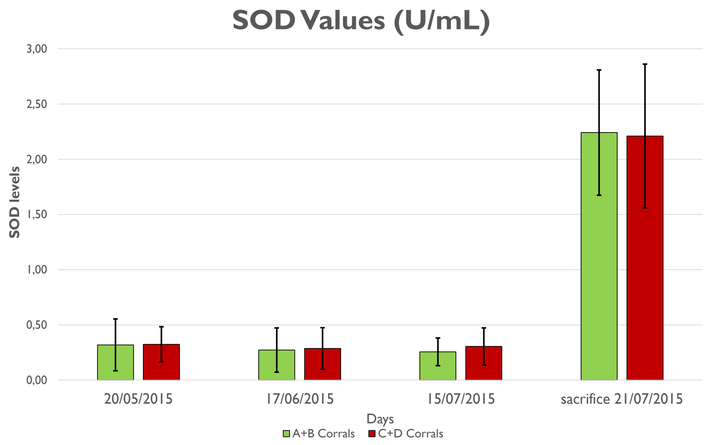
Results are exposed graphically with the medium and standard deviation (sd) of each group (A-B, C-D). We used T-test to compare the dates and determine if there where statistically significant differences between groups with an interval confidence of 95% (p valor>0,05). The dates are considered to be in a range of normality.



Data	GPX (U/mL)			
	A+B Corrals	C+D Corrals	sd A+B	sd C+D
20/05/2015	3582	3818,363636	757,1314285	547,5156484
17/06/2015	3745,045455	4463,863636	593,2794634	700,052127
15/07/2015	5396,181818	6088,227273	887,2589484	976,5803764
sacrifice 21/07/2015	7021,045455	7367,636364	1315,471253	1342,076662

Comparison AB -CD (GPX)	
DAY	P value
20/05/2015	0,117466299
17/06/2015	0,00042403
15/07/2015	0,010128221
Sacrifice 21/07/2015	0,215655665

GPX	Comparison between days in the same group	
DAYS	P value AB	P value CD
20-5/17-6	0,053	$1,30X10^{-5}$
17-6/15-7	$7,93X10^{-14}$	$1,67X10^{-12}$
15-7/sacrifice	$5,11X10^{-8}$	$3,35X10^{-5}$
20-5/sacrifice	$1,35X10^{-13}$	$5,17X10^{-13}$



Data	SOD (U/mL)			
	A+B Corrals	C+D Corrals	sd A+B	sd C+D
20/05/2015	0,32	0,32	0,24	0,16
17/06/2015	0,27	0,29	0,20	0,19
15/07/2015	0,26	0,30	0,13	0,17
sacrifice 21/07/2015	2,24	2,21	0,57	0,65

Comparison AB -CD (SOD)	
DAY	P value
20/05/2015	0,46641641
17/06/2015	0,390574801
15/07/2015	0,141457681
sacrifice 21/07/2015	0,425319693

SOD	Comparison between days in the same group	
DAYS	P value AB	P value CD
20-5/17-6	0,23	0,26
17-6/15-7	0,38	0,36
15-7/sacrifice	$9,02X10^{-14}$	$3,23X10^{-12}$
20-5/sacrifice	$1,29X10^{-13}$	$1,53X10^{-12}$

CONCLUSIONS OF STUDY

-**GPX** didn't have significant big differences between animals in good or bad conditions but it was quite enough to determine them significant. Levels of GPX increased along the days until the day of sacrifice where the levels were the highest. So GPX as antioxidant is increased in stressed situations. The day of sacrifice there weren't significant differences among animals AB or CD probably because the stress of transport and sacrifice hide that differences.
-There weren't significant differences in any moment between groups for **SOD**. But their levels augmented specially in the day of sacrifice so stress of this situation increased levels of SOD so the rise is more evident in last days (it activity appears lately comparing with GPX).

FINAL CONCLUSIONS:

It exists a big discussion about whether OE is the cause or the consequence in the pathophysiological processes. And the conclusion is that in some diseases is clear their role as trigger of the process (Ex: Cancer) while in other cases still unclear. Thereby more studies in determinant pathologies are needed to establish clearly the role of OE in the processes. An improved study of OE will allow the discovery of new therapeutic targets to create new treatments.