EFFECTS OF DIETARY METHIONINE DEFICIENCY ON ADIPOSE TISSUE GROWTH AND OXIDATIVE STATUS IN PIGLETS

R. Castellano[1], MH. Perruchot[1], JA. Conde-Aguilera[1], J. van Milgen[1], Y. Mercier[2], S. Tesseraud[3], F. Gondret[1]

[1]INRA, UMR1348 PEGASE (St-Gilles, France)
[2]Adisseo France SAS
[3]INRA, UR83 Recherches Avicoles (Nouzilly, France)

INTRODUCTION

Why Methionine?

The use of **synthetic amino acids** is an important part of pig nutrition

Formulating diet with synthetic **Met** improves feed efficiency

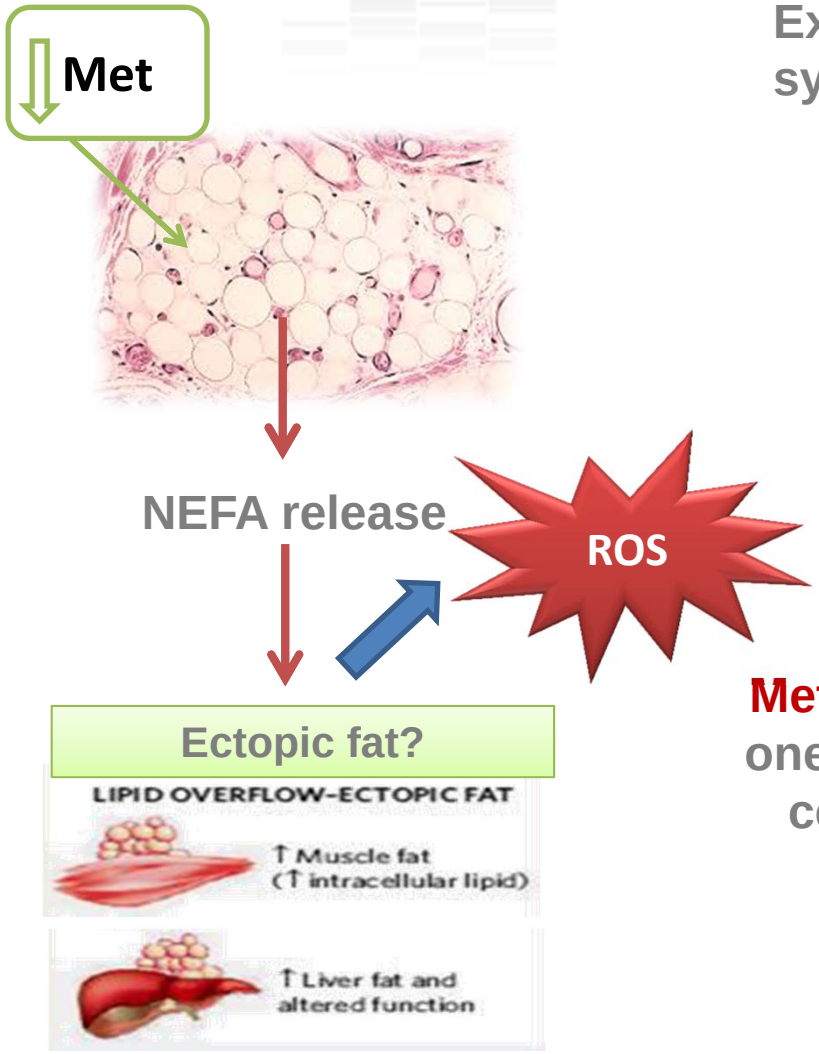
Met is the second limiting AA for growth in pigs

A **Met** deficiency decreases the muscular development (Conde-Aguilera et al., 2010)

Consequences on adipose tissue development need to be further explored

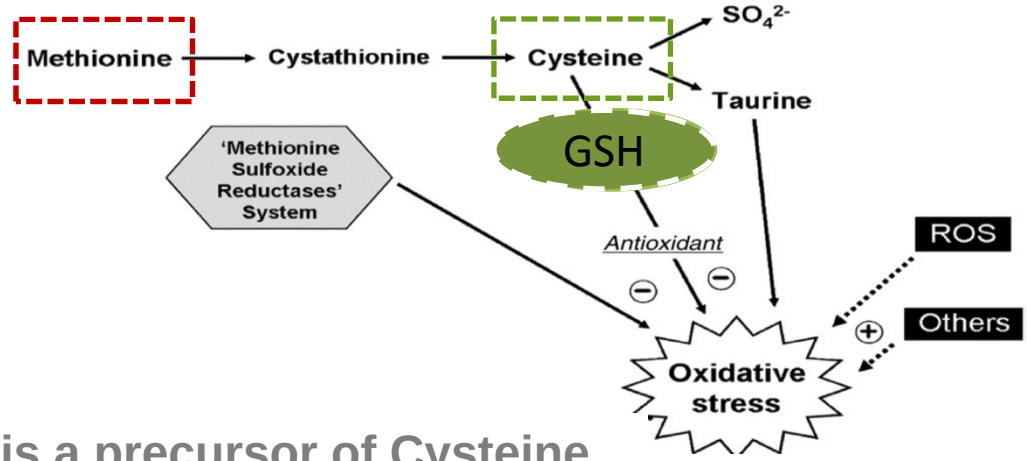
In aging rats, Met deficiency limits growth of adipose tissue (Malloy et al., 2006)
Preliminary experiments show an increase in adipose tissue mass in growing piglets

Why adipose tissue?



Plays a crucial role in energy balance

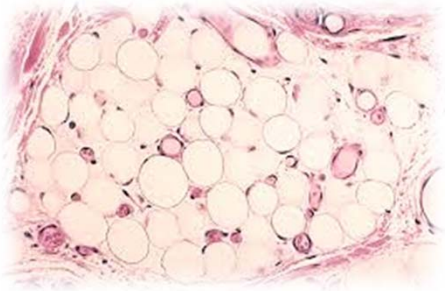
Excessive fat deposition may be linked to systemic oxidative stress

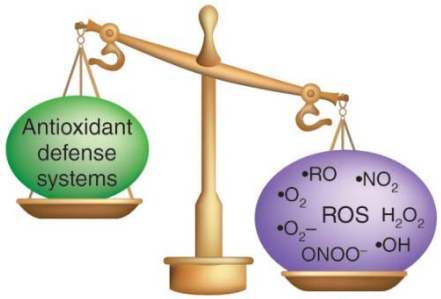


Met is a precursor of Cysteine, one of the three AA of the main cell antioxidant glutathione (GSH)

OBJECTIVE

To determine the mechanisms associated with adipose tissue growth in piglets in response to a dietary Met deficiency and to clarify the consequences on the redox metabolism





EXPERIMENTAL DESIGN

9 kg BW

REST n = 6

Methionine: 0.24%

10 days

Perirenal adipose tissue (**PRAT**)

Dorsal subcutaneous adipose tissue (**SCAT**)

Muscle (longissimus **LD**)

Crude proteins: 18.1%
Fat: 2.4%
Net energy: 9.95 MJ/kg

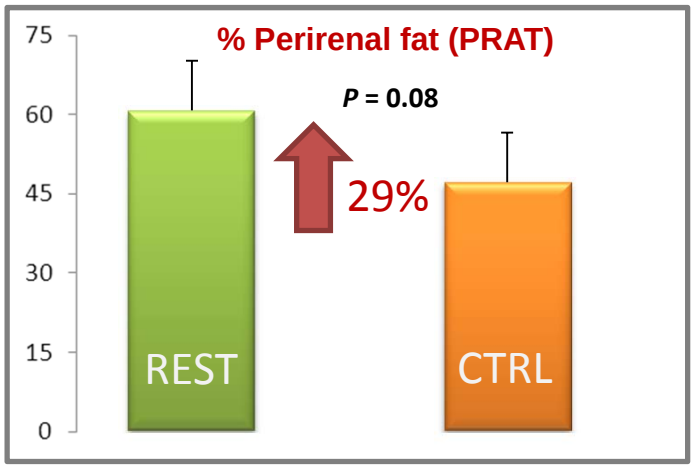
CTRL n = 6

Methionine: 0.47%

Lipid content
Lipogenic enzyme activities
Gene expression
Anti-oxidant enzyme activities
Glutathione content

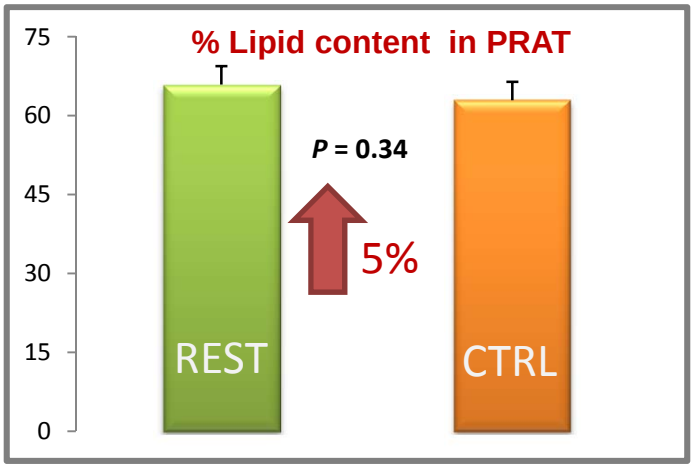
Feed intake was imposed at the same level in both groups (380 g feed/d)

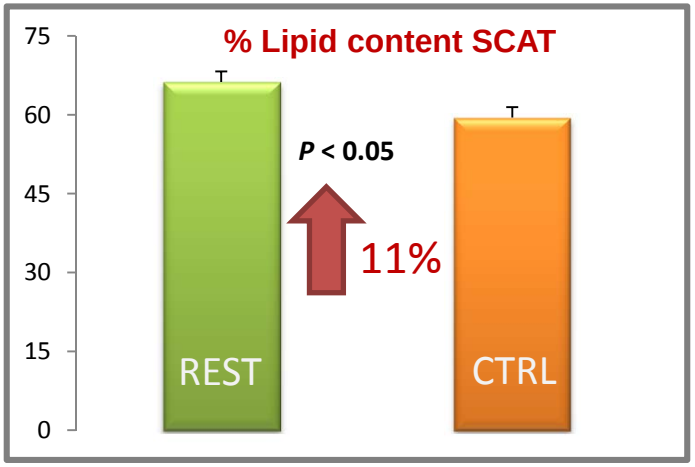
RESULTS



Perirenal fat proportion in the body tended to be greater

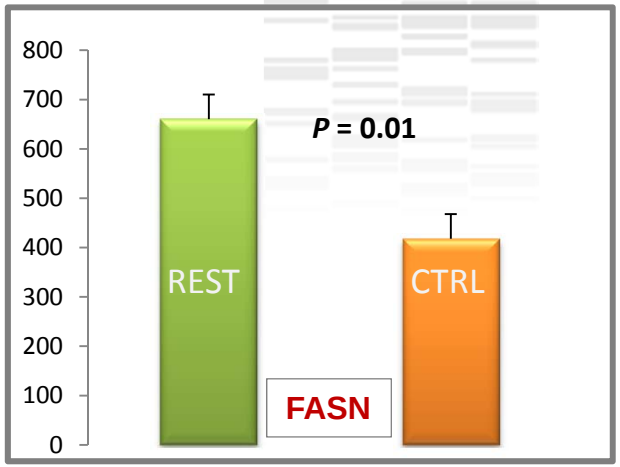
Lipid content into subcutaneous fat was greater in **Met** deficient piglets

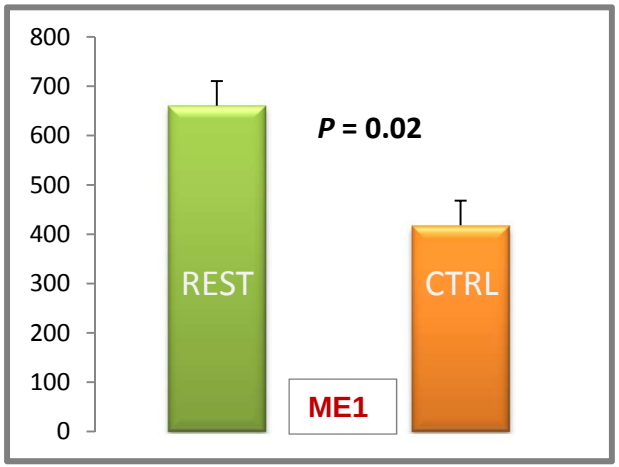


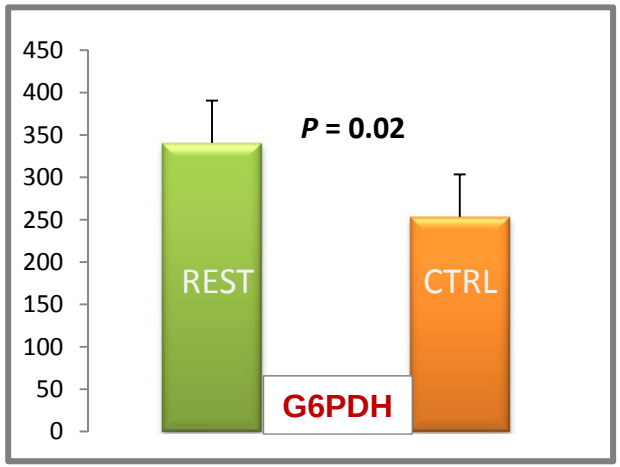


PRAT

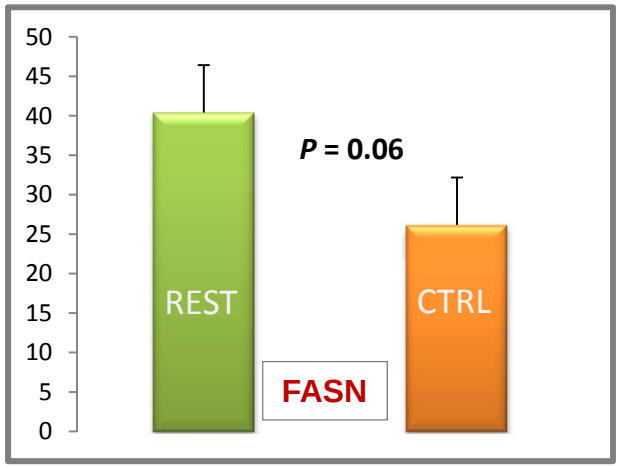
LIPOGENIC ENZYME (FASN, ME1, G6PDH) (µM/min/mg proteins)

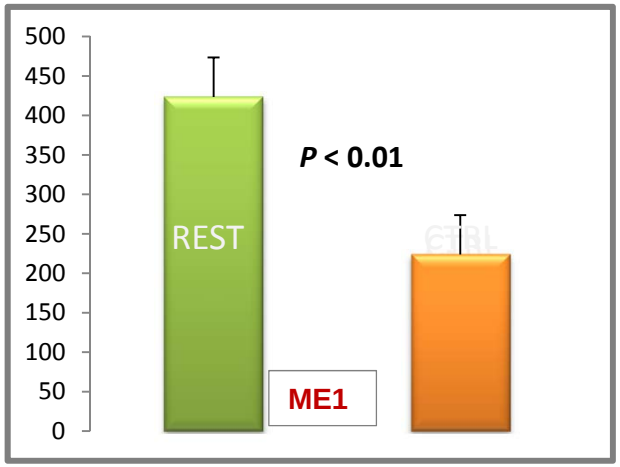






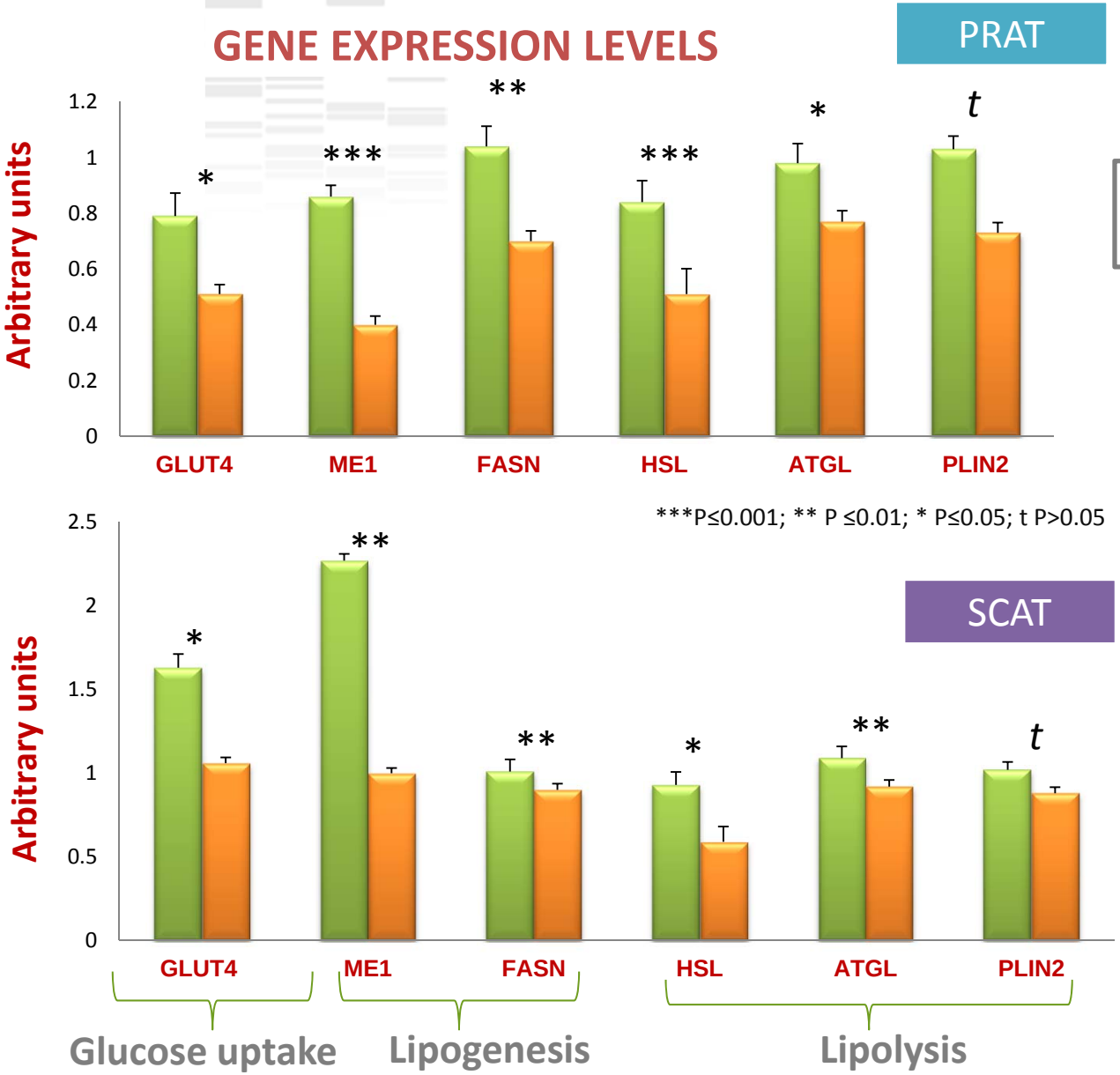
SCAT





Activities of lipogenic enzymes were greater in adipose tissues of **Met** deficient piglets

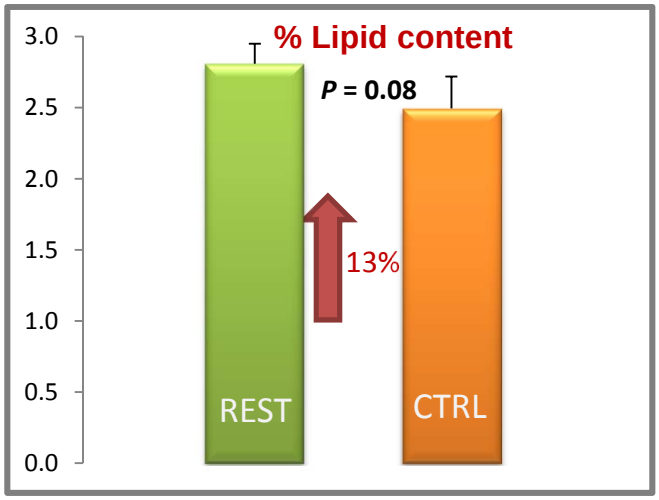
GENE EXPRESSION LEVELS

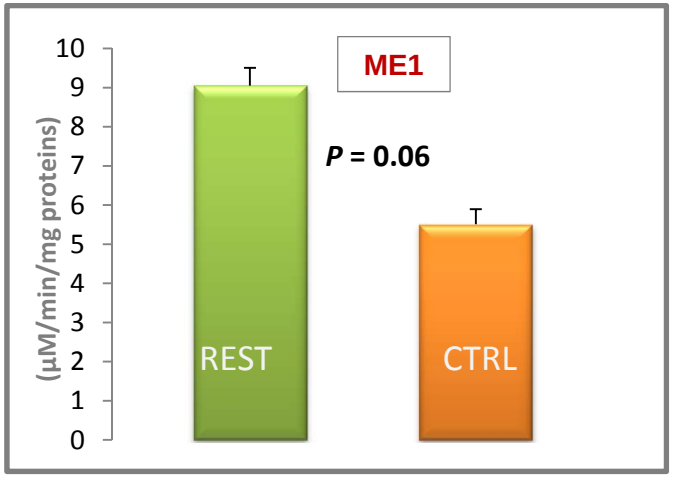


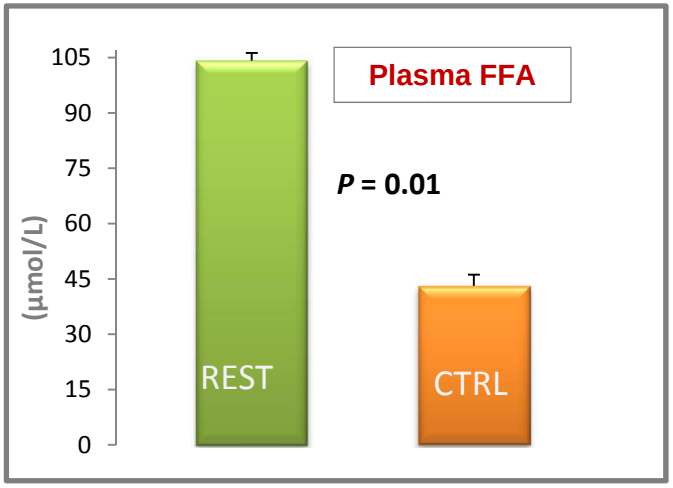
Lipid accumulation in REST piglets was associated with simultaneous increases in gene expressions related to lipogenesis and lipolysis

Ectopic lipid accumulation?

LD muscle

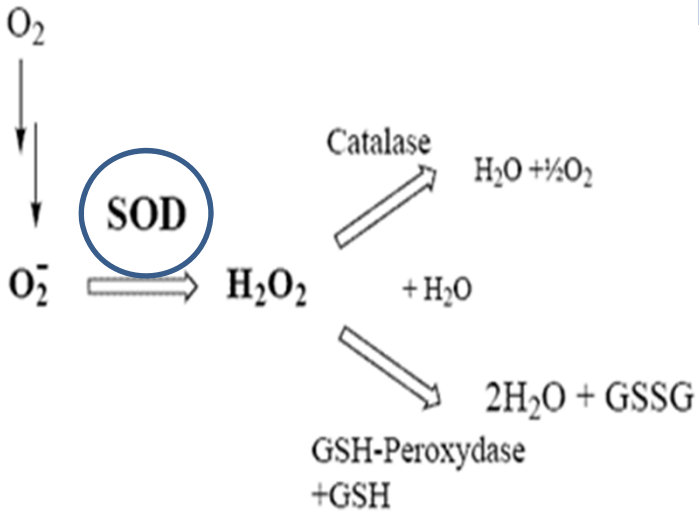






Lipid accumulation in skeletal muscle was associated with an increase in lipogenesis and an increased uptake (?) of circulating FFA

ANTI-OXIDANT SUPEROXIDE DISMUTASE (SOD)

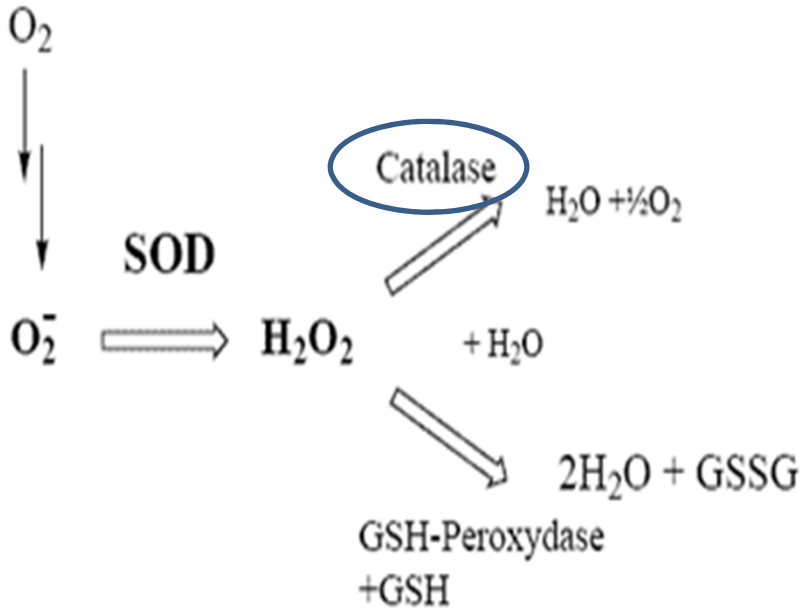


PRAT

SCAT

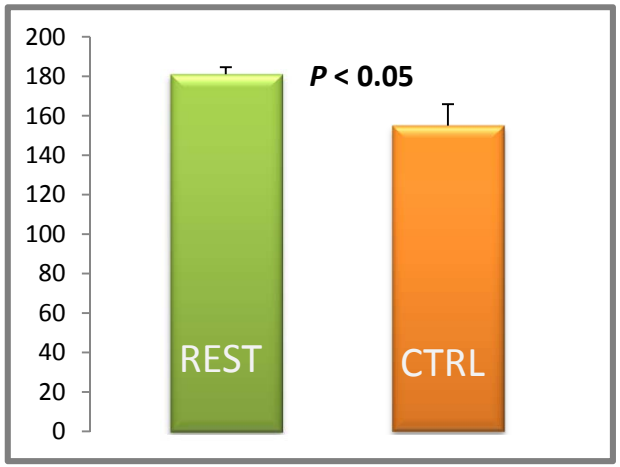
SOD responsible for destroying superoxide radicals had greater activity in adipose tissues of **Met** deficient piglets

ANTI-OXIDANT CATALASE

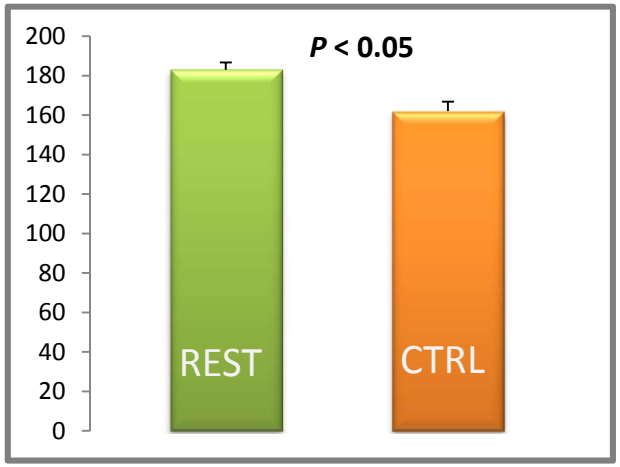


PRAT

SCAT

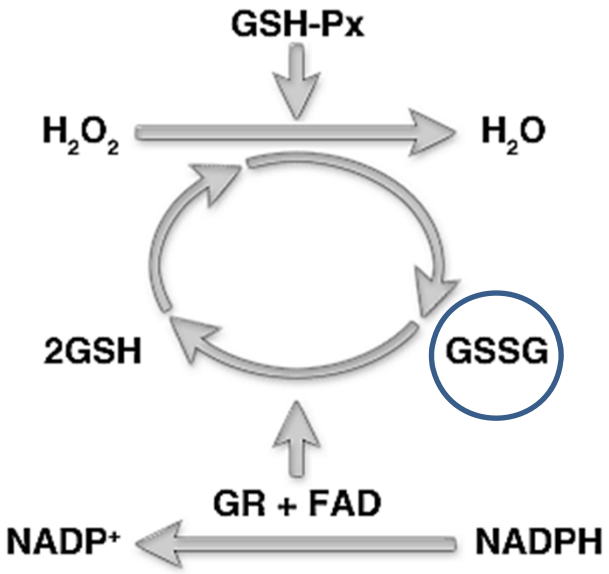


(U/mg protein)



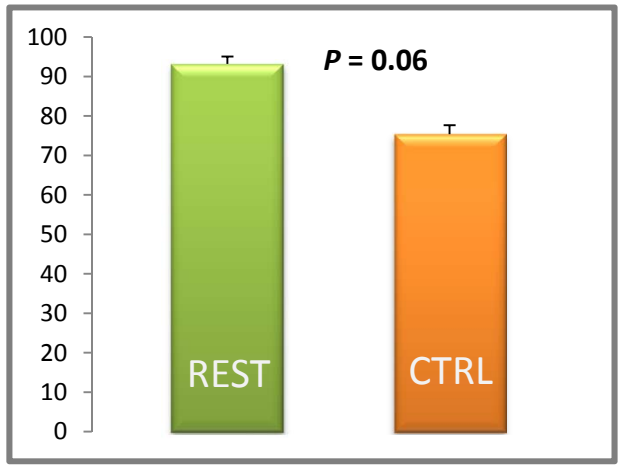
Catalase responsible for the decomposition of hydrogen peroxides had greater activity in adipose tissues of **Met** deficient piglets

ANTI-OXIDANT GLUTATHIONE

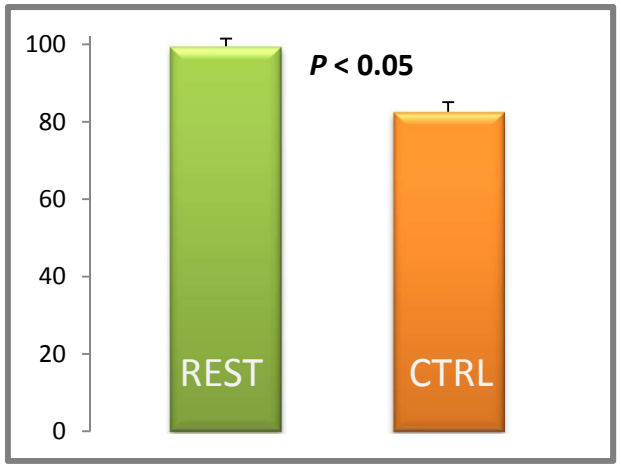


PRAT

SCAT



GSSG (picomoles of glutathione/well)



The oxidized form of the glutathione (GSSG) had a greater abundance in adipose tissues of Met deficient piglets

CONCLUSIONS

- Dietary Met restriction modifies the partition of energy towards lipid accumulation in adipose tissues and skeletal muscle.
- Dietary Met restriction promotes the conversion of glucose to lipids (lipogenesis) but also lipolysis, which might result in ectopic (muscle) fat accumulation.
- The antioxidant capacity in adipose tissues is increased in Met deficient piglets, likely to cope with more oxidative stress.
- Altogether, both adipose tissue metabolism and redox status of piglets are modulated by dietary Methionine supply during growth

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THANK YOU FOR YOUR ATTENTION

ANTI-OXIDANT TOTAL CAPACITIES IN PLASMA