UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

Serum malondialdehyde in horses supplemented with Selenium and vitamin E, moderately exercised in a polluted environment

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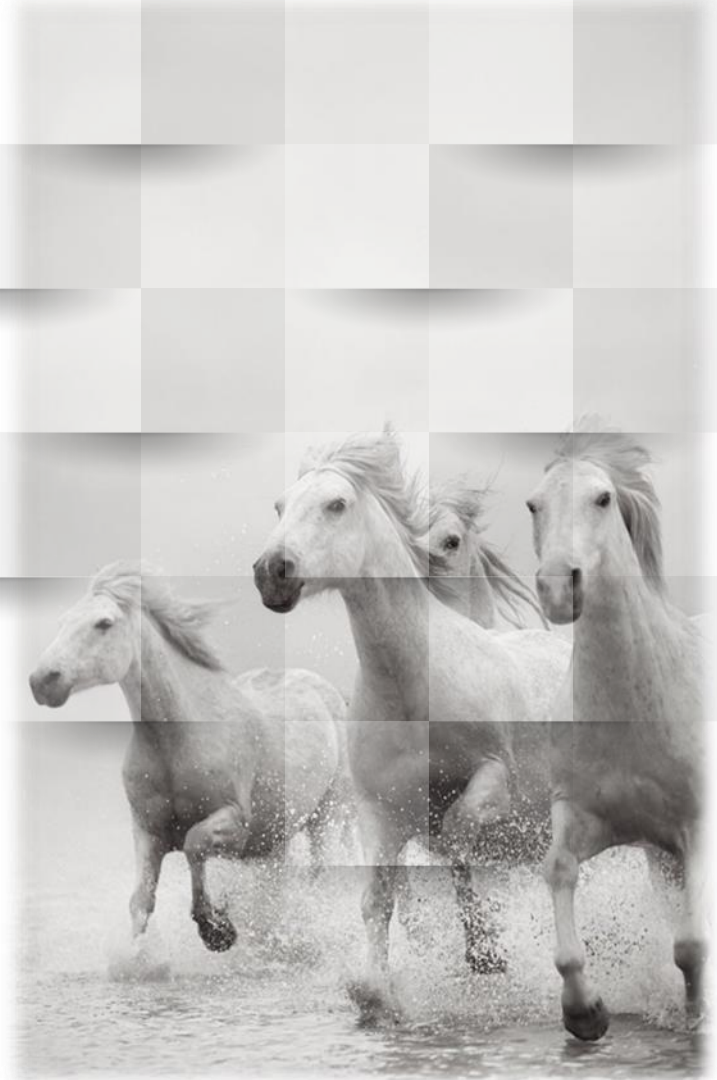
70TH ANNUAL MEETING OF THE EUROPEAN FEDERATION OF ANIMAL SCIENCE
ANIMAL FARMING FOR A HEALTHY WORLD
GHENT – BELGIUM
26 – 30 AUGUST 2019
EAAP2019

AGENDA…

1. INTRODUCTION
   - Objective
   - Hypothesis
2. MATERIAL & METHODS
3. RESULTS
4. CONCLUSIONS

1. INTRODUCTION



INTRODUCTION

Mexico City:
2240 m altitude
High altitude

O_2

Horse with physical activity

CRITERIA AIR POLLUTANTS

PM_{10}

O_3

NO_2

CO

NO_x

SO_2

UV RADIATION

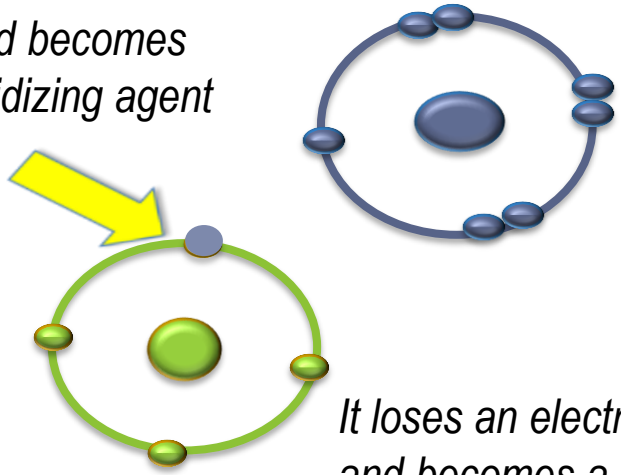
Physical activity increases serum MALONDIALDEHYDE

Oral antioxidant protection
Se and vitamin E

INTRODUCTION

OXIDANTS

It steals an electron and becomes oxidizing agent

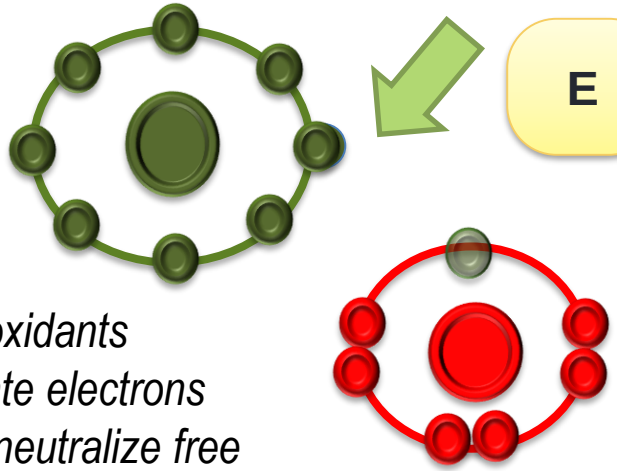


It loses an electron and becomes a free radical

ANTIOXIDANTS

Se

E



Antioxidants donate electrons and neutralize free radicals

FREE RADICAL

Hypothesis

↑Se + ↑E

Objective

Se
mg/kg DM,
0.1 or 0.3

+

Vit E
IU/kg BW,
1.6 or 2.0

2. MATERIAL & METHODS

Material & Methods

EXPERIMENTAL PROTOCOL APPROVED

Institutional Animal Care and Use Committe of the Faculty Veterinary Medicine of the National University of Mexico

Experimental site:

Mounted Police Unit of Mexico City

Animals:

24 horses (hot blood), 4 treatments with 6 horses each one

5 - 13 years old

Individually stable (ventilation, feeding and water dispenser)

Exercise:

Sand track

Material & Methods

Factorial arrangement: **2 × 2,**

- **2 selenium levels**
- **2 vitamin E levels**
- **a positive control group was used**

Se and E (NRC, 2007 recommendations)

with repeated measures (0-11 weeks, 77 days)

Selenium	Vitamin E: LE (1.6 UI/kg PV)	Vitamin E: HE (2.0 UI/kg PV)
LSe (0.1 mg/kg MS)	LSeLE	LSeHE
HSe (0.3 mg/kg MS)	HSeLE	HSeHE

EXPERIMENTAL PERIODS

SELENIUM AND VITAMIN E SUPPLEMENTATION

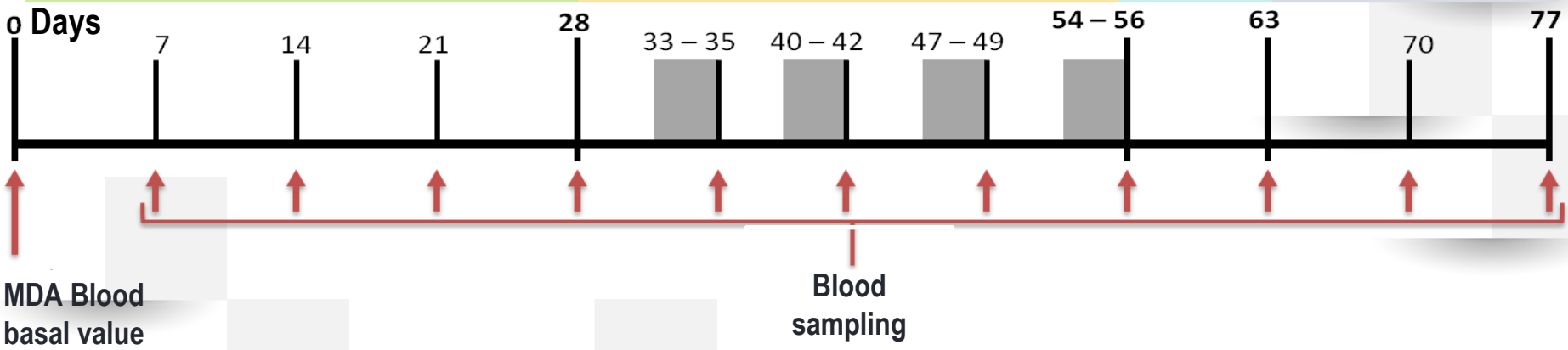
NO SUPPLEMENTATION

ADAPTATION

EXERCISE
4 d rest / 3 d activity

REST

READAPTATION



CRITERIA AIR POLLUTANTS DATA

GOBIERNO DE LA CIUDAD DE MÉXICO

http://www.aire.cdmx.gob.mx

MATERIAL & METHODS

CHEMICAL COMPOSITION OF THE DIET (DRY MATTER, DM)	
Item	
CP (N x 6.25, g/kg of DM)	103.88
NDF (g/kg of DM)	389.70
ADF (g/kg of DM)	342.43
Ca (g/kg of DM)	5.15
P (g/kg of DM)	3.58
Se (g/kg of DM)	ND
Vitamin E (IU/kg)	13.74
E (Mcal/kg of DM)	5.42

ND= No detectable UNDER 2 ppb (2 ng/g or 2 µg/kg)
Total kg offer/day: 8 kg of DM

Ingredients	g / kg DM
Oat hay	611.50
Lucerne hay	195.40
Comercial feed	193.10

- Feeding schedule: 0500, 0700, 1400 and 1600 h.
- 9.3 kg DM / day

METHODOLOGY:

- CP (N*6.25) = Kjeldahl Method
- TOTAL ENERGY = Calorimeter
- NDF and ADF = Van Soest (1991)
- Ca = Absorption Atomic Spectrophotometry
- P = Photometric method
- Se = Hydrides Generater Coupled to AAS
- Vitamina E = HPLC

MATERIAL & METHODS

ANTIOXIDANTS

Seleno-yeast
(2.052 g Se/ kg)
(Se-met)

DL- tocopherol
(439 UI E/g)

MATERIAL & METHODS

MODERATE EXERCISE, 30 MIN.

WARM UP (5 min)

CANTERING (20 min)

COOL DOWN (5 min)

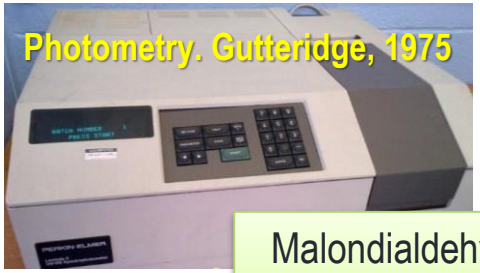
Johnstone B. et al., 1991; Manohar M y Goetz T., 1999; O'Connor C. et al., 2004; Pfau T. et al., 2006)

Material & Methods

Blood sampling…

Refrigeration
4°C

Animal Nutrition Department



Malondialdehyde (MDA)

STATISTICAL ANALYSIS…

- **PROC MIXED (SAS 9.1.3).**
  - A mix model,
    - **Fix effects:**
      - Se level,
      - Vitamin E level,
      - day,
      - their interactions.
    - **Random effect:**
      - Horse nested within the treatment.
  - Tukey-Kramer test (mean difference)
  - Significance ($P < 0.05$)
- **RSM package in R.**
  - Relationship between MDA and PM_{10}
    - Multiple sequence regression to test linear and non linear effects.

3. Results & Discussion

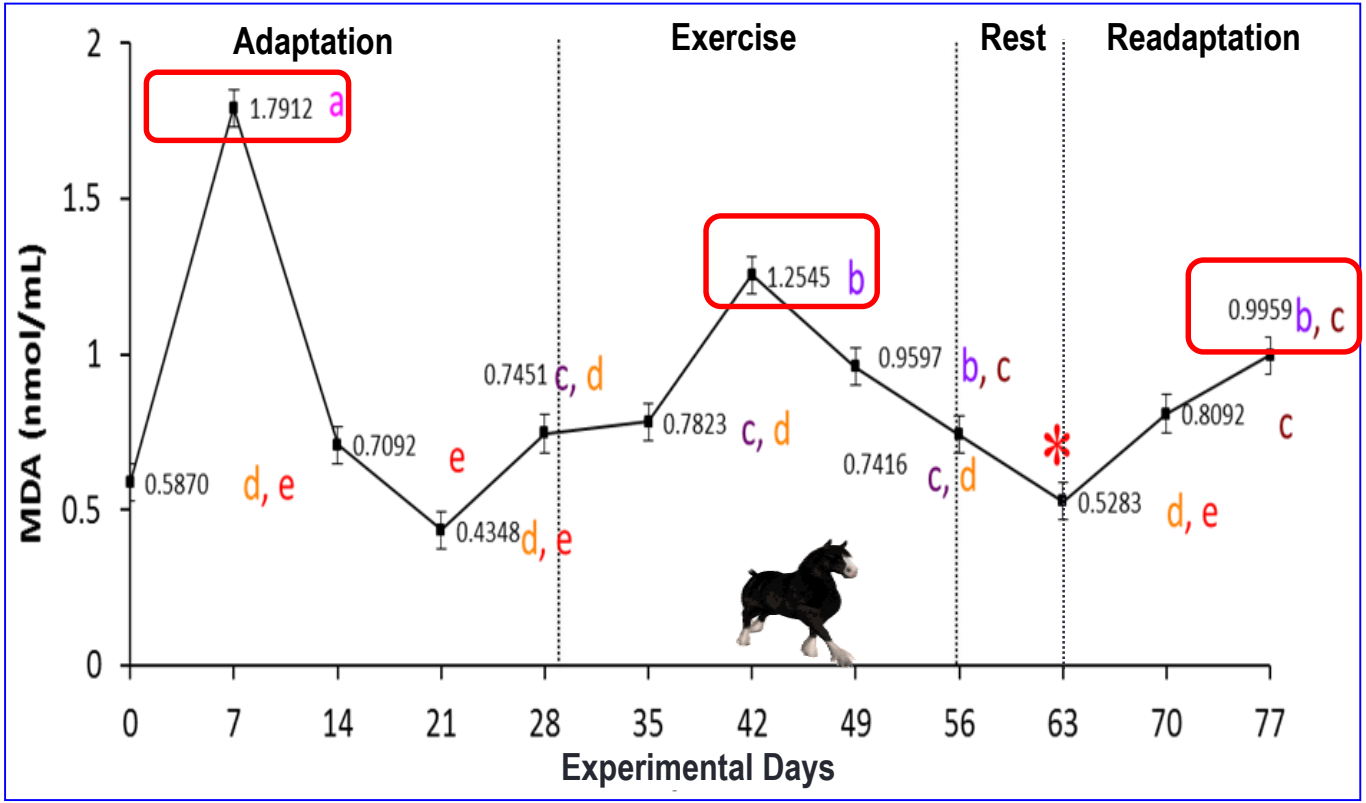
Results & Discussion

Effect of two supplemention levels of Selenium (0.1 and 0.3 mf Se/kg of DM) and α-tocopheryl (1.6 and 2.0 IU/kf of BW) on malondiandehyde (MDA) concentrations in horses under moderate exercise.

P value, for the effects of the experimental model						
Se	Vit E (E)	Se × E	Experimental day (d)	Se × d	E × d	Se × E × d
0.716	0.450	0.928	**<0.001**	0.958	0.712	0.993

HYPOTHESIS: SUPPLEMENTACIÓN WITH Se AND VITAMIN E **WILL DECREASE** SERUM **MALONDIALDEHYDE**

RESEARCH HYPOTESIS WAS REJECTED

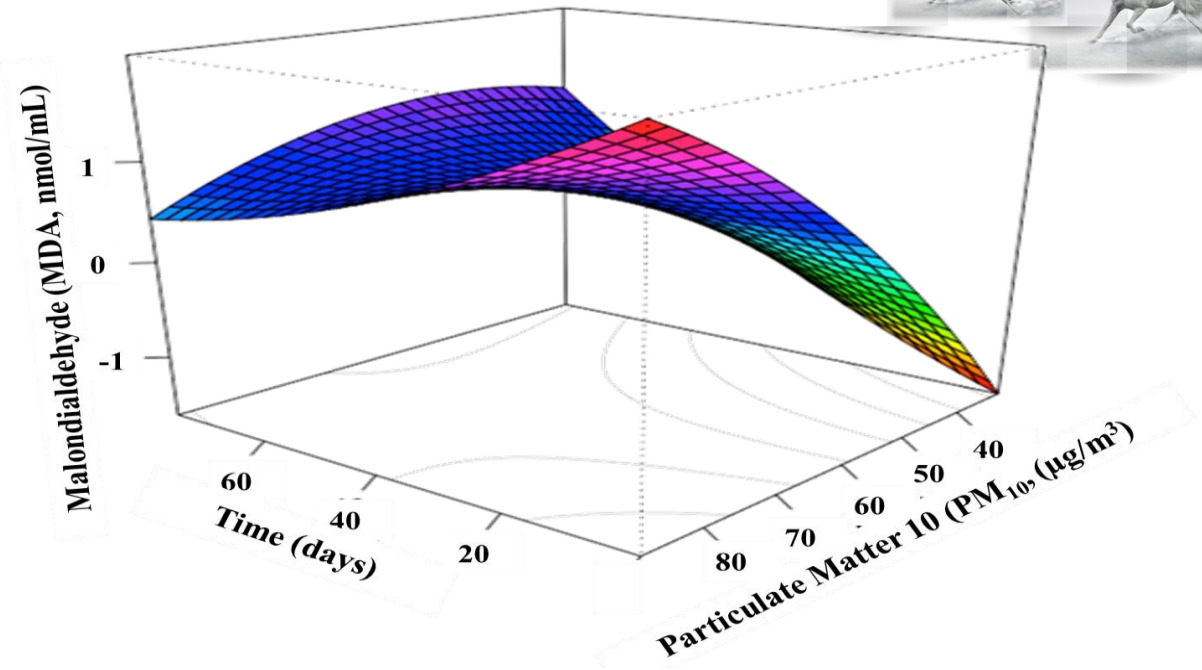


Mean serum concentrations of malondialdehyde (MDA) from supplemented horses with two selenium- (seleno-yeast, 0.1 and 0.3 mg Se/kg DM) and two vitamin E levels (DL- tocopherol; 1.6 and 2.0 UI/kg BW).

Day effect:
P < 0.001; SEM = 0.06

MDA (nmol/mL):

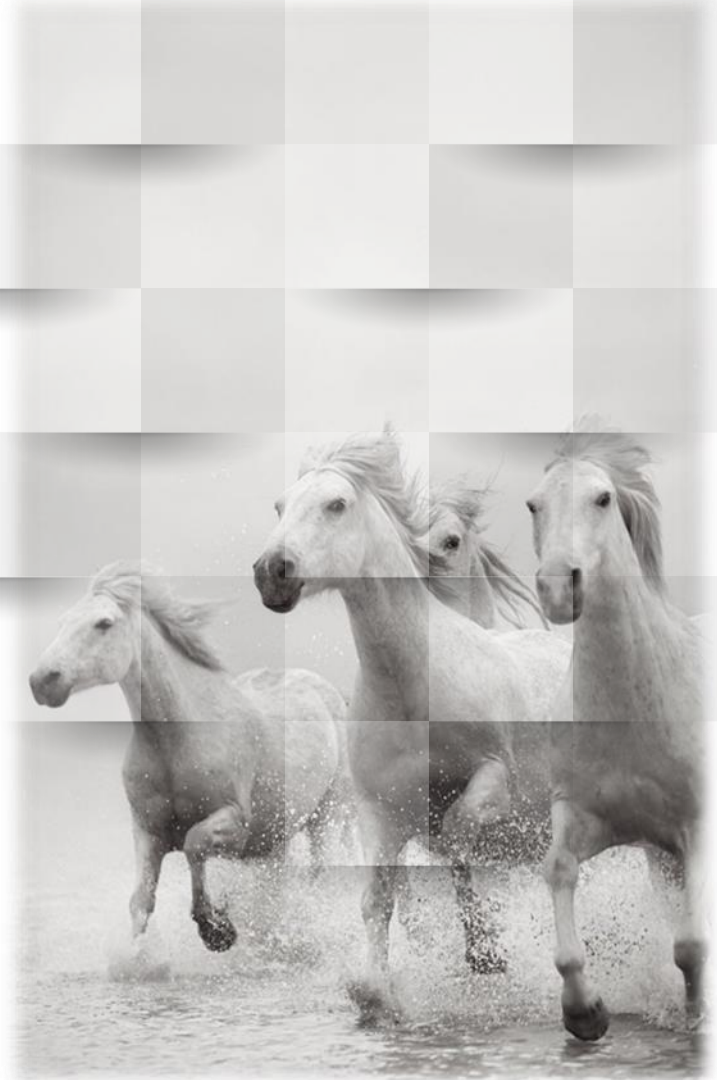
- 0.0028 (Al-Qudah *et al.*, 2016), before exercise
- 11.19 (Onmaz *et al.*, 2011), 12 h after transport



Estimated response surface for serum malondialdehyde concentrations, particulate matter (PM_{10}) and time in police horses subjected to moderate exercise (days 29 to 57), two selenium levels (0.1 or 0.3 mg/kg DM) and two vitamin E levels (1.6 or 2.0 UI/kg BW), from the second order polynomial regression model:

$$5.1 + 0.05 \times day + 0.12 \times PM_{10} - 0.001 \times PM_{10} \times day + 0.0002 \times day^2 - 0.0005 \times PM_{10}^2$$

4. CONCLUSIONS

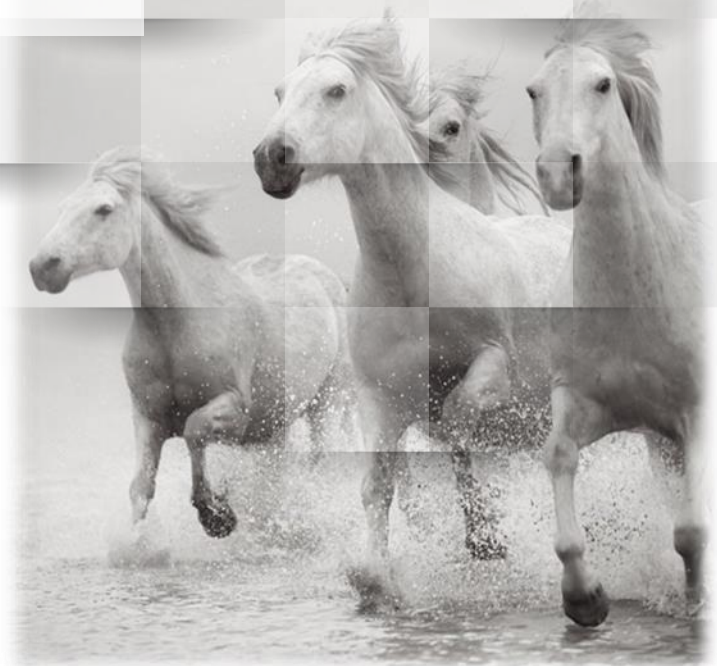


Conclusions

- MDA would be higher on the first days of exposure to high PM10 concentrations and later decrease over time, even though PM10 increased…
- This could be an adaptation response; however, these results require further research.

ACKNOWLEDGMENTS

- EEAP 2019 Organizers
- Mounted Police Unit of Mexico City



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