Hepatic tyrosine aminotransferase and glucocorticoid abuse in meat cattle

HEPATIC TYROSINE AMINOTRANSFERASE AND GLUCOCORTICOID ABUSE IN MEAT CATTLE

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INTRODUCTION

Dexamethasone (DEX), a fluorinated hydro-cortisone derivative, is characterized by a remarkable glucocorticoid potency associated with nearly complete lack of mineralocorticoid activity, making this compound the drug of choice for a wide range of therapeutic applications in both human and veterinary clinical practice (Fenguset al., 1995). In recent years DEX and other synthetic glucocorticoids (GCs) have been illegally used in meat cattle production to improve the zootechnical performances and the carcass quality (Courtheyn et al., 2002), and/or to synergize the growth promoting effects of other illegal compounds, such as estrogens or agonists (Abraham et al., 2004). This has resulted in a sharp increase in the non-compliances for corticosteroids; interestingly, the published report referring to 2010 (EC, 2010) showed Italy ranking largely first, with a total of 86 non-compliant results, 35 of them related to DEX.

In order to achieve growth-promoting effects, DEX is usually administered by the oral route at very low dosages for an extended period of time, yielding urinary concentrations often below the "cut-off" of the most common immunoenzymatic kits used in routinary official controls (Girolami et al., 2010). Evidence has been presented indicating that, in line with other GCs, DEX undergoes limited oxidative and conjugative biotransformation in cattle (Vincenti et al., 2009), being able to build up mainly as such in meat and offal (Cheng et al., 2005). Due to the strong biological activity, DEX residues are potentially hazardous for the consumer's health (Botsoglou & Fletouris, 2001).

All the above reasons have prompted the research to develop reliable biomarkers for revealing the exposure to DEX or other GCs in cattle (Girolami et al., 2010; Nebbia et al., 2011). While some groups have focused their attention on the histological changes occurring in target organs, most notably the thymus (Cannizzo et al., 2008; Cannizzo et al., 2010), others have investigated the GC-mediated effects on blood leukocyte formula (Brambilla et al., 1998) or on blood cortisol levels (Vascellari et al., 2006;). According to the legislation in force, a biological marker should always be used in conjunction with an official analytical method to prove the non compliance of a given sample. Nonetheless, if proved feasible, the blood-based approaches may facilitate the screening of more animal populations than is possible by means of the more expensive and time consuming current analytical techniques, thereby ultimately improving the effectiveness of the official controls (Mooney et al., 2009)

The metabolic enzyme tyrosine aminotransferase (E.C. 2.6.1.5, TAT) is predominantly expressed in hepatic parenchymal cells and is involved in tyrosine degradation providing ketogenic

μ

Bos taurus *Rattus norvegicus*

μ

ΔΔ

in vitro

Enzyme assays

g

et al

et al

p

Data and statistical analysis

t

Liver TAT activities in veal calves

DEX-mediated increase in TAT mRNA and specific activity in cell lines

Effects of DEX and other growth-promoters on liver TAT mRNA and specific activity in finishing bulls

per capita

per capita

b

per capita

et al.

β

et al

et
al. *in vitro* *in vivo*

in vitro

et al.

in vitro

et al

et al

et al. *et al.*

et al

et al.

et al.

et al. *et al.*

μ

μ

et al. *et al.*

et al. *et al.*
in vivo
et al.
et al.

et al
et al *et al*

et al
et al

β

β
β
et al
β *et al.*

et al.

et al

viz

et al *et al*

et al

et al *e.g*

et al

et al. *et al.*

et al.

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Veterinary Record

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European Journal of Biochemistry **165** -

The Journal of Biological Chemistry **259** -

Biochimica et Biophysica Acta (BBA) - Molecular Cell Research **886** -

American Journal of Veterinary Research **46** -

Journal of Agricultural and Food Chemistry **57** -

Endocrinology **151** -

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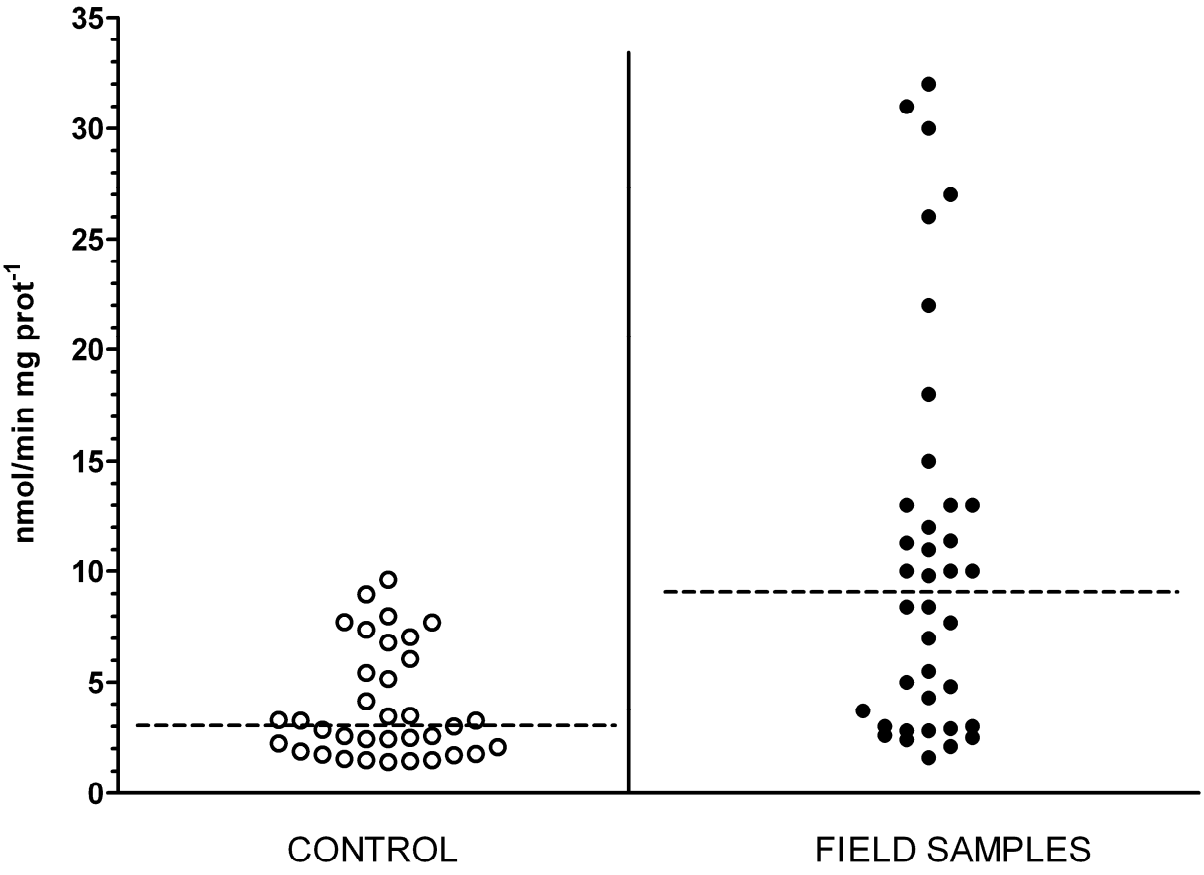
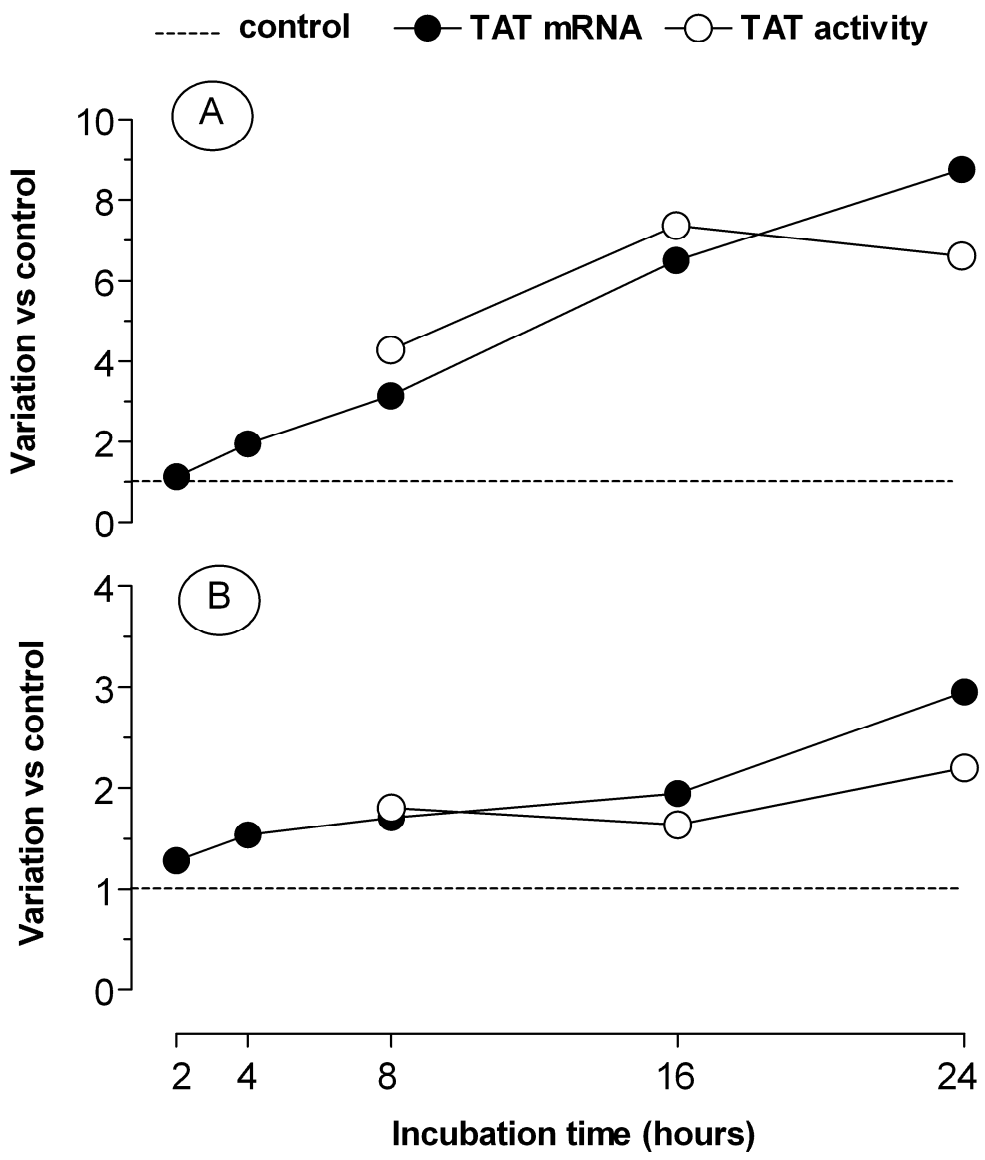
FIGURE LEGENDS


35
30
25
20
15
10
5
0
nmol/min mg prot-1
CONTROL
FIELD SAMPLES


control
TAT mRNA
TAT activity
A
B
Variation vs control
Variation vs control
10
8
6
4
2
0
4
3
2
1
0
2
4
8
16
24
Incubation time (hours)