Effect of abrupt weaning at housing on welfare biomarkers in beef suckler calves

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Weaning

- Abrupt weaning is a multifactorial stressor (Weary et al., 2008)
- Psychological (Enriquez et al., 2010)
    - Complete separation from dam
    - Adaptation to new environment
    - Social reorganisation (Veissier et al., 1989)
- Nutritional
    - Adaptation from liquid diet to novel solid diet

(Ungerfield *et al*., 2009)

- Physical
    - Environment e.g. housing and transportation

Stress has a negative impact on disease susceptibility and welfare of livestock

(Blecha et al., 1984; Griffin, 1989; von Borell, 2001; Hickey *et al*., 2003, Arthington *et al*., 2005; 2008, Blanco *et al*., 2009)

Weaning stress response

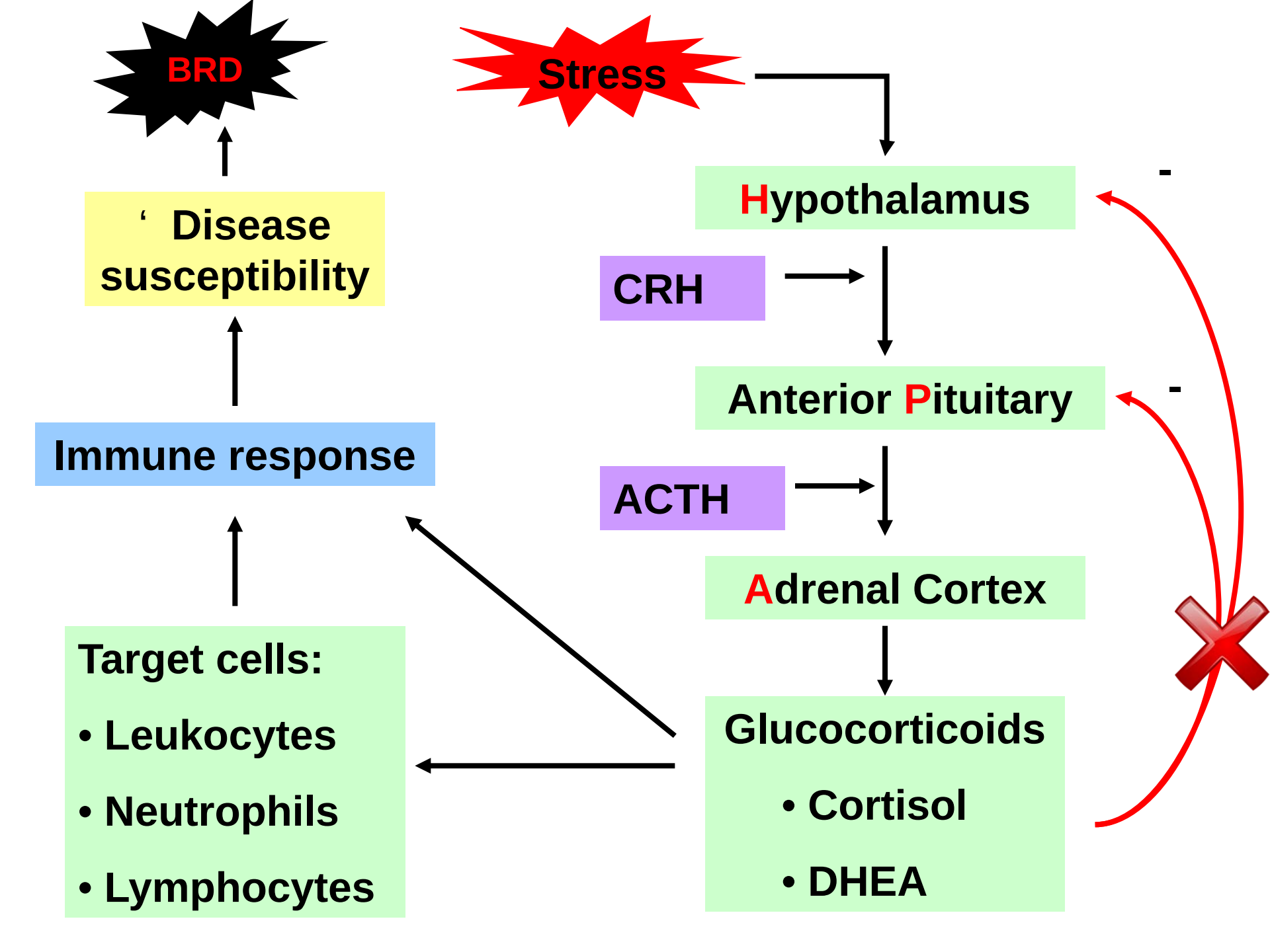
- Abrupt weaning is stressful event that can elicit an acute stress response that alters physiological responses and can impaired immune response

  - Mediated by the action of stress hormones (cortisol and noradrenaline) on leukocytes

  - Involves activation of the hypothalamic pituitary adrenal (HPA) axis and other integrated axes

  - HPA activation is associated with reduced immunity

(Lefcourt and Elsasser, 1995; Hickey *et al*., 2003, Arthington *et al.,* 2005; 2008; Blanco *et al*., 2009)


BRD
Stress
‘ Disease susceptibility
Hypothalamus
-
CRH
Anterior Pituitary
-
Immune response
ACTH
Adrenal Cortex
Target cells:
• Leukocytes
• Neutrophils
• Lymphocytes
Glucocorticoids
• Cortisol
• DHEA

Gaps in the knowledge

Further investigation on the effects of pre- and post-weaning management on the weaning stress response in beef calves

Further investigation into the mechanisms of immune suppression post-weaning

- Lymphocyte immunophenotypes
- Neutrophil functional activity

Effect of weaning on the physiological and immunological responses in beef cows has not been investigated

Objectives

To examine the effect of **abrupt weaning at housing** on the peripheral leukocyte and lymphocyte subset distribution, neutrophil functional activity, and APP response in abruptly weaned beef calves compared with non-weaned (control) calves

Experimental design -

16 male beef calves at pasture with their dams

-7

All calves housed on d 0

Days relative to housing

0 2 7 14

(n = 8) **W** = Housed and weaned

(n = 8) **C** = Housed and not weaned (controls)

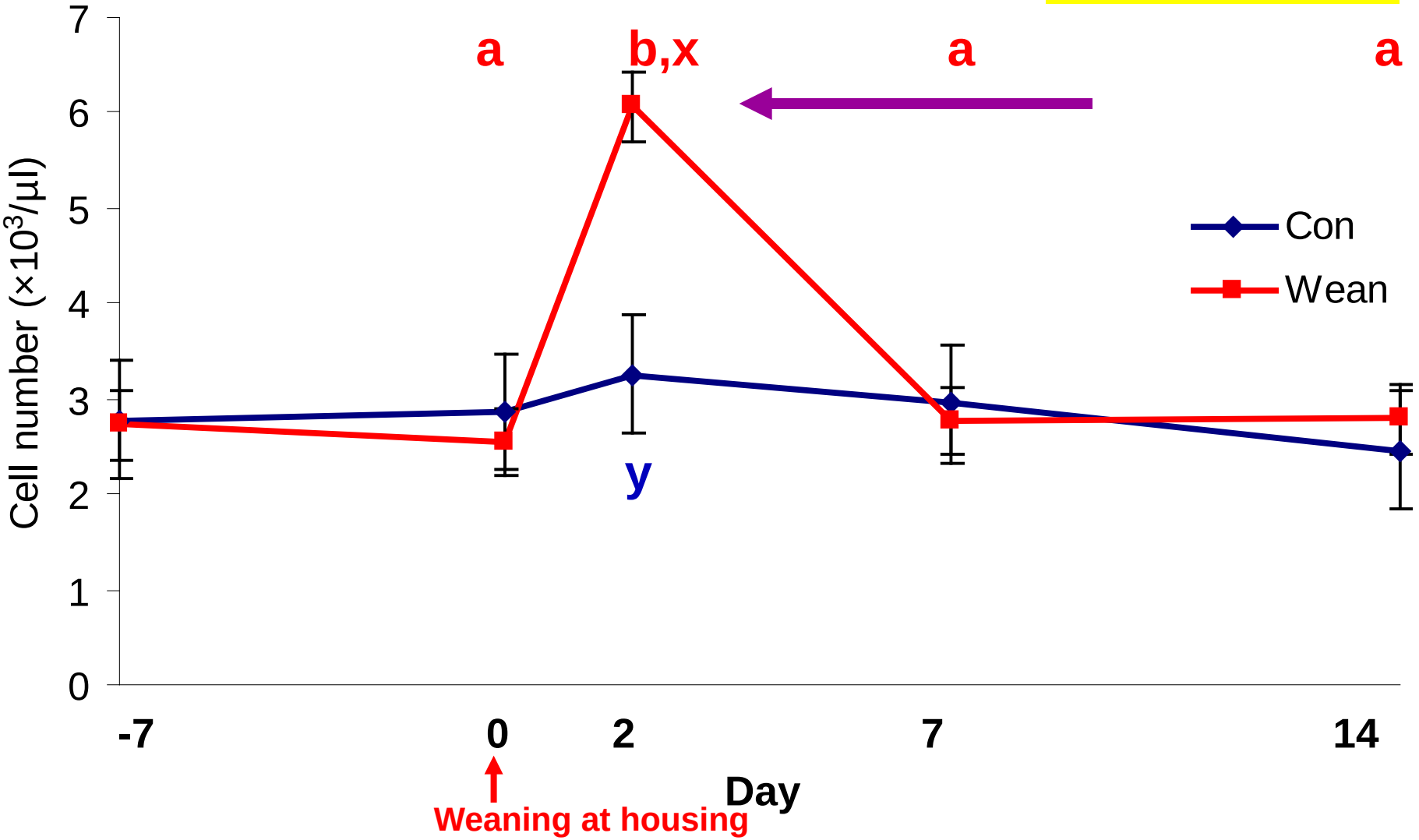
0 2 7 14

Days relative to housing

Results -

Neutrophil number

S × T: *P* < 0.001



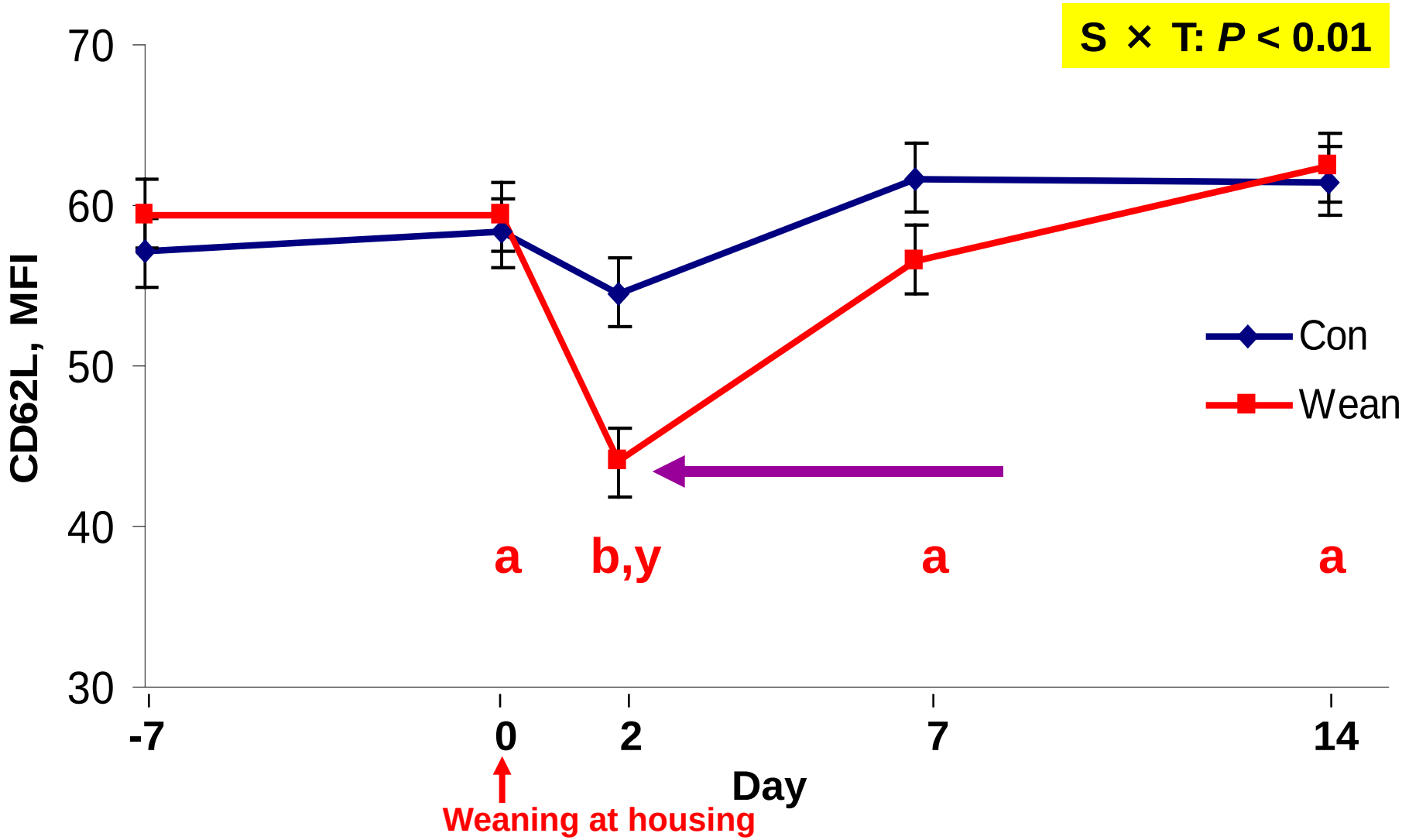
[a,b]means differ (P < 0.05) from pre-weaning baseline (d 0)

[x,y]means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment

Neutrophil L-selectin surface expression



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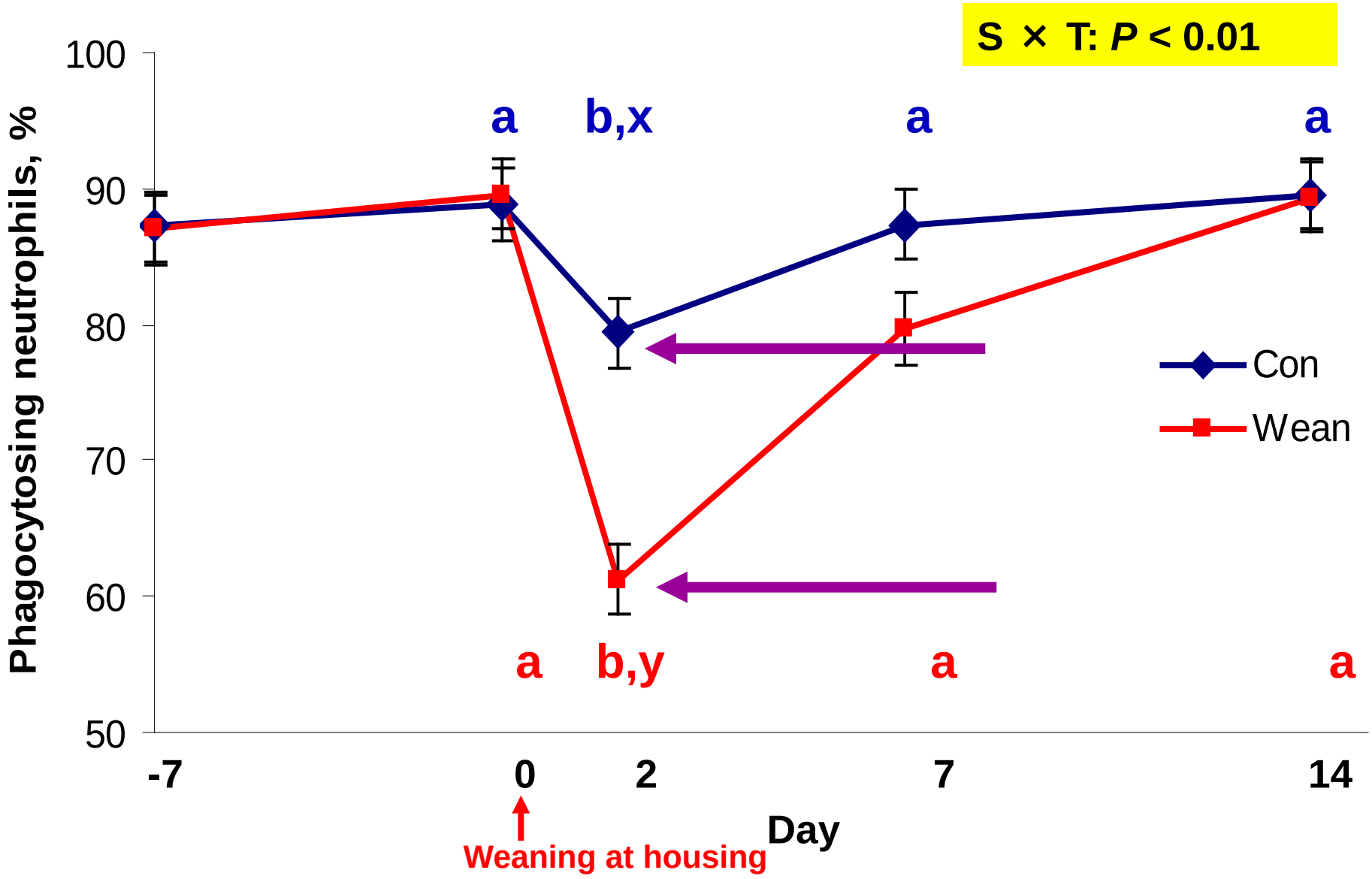
Neutrophil phagocytic activity



[a,b]means differ (P < 0.05) from pre-weaning baseline (d 0)

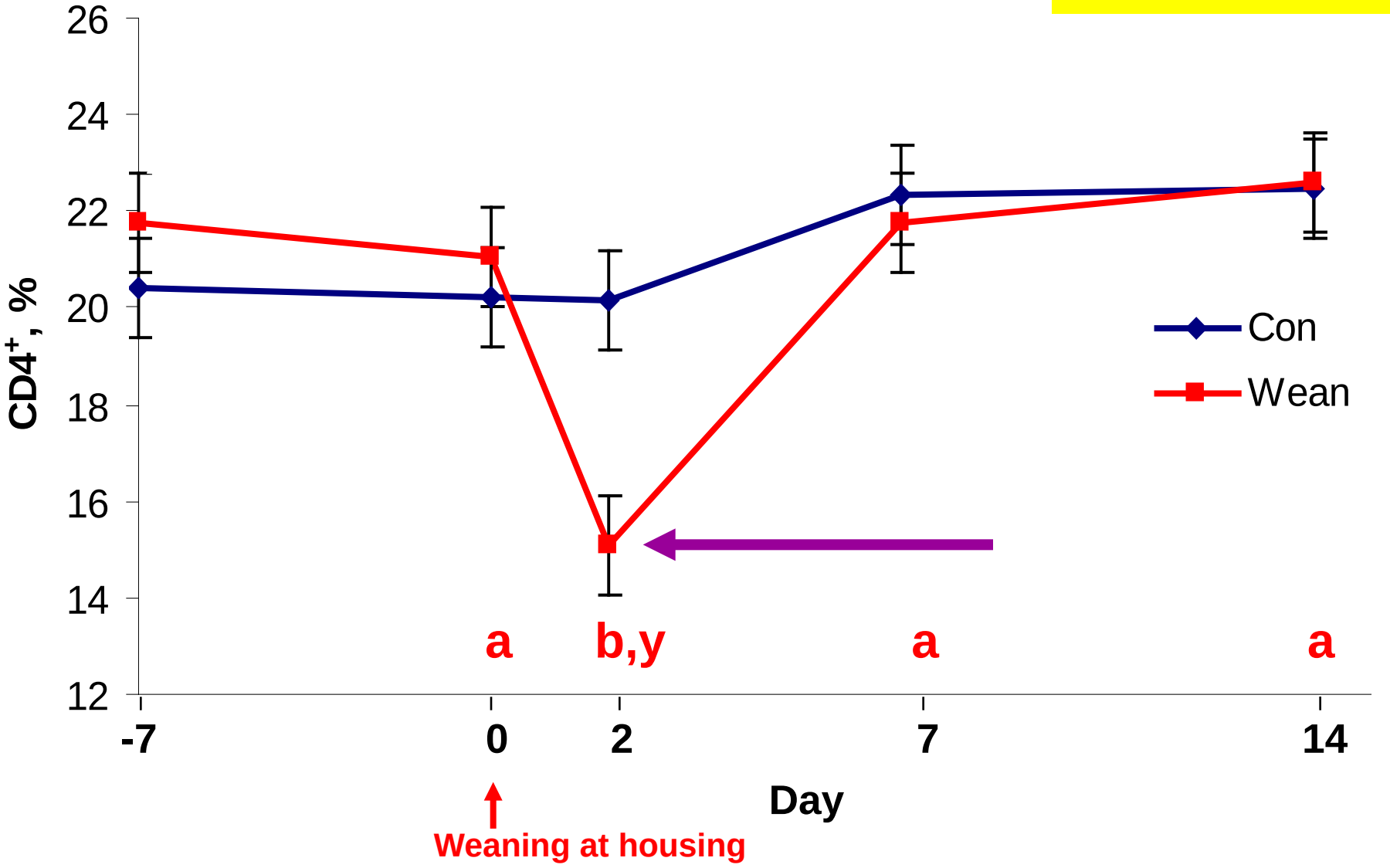
[x,y]means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment

$CD4^+$ T cells

S × T: *P* < 0.05



[a,b]means differ (P < 0.05) from pre-weaning baseline (d 0)

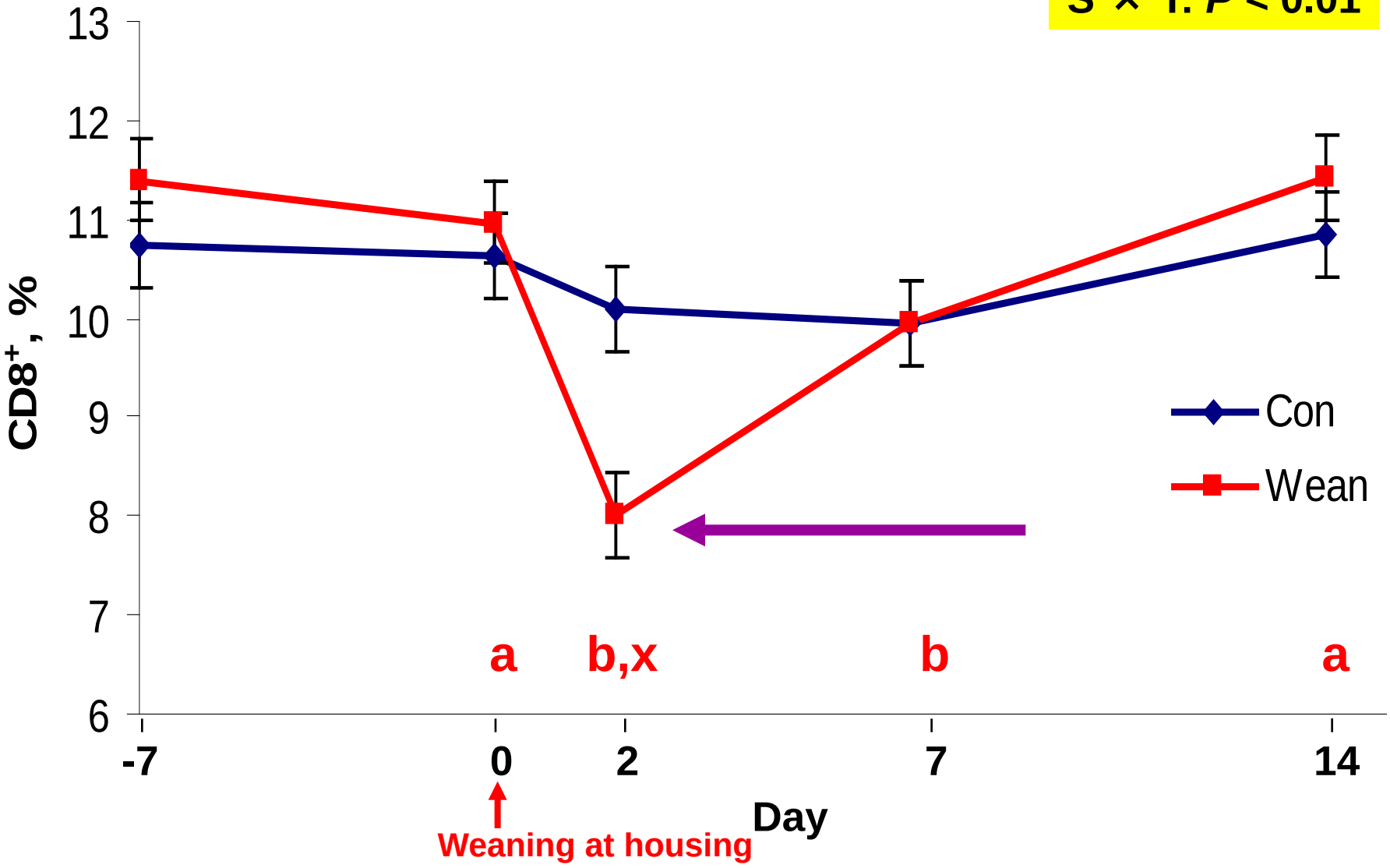
[x,y]means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment

$CD8^+$ T cells

S × T: *P* < 0.01



[a,b]means differ (P < 0.05) from pre-weaning baseline (d 0)

[x,y]means differ (P < 0.05) between treatments

S: Sampling time

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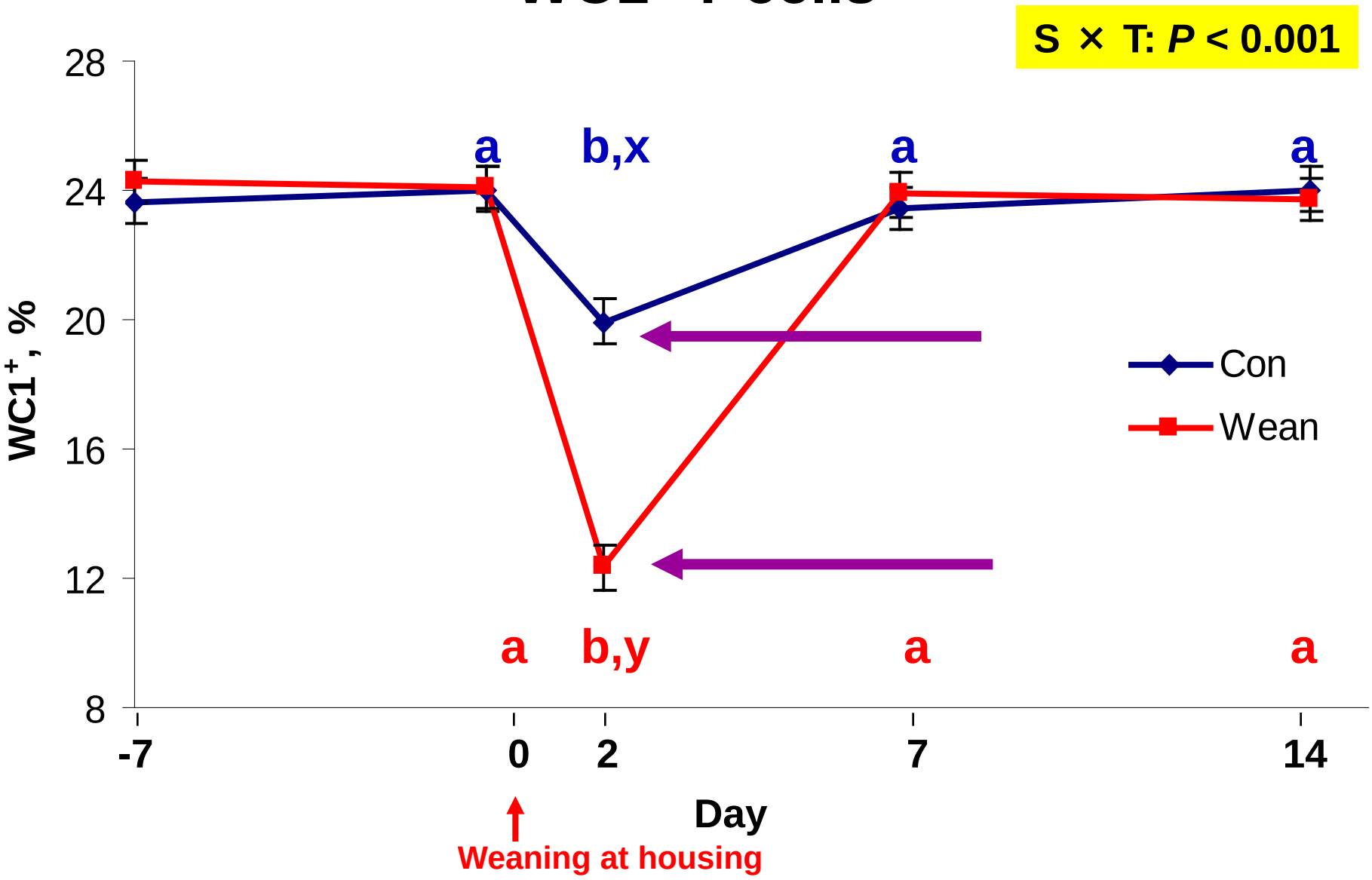
WC1$^+$ T cells



[a,b]means differ (P < 0.05) from pre-weaning baseline (d 0)

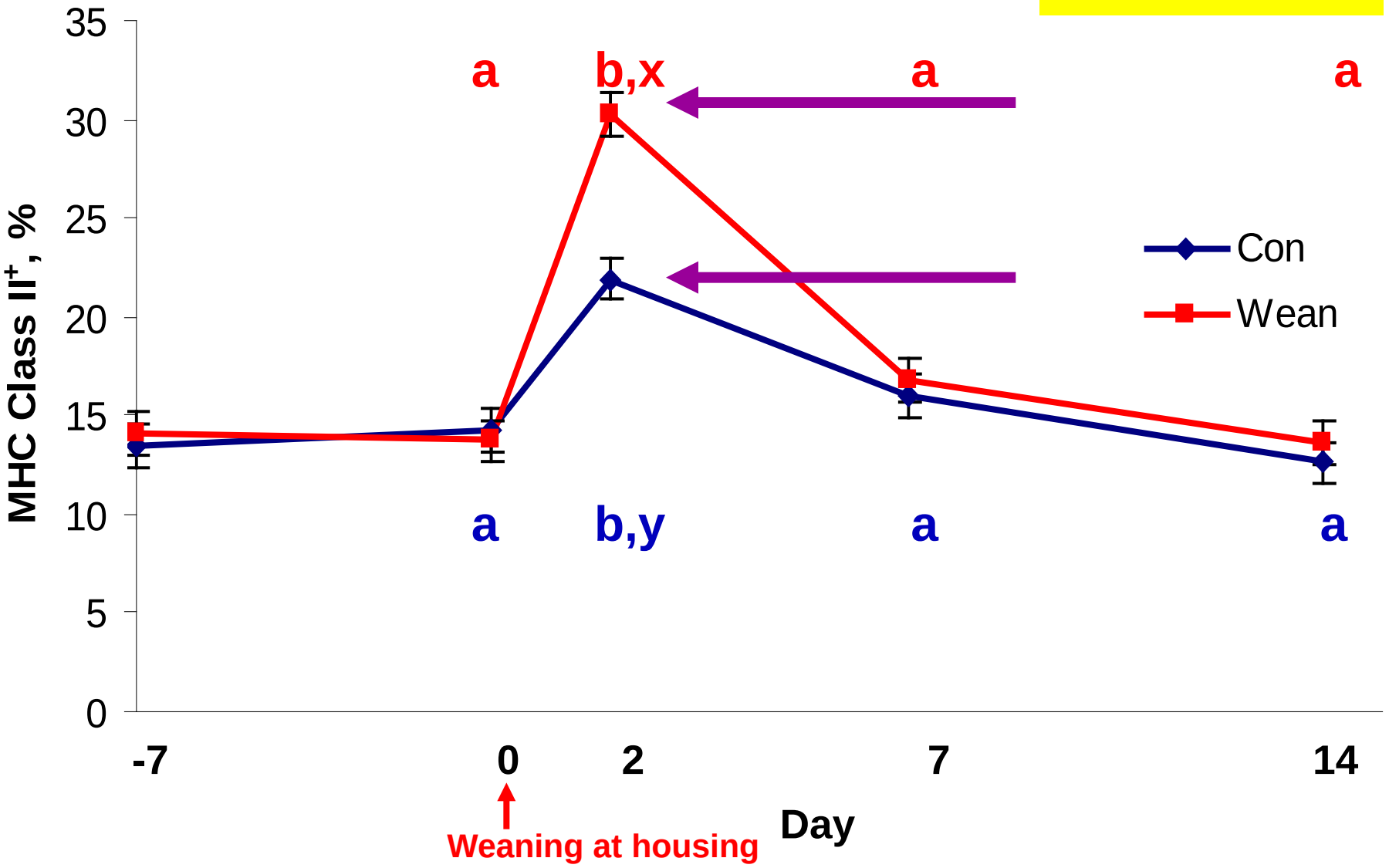
[x,y]means differ (P < 0.05) between treatments

S: Sampling time

T: Treatment

MHC Class II$^+$ cells

S × T: *P* < 0.001



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S: Sampling time

T: Treatment

Results – Neutrophils

Variable	Control	Wean
Neutrophil number	↔	↑
L- selectin, CD62L^{+} MFI	↔	↓
Phagocytic activity	↓	↓ ↓

Results – Lymphocytes

Variable	Control	Wean
$CD4^+$ T cells, % (Helper)	”	“
$CD8^+$ T cells, % (Cytotoxic)	”	“
$WC1^+$ T cells, %	“	“ “
MHC class II^+ cells, %	‘	‘ ‘

Conclusions

Abrupt weaning at housing:

- Increased neutrophil number and impaired trafficking and phagocytic function

- Together with the changes in lymphocyte subsets, the results suggest that there was a greater transitory reduction in immune function at housing in abruptly weaned than non-weaned beef calves.

Thank you for your attention

Teagasc
Agriculture and Food Development Authority

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