Effect of preweaning plane of nutrition on body size and age at puberty in dairy calves

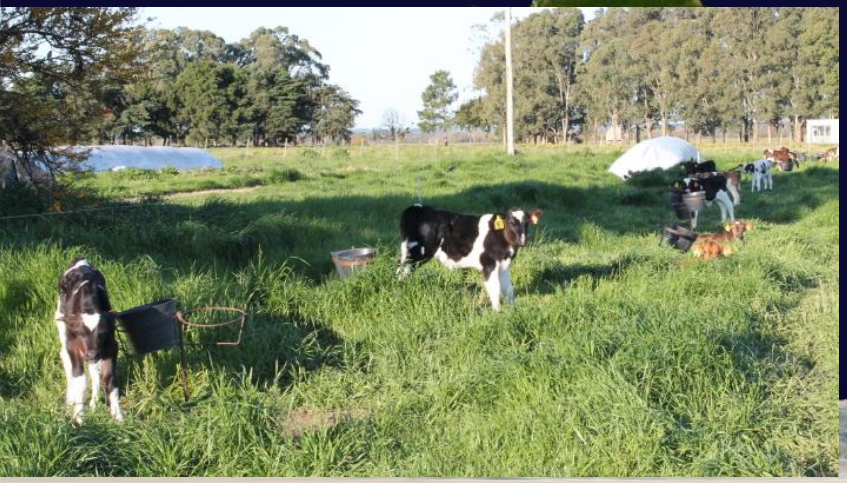
A Mendoza, S De Trinidad, C Viñoles, C Cajarville, T Morales, M Pla, D Ubilla, J Soutto and E Garófalo

67th Annual Meeting of the European Federation of Animal Science, Belfast UK

Instituto Nacional de Investigación Agropecuaria
URUGUAY

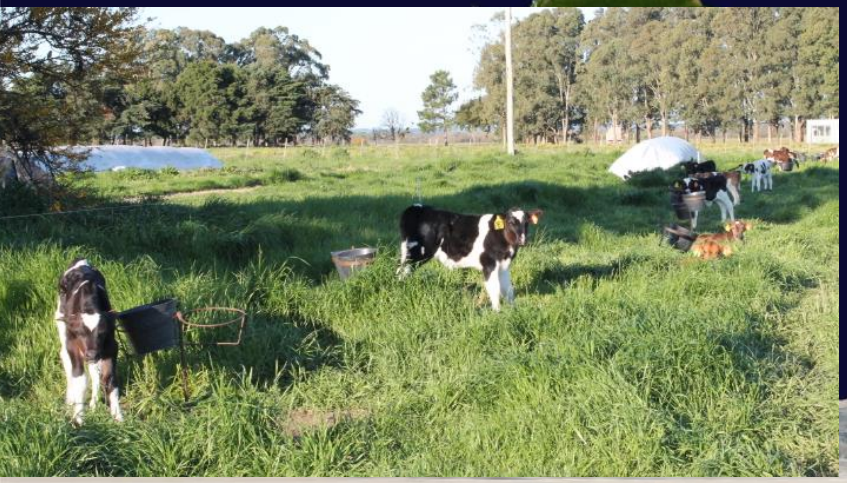
FVET Facultad de Veterinaria
Universidad de la República
Uruguay

Introduction



- Age at first calving: 32.2 months (Sotelo, 2016)
- Related to poor rearing management
- Impact on long-term reproductive and productive performance?

Introduction



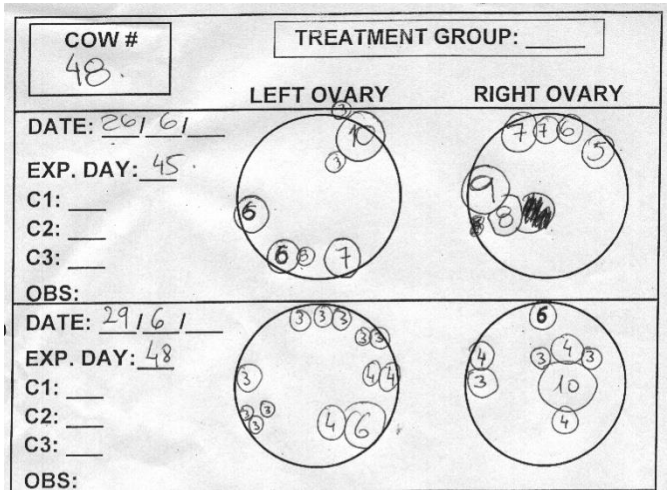
To establish the effects of preweaning plane of nutrition on body size and age at puberty

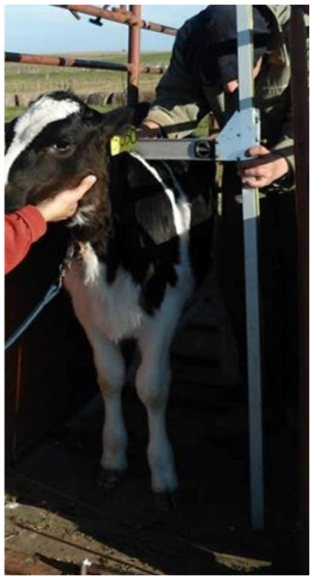
Materials & methods

- INIA “La Estanzuela”
- 34 Holstein dairy calves (39,6 ± 4,2 kg)
- Treatments (from 7 to 56 d):
  - **T4**: 4 L/d of whole milk
  - **T8**: 8 L/d of whole milk

Materials & methods

- Blood samples every 14 (preweaning) and 30 d (postweaning): IGF-I & insulin.
- From d 180: follicular dynamics by transrectal ultrasonography in alternate days for 21 d.
- When BW > 195 kg, ovaries were examined by ultrasonography to evaluate the presence of a corpus luteum.

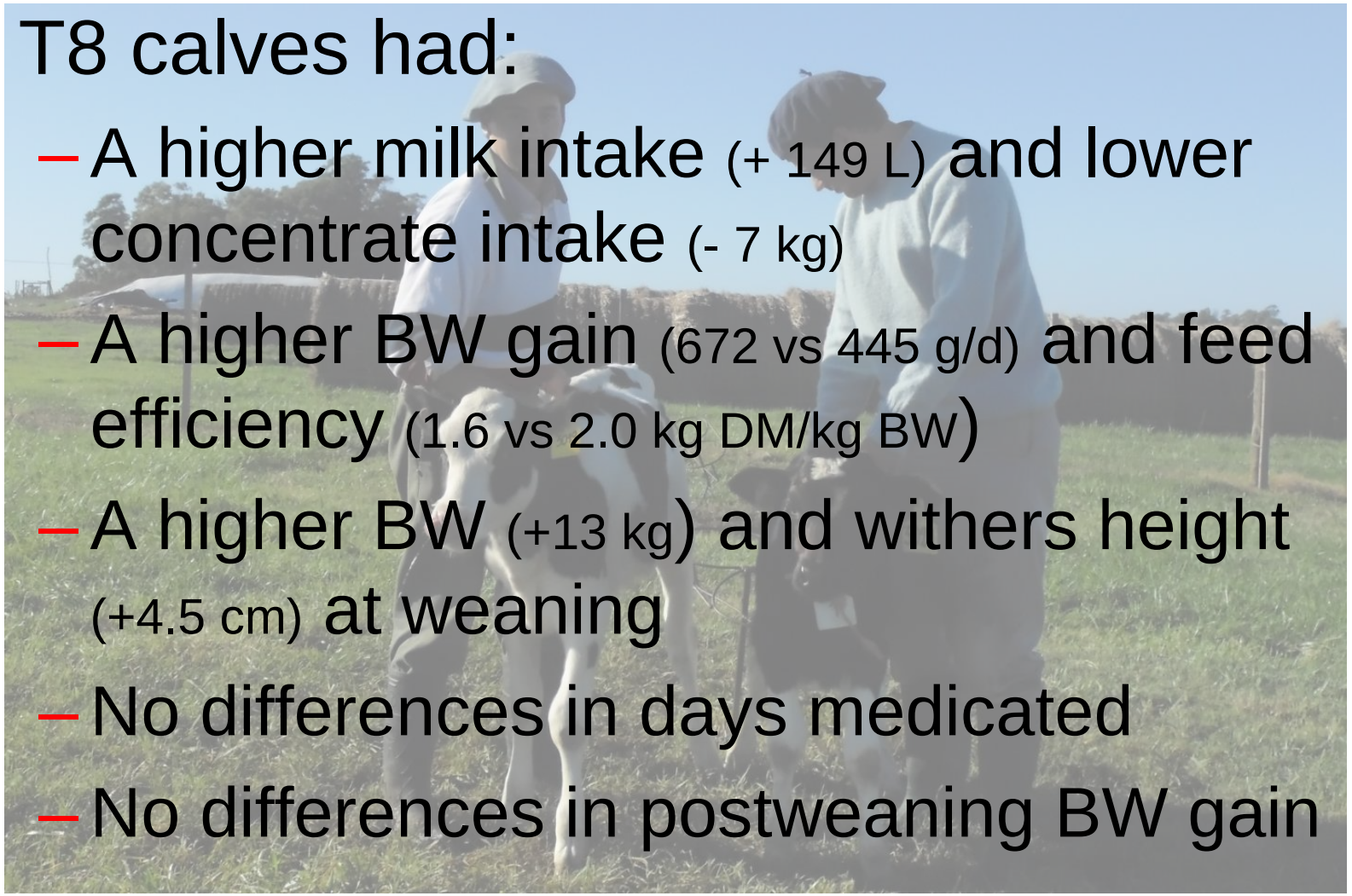




Results

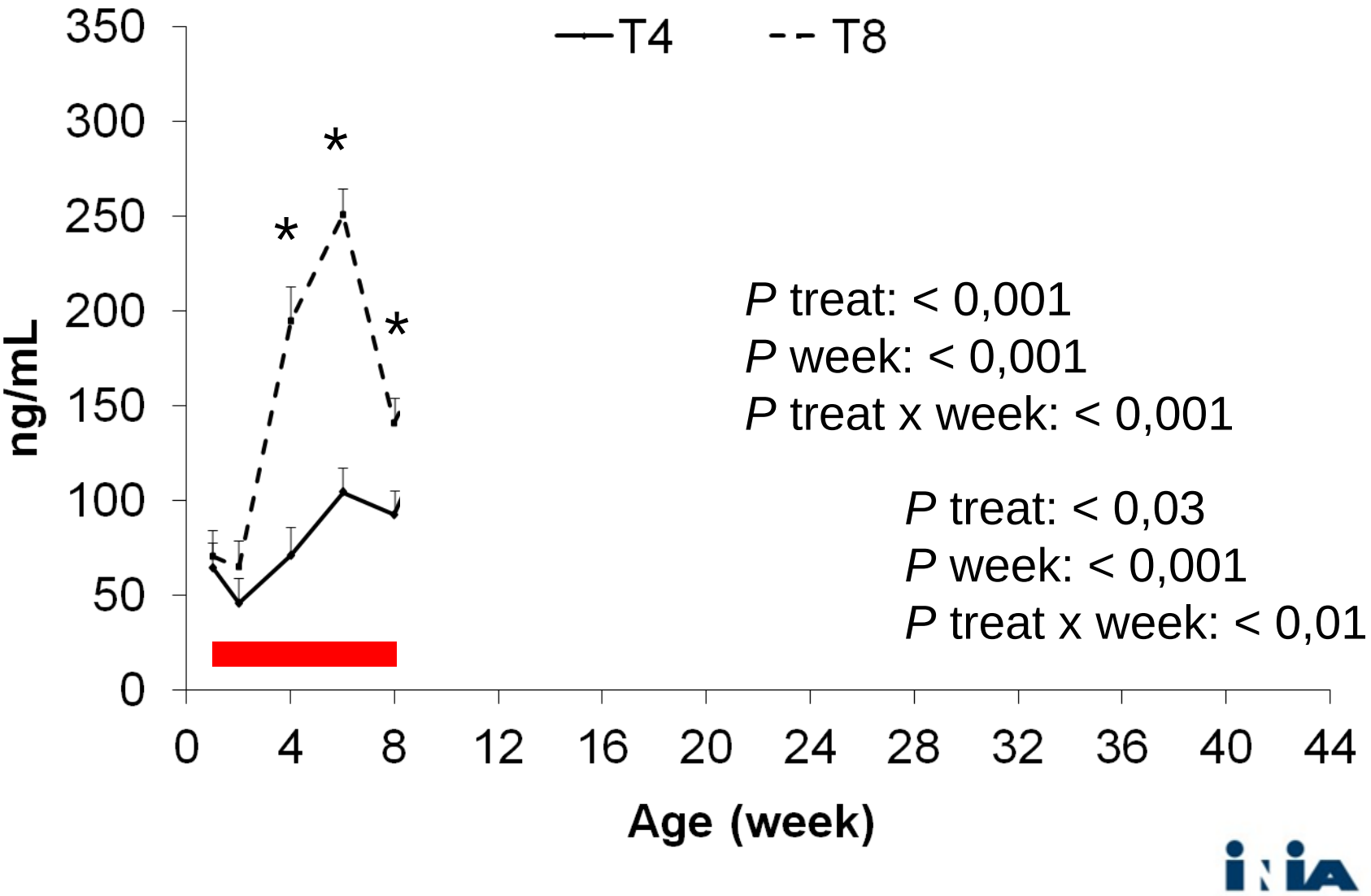
Preweaning performance

- T8 calves had:
  - A higher milk intake (+ 149 L) and lower concentrate intake (- 7 kg)
  - A higher BW gain (672 vs 445 g/d) and feed efficiency (1.6 vs 2.0 kg DM/kg BW)
  - A higher BW (+13 kg) and withers height (+4.5 cm) at weaning
  - No differences in days medicated
  - No differences in postweaning BW gain



De Trinidad et al., 2014

IGF-I concentrations



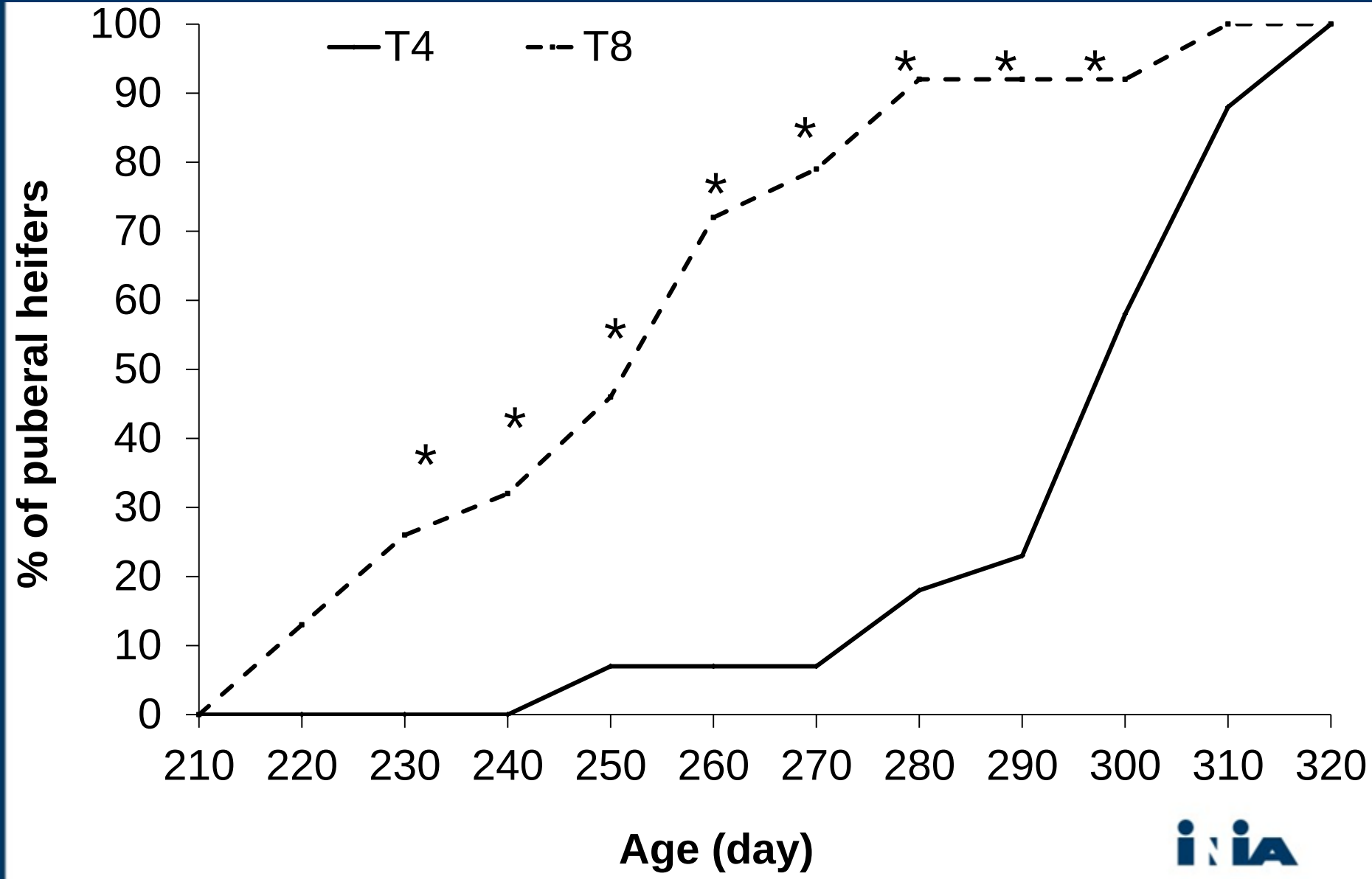
P treat: < 0,001
P week: < 0,001
P treat x week: < 0,001

P treat: < 0,03
P week: < 0,001
P treat x week: < 0,01

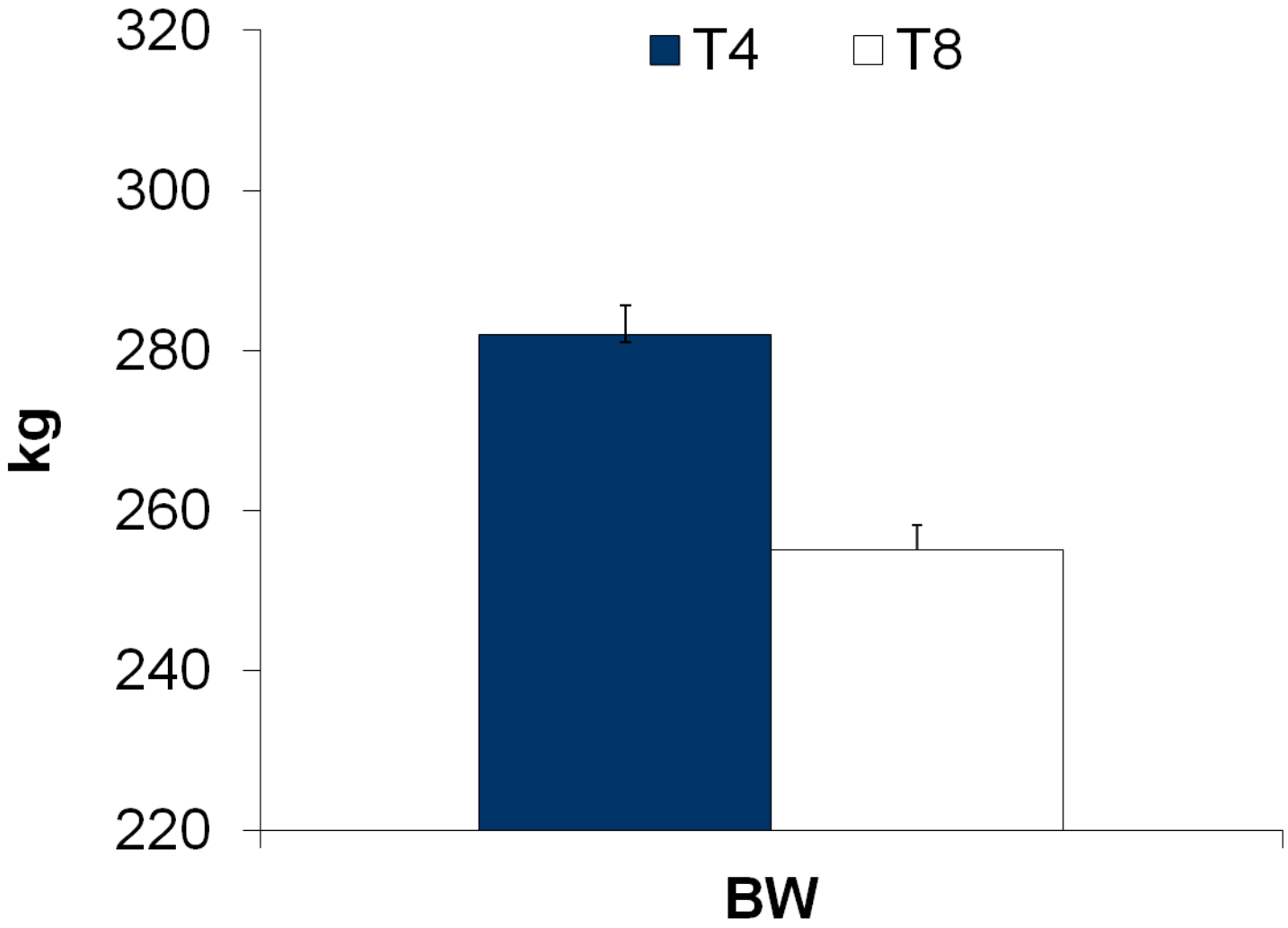
Follicular dynamics

- No effect of treatment on:
  - total number of follicles (18.2 ± 1.4)
  - diameter of dominant follicle (6.3 ± 0.5 mm)
  - growth (0.82 ± 0.06 mm/d) & regression (0.95 ± 0.07 mm/d) rates
  - follicle lifespan (13.8 ± 0.8 d)

Puberty


T4
T8
% of puberal heifers
100
90
80
70
60
50
40
30
20
10
0
210
220
230
240
250
260
270
280
290
300
310
320
Age (day)

Puberty

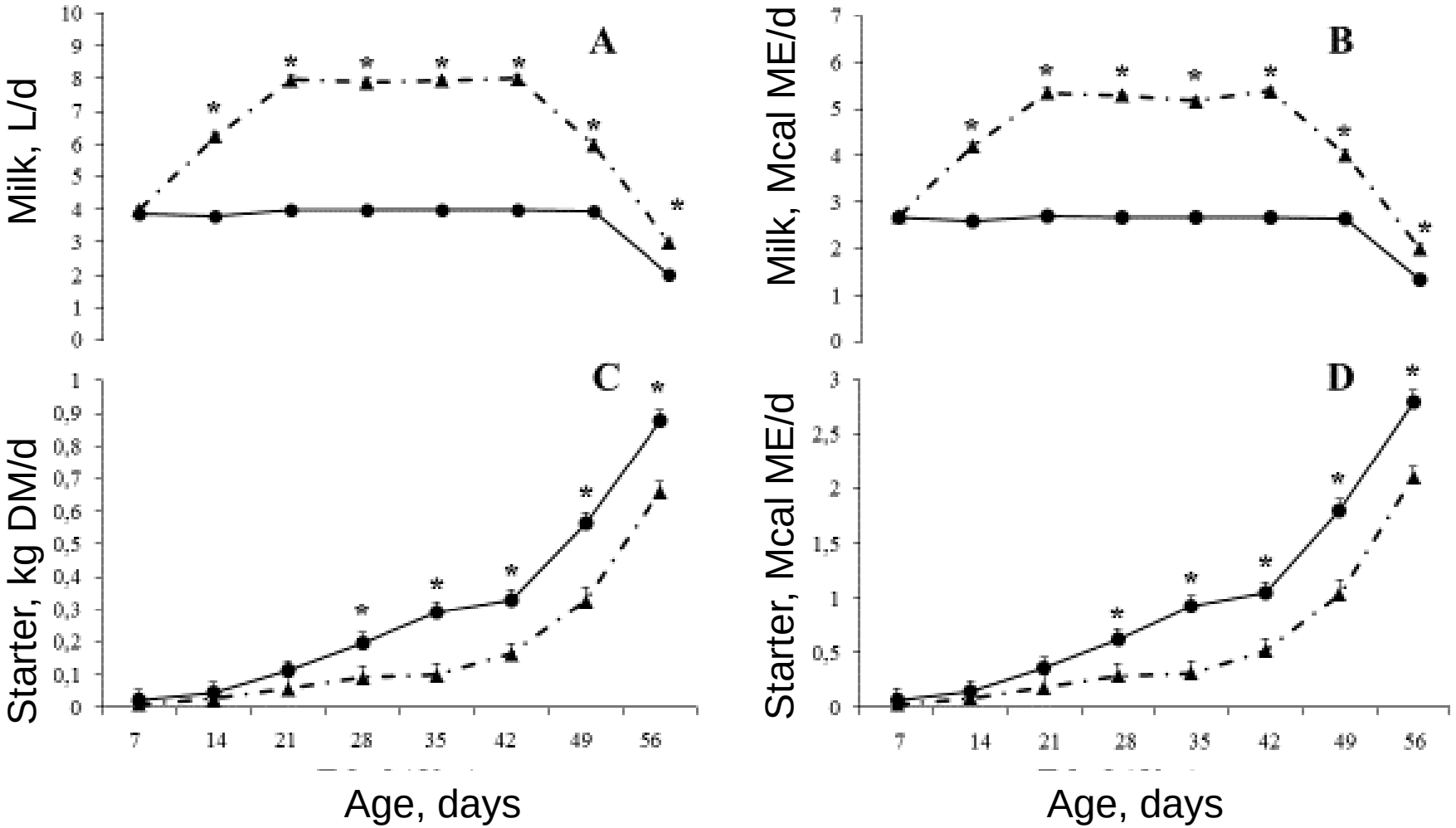


Conclusions

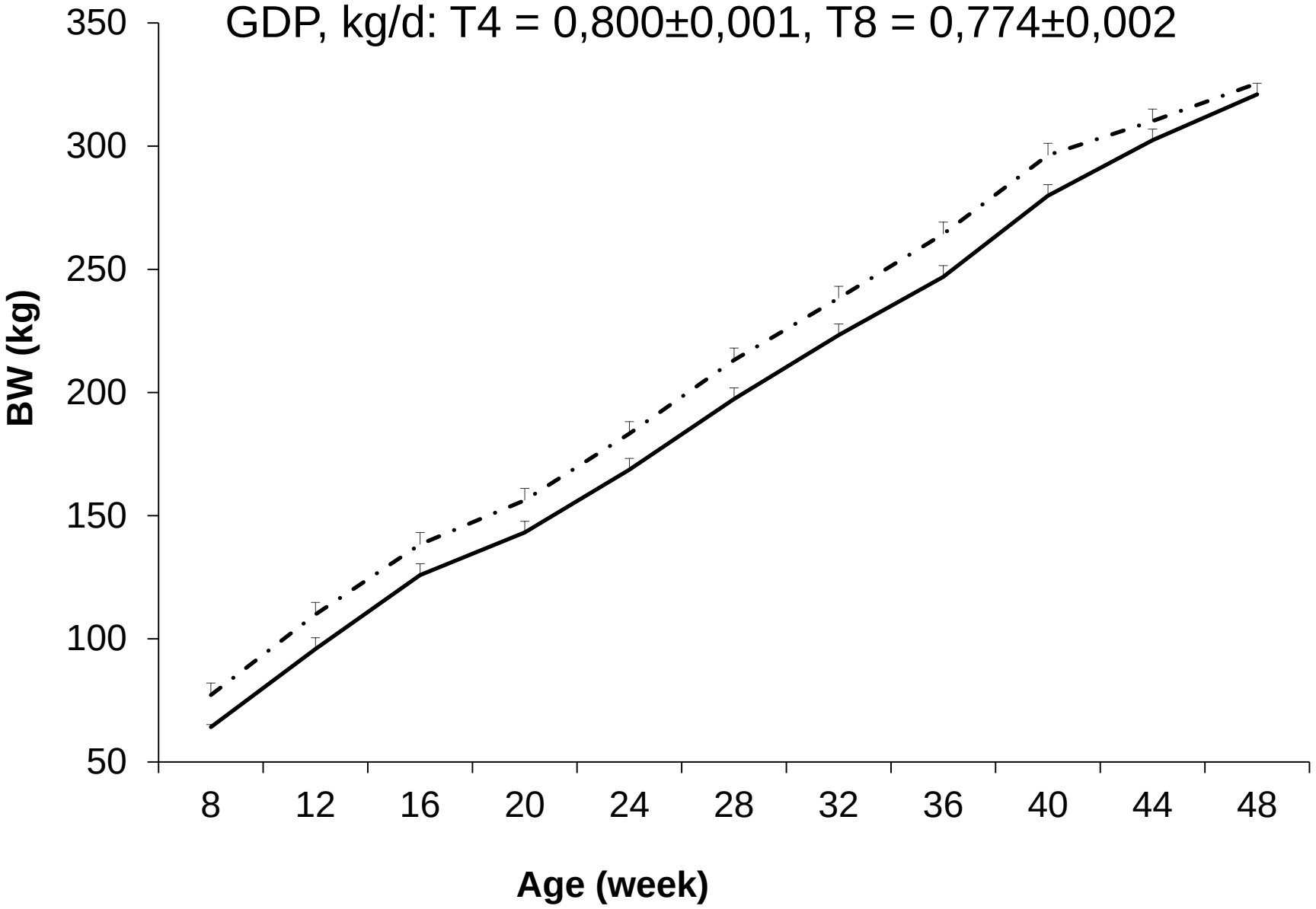
A higher plane of nutrition during the preweaning phase increased the concentrations of IGF-I and reduced the age and body size at puberty in dairy calves

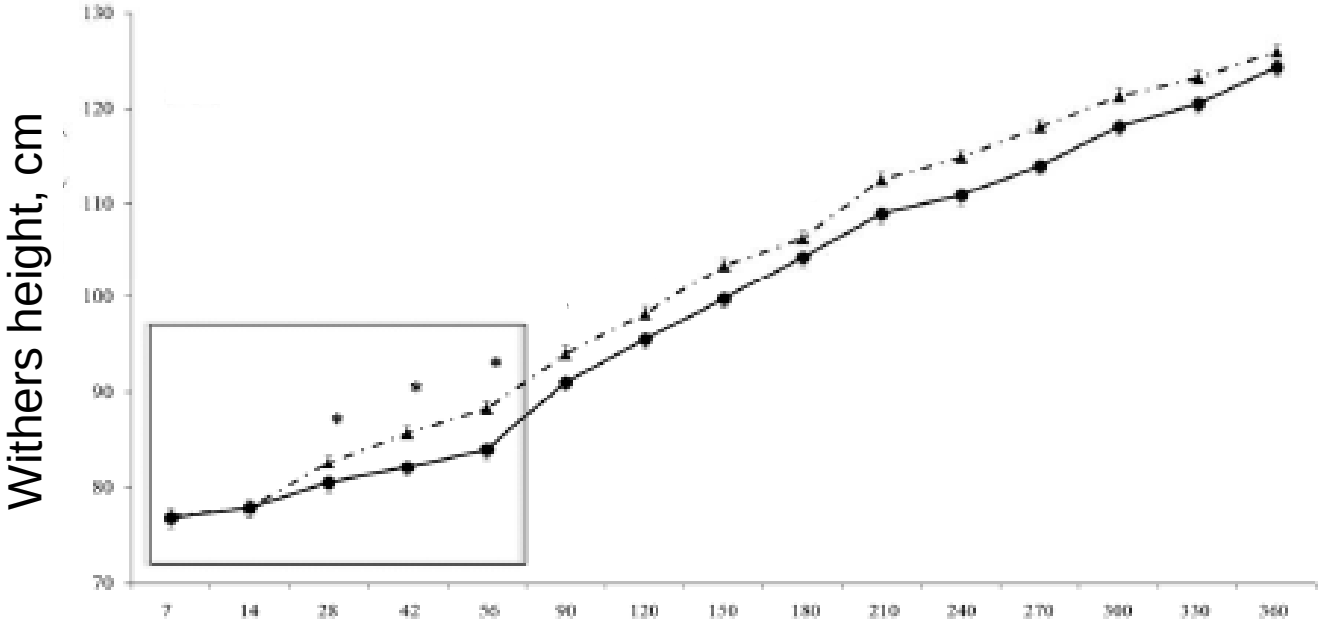
Thank you for your attention!

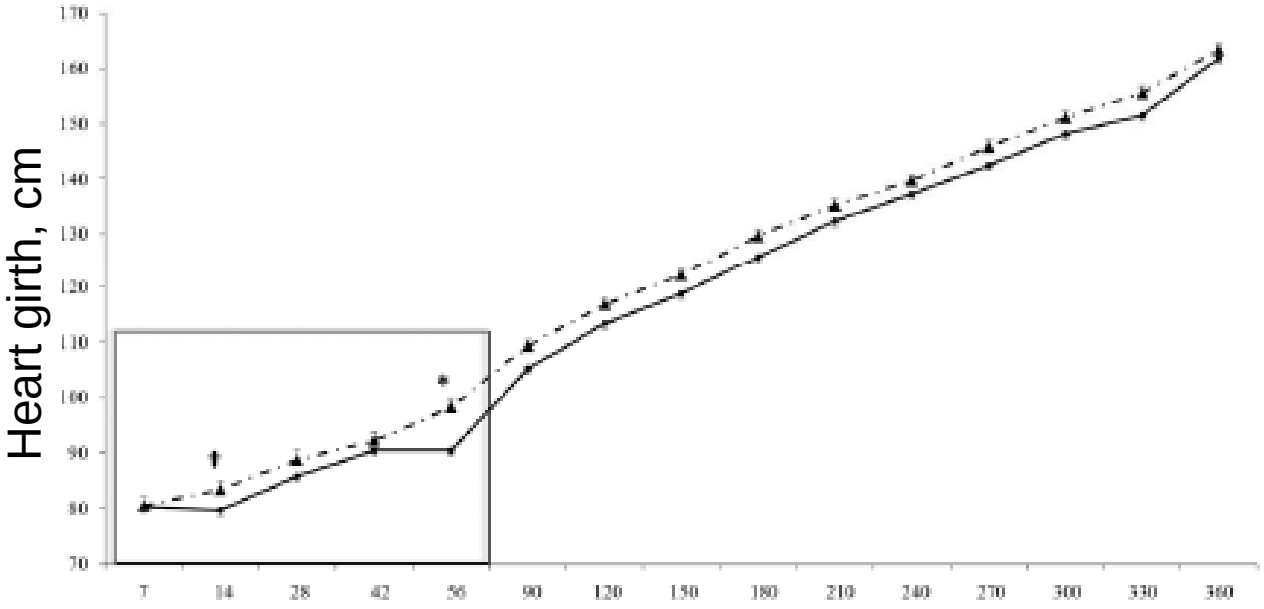
amendoza@inia.org.uy

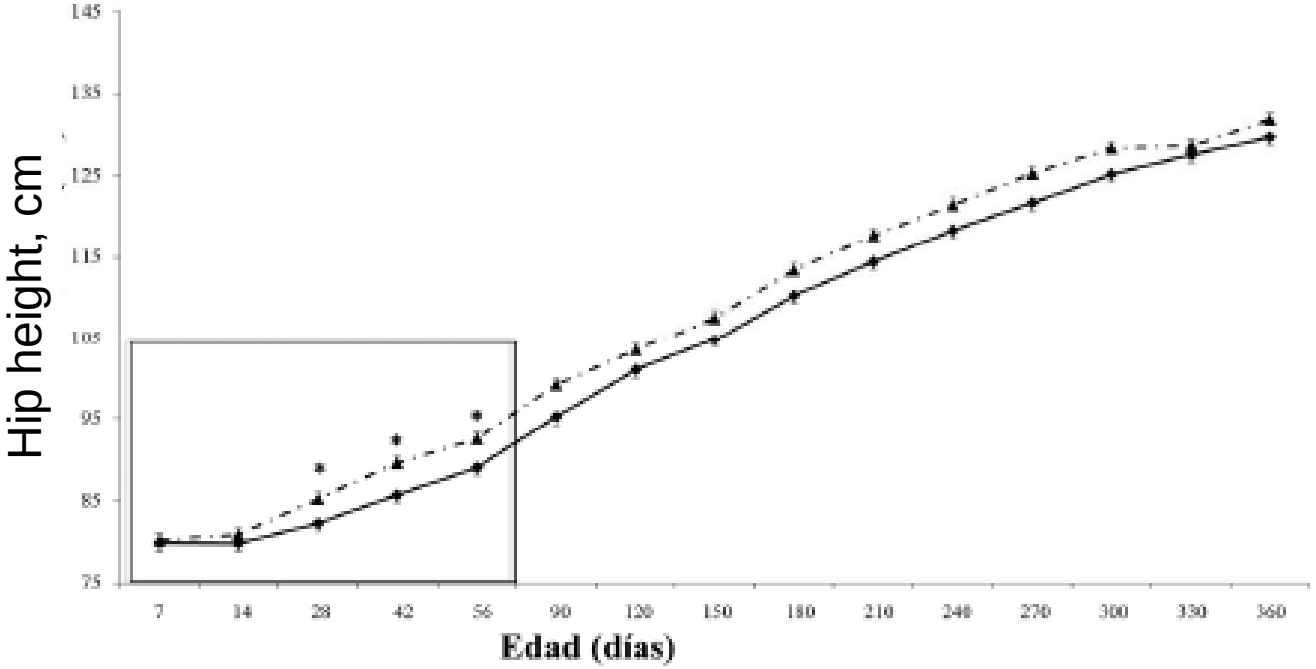

A
B
C
D
Milk, L/d
Milk, Mcal ME/d
Starter, kg DM/d
Starter, Mcal ME/d
Age, days
Age, days

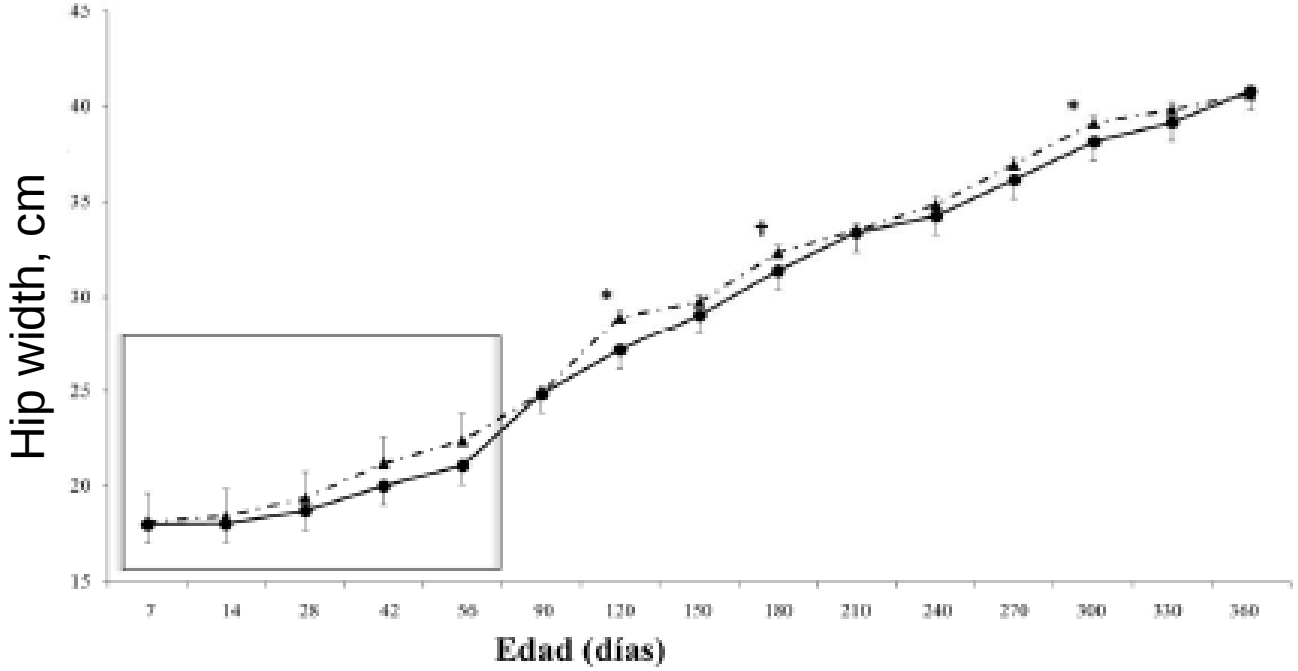
Parámetros	Promedio		EEM	P		
	T4	T8		trat	días	trat*dias
EM Total/d (Mcal)	3,56	5,12	0,06	<0,0001	<0,0001	<0,0001
EM Leche/EM Total	0,73	0,86	0,01	<0,0001	<0,0001	0,0002


GDP, kg/d: T4 = 0,800±0,001, T8 = 0,774±0,002
BW (kg)
350
300
250
200
150
100
50
8
12
16
20
24
28
32
36
40
44
48
Age (week)


Withers height, cm
130
120
110
100
90
80
70
7
14
28
42
56
90
120
150
180
210
240
270
300
330
360


Heart girth, cm
170
160
150
140
130
120
110
100
90
80
70
7
14
28
42
56
90
120
150
180
210
240
270
300
330
360

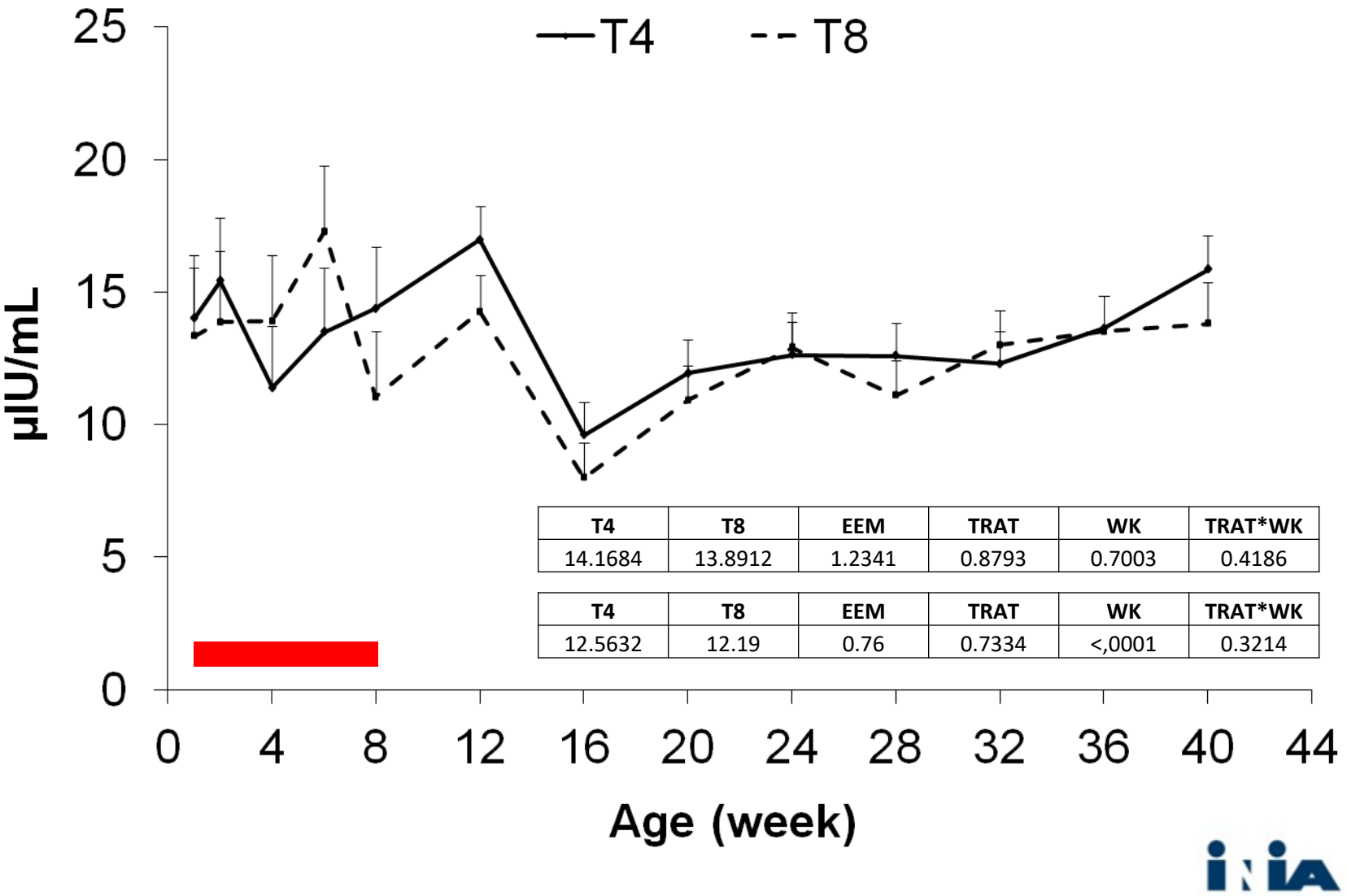

Hip height, cm
145
135
125
115
105
95
85
75
7
14
28
42
56
90
120
150
180
210
240
270
300
330
360
Edad (días)


Hip width, cm
40
35
30
25
20
15
7
14
28
42
56
90
120
150
180
210
240
270
300
330
360
Edad (días)

Residual period

	4 L	8 L	SEM	treat	wk	treat*wk
BW, kg	210.5	223.6	3.8	0.0216	<0.0001	0.4492
Heart girth, cm	133.71	136.92	0.7908	0.0075	<0.0001	0.2846
Withers height, cm	108.74	111.8	0.417	<0.0001	<0.0001	0.5542
Hip height, cm	114.79	117.6	0.466	0.0002	<0.0001	0.4824
Hip width, cm	33.42	34.07	0.1759	0.0142	<0.0001	0.0192

Insulin concentrations



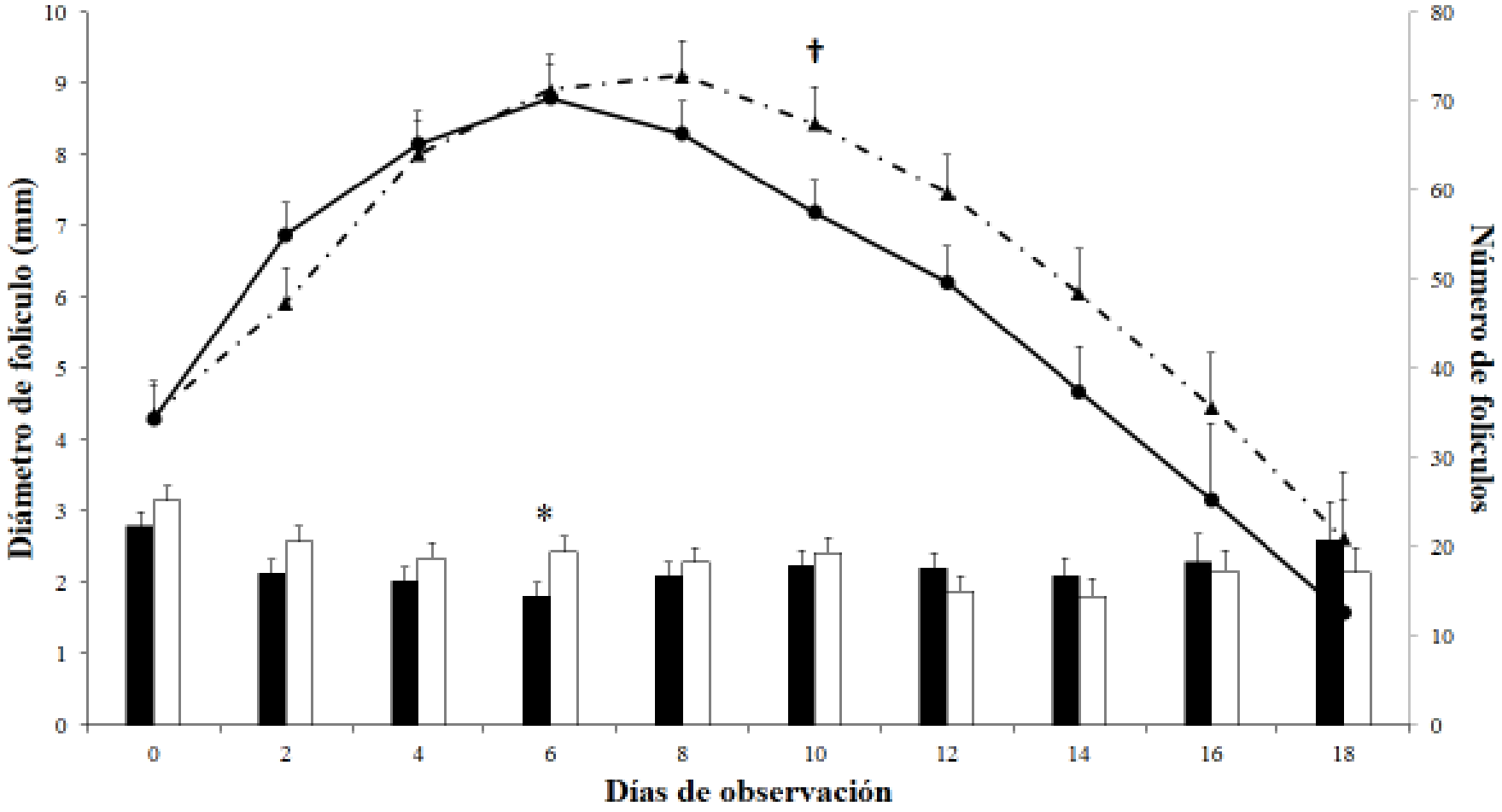
T4	T8	EEM	TRAT	WK	TRAT*WK
14.1684	13.8912	1.2341	0.8793	0.7003	0.4186

T4	T8	EEM	TRAT	WK	TRAT*WK
12.5632	12.19	0.76	0.7334	<,0001	0.3214

IGF-I

T4	T8	SEM	Treat	Wk	Treatxwk
75.54	146.26	11.63	<,0001	<,0001	<,0001

T4	T8	SEM	Treat	Wk	Treatxwk
160.96	198.82	11.63	0.023	<,0001	<,01

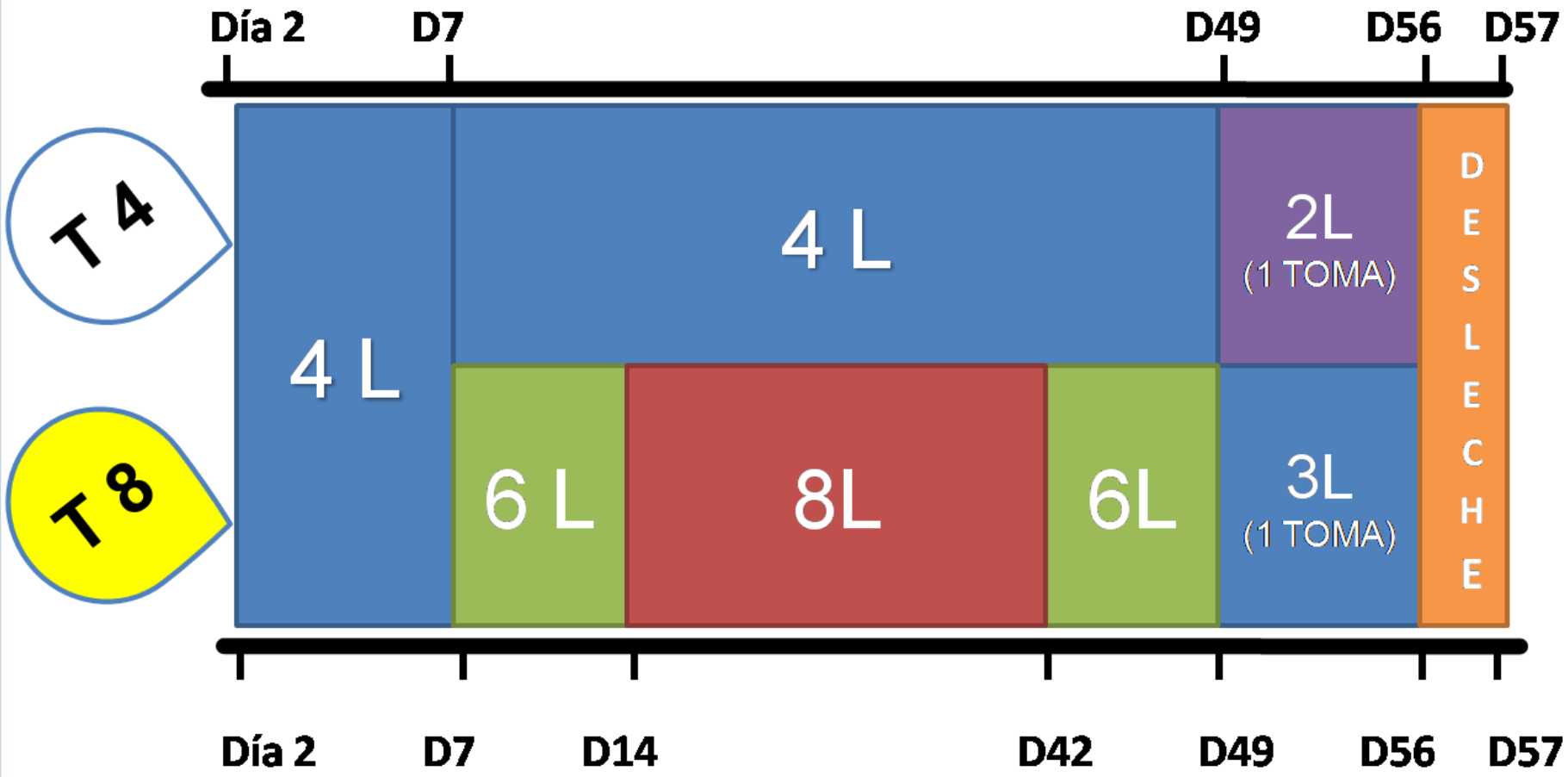

Diámetro de folículo (mm)
Número de folículos
Días de observación
†
*
0
2
4
6
8
10
12
14
16
18
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60
70
80

Tests de tipo 3 de efec tos fijos

Efecto	Num DF	Den DF	F Value	Pr > F
TRATAMIENTO	1	158	1.35	0.2475
DIASEM	9	158	7.51	<.0001
TRATAMIENTO*DIAS	9	158	1.98	0.0454

Med ias de mín imos cua drados

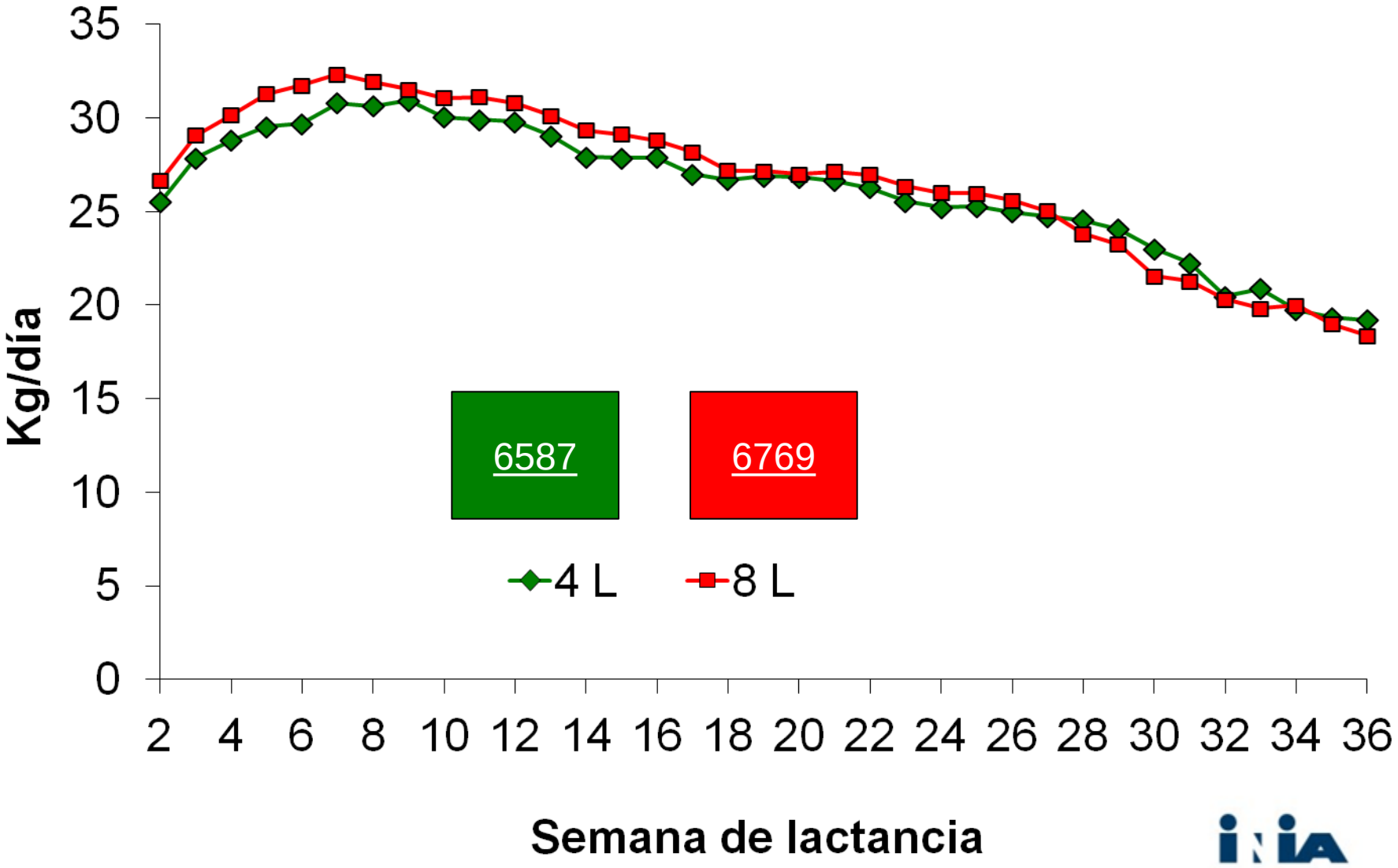
Efecto	TRATAMIENTO	DIA	SEM	E	stimador	Error estándar
TRATAMIENTO	1				5.9421	0.5073
TRATAMIENTO	2				6.7122	0.4277



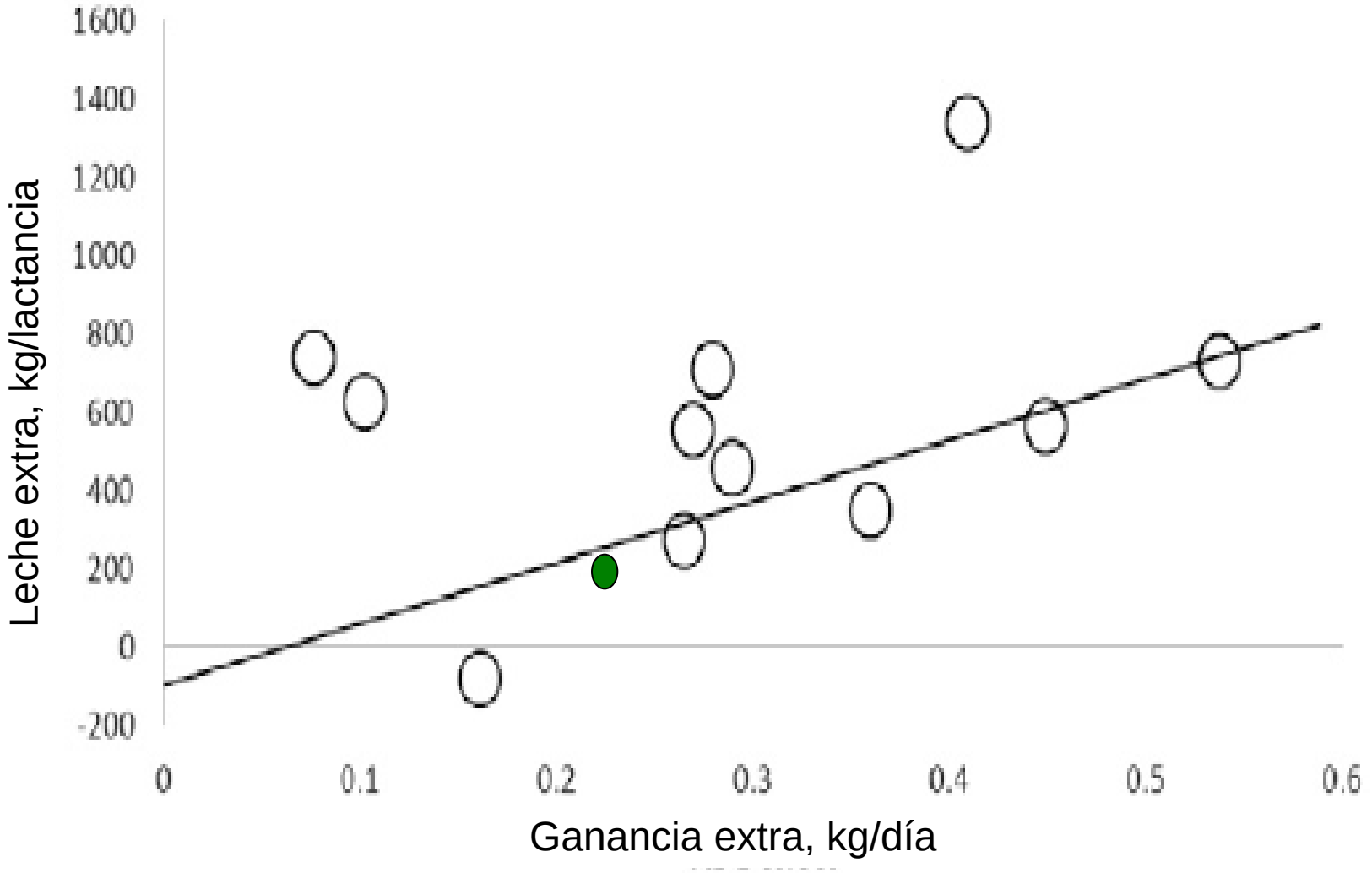
❖ A partir del 4° día de vida se les ofreció un concentrado iniciador.

❖ Agua a voluntad (2 h después de la oferta de leche)

Nivel de alimentación en la crianza

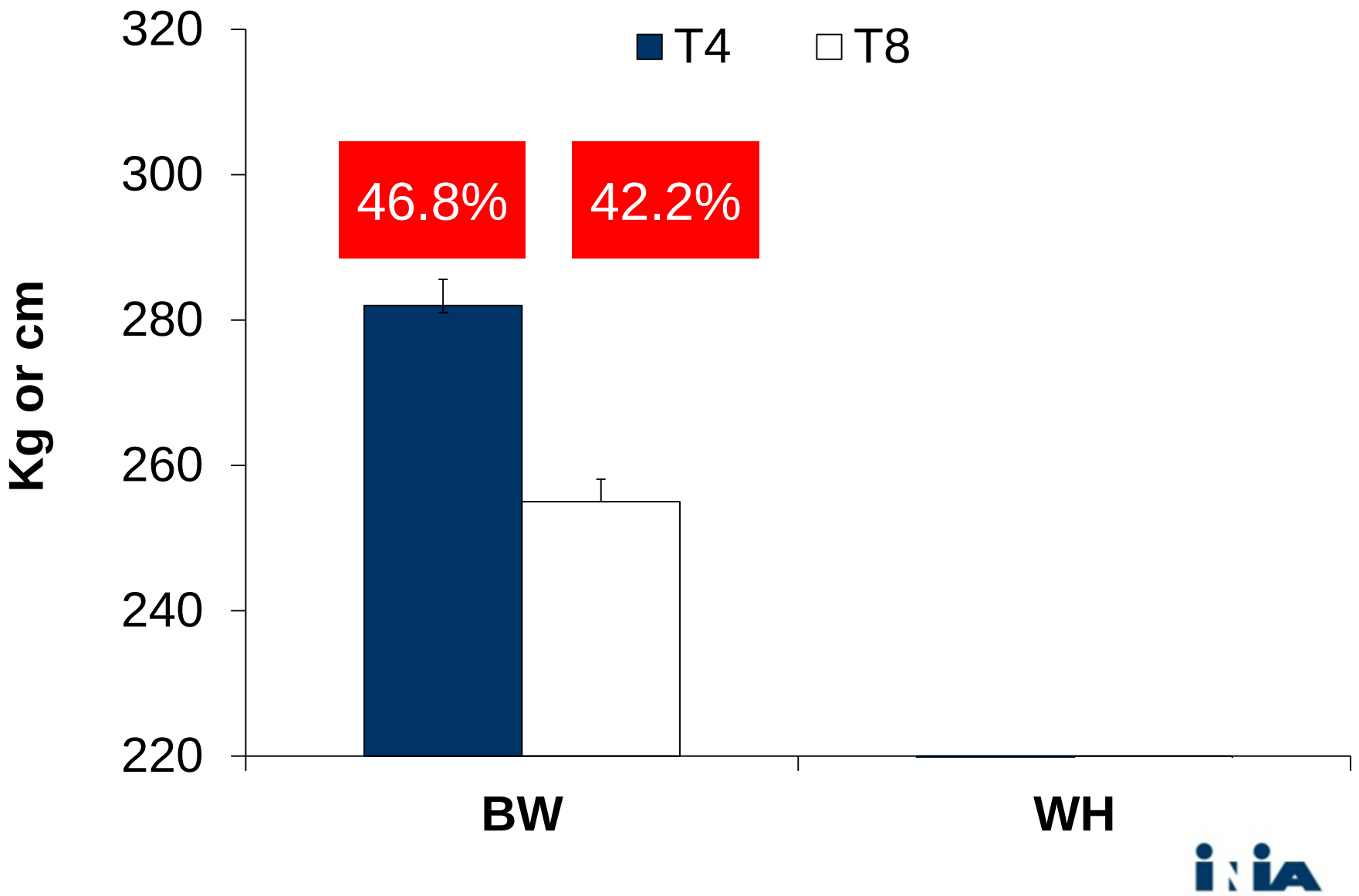


Nivel de alimentación en la crianza



Soberon y Van Amburgh, 2013

Puberty



Hormone assay quality

- IGF-1:
  - Sensitivity: 0.32 ng/mL
  - CV intra: low (38 ng/mL) and high (659 ng/mL) = 7.3 & 10.5%
  - CV inter: low = 17.3 & 14.1%
- Insulin
  - Sensitivity: 2,9 uUI/mL
  - CV intra: low (17.1 uUI/mL) and high (94.2 uUI/mL) = 9.1 & 5.1%
  - CV inter: low = 10.3 & 5.5%