

Study 3 Appendix: An assessment of responsiveness of calves on the index farm, with known trace element deficiencies to selenium supplementation, May 2007 to April 2008

1. Weights and average daily gains, kgs.

Table 1.1. The mean±SEM (range) live weight (kgs) at selected time points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Live weight (kgs)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	64.91±5.43 (52, 92)	62.90±5.0 (42, 90)	61.45±5.76 (39, 96)	63.89±5.79 (37, 93)
Turn out to pasture	29/05/07	27	79.27±5.43 (54, 105)	78.70±5.0 (57, 99)	74.18±6.69 (40, 107)	74.0±6.62 (42, 107)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	86.73±6.0 (60, 114)	85.60±5.52 (61, 113)	80.27±7.20 (43, 113)	81.89±7.66 (52, 121)
Mid grazing	20/08/07	110	114.30±9.22 (66, 159)	155.5±6.90 (80, 162)	102.91±8.63 (62, 138)	107.67±10.64 (71, 157)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	142.8±13.33 (75, 198)	148.0±8.32 (96, 199)	134.0±12.58 (67, 194)	171.0±14.21 (111, 243)
Winter housing	30/10/07	181	157.1±14.51 (84, 215)	163.1±8.60 (107, 213)	147.18±13.40 (74, 206)	177.56±13.85 (119, 247)
Mid winter housing	06/02/08	280	203.38±17.22 (147, 275)	199.9±10.61 (138, 262)	186.18±16.22 (89, 263)	207.11±17.71 (143, 292)
End date	29/04/08	363	266.88±25.08 (175, 367)	260.8±13.15 (191, 341)	241.27±20.91 (118, 346)	264.44±22.62 (184, 377)

Table 1.2. The mean±SEM (range) of the average daily gains (ADG, kgs) for each period ending for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

ADG (kgs)			Treatment group			
	Period of interest	Period ending	Days	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3 Vital</i>
Start to turn out to pasture	29/05/07	0-27	0.53±0.08 (0.07, 1.04)	0.58±0.06 (0.33, 0.86)	0.47±0.07 (0.04, 0.79)	0.37±0.05 (0.19, 0.56)
<i>Tx4OffFC</i> leave index farm	12/06/07	27-41	0.53±0.08 (0.21, 1.0)	0.49±0.08 (0.14, 1.0)	0.44±0.07 (0.14, 0.93)	0.56±0.12 (0.0, 1.07)
<i>Tx4</i> leave to mid grazing	20/08/07	41-110	0.38±0.05 (-0.09, 0.70)	0.43±0.05 (0.2, 0.71)	0.33±0.04 (0.04, 0.55)	0.37±0.06 (0.07, 0.62)
<i>Tx4OffFC</i> return to index farm	16/10/07	110-167	0.50±0.08 (0.16, 0.86)	0.56±0.05 (0.28, 0.69)	0.54±0.08 (0.08, 1.03)	1.11±0.08 (0.70, 1.51)
<i>Tx4</i> return to housing	30/10/07	167-181	1.02±0.10 (0.57, 1.50)	1.07±0.07 (0.79, 1.36)	0.94±0.09 (0.50, 1.64)	0.47±0.06 (0.29, 0.79)
Calf turn out to housing	30/10/07	27-181	0.50±0.06 (0.19, 0.78)	0.55±0.04 (0.29, 0.75)	0.47±0.05 (0.14, 0.70)	0.67±0.06 (0.42, 0.96)
Mid winter housing	06/02/08	181-280	0.41±0.05 (0.19, 0.61)	0.37±0.04 (0.13, 0.49)	0.39±0.04 (0.15, 0.58)	0.31±0.05 (0.11, 0.52)
End	29/04/08	280-363	0.77±0.10 (0.34, 1.11)	0.73±0.04 (0.60, 0.95)	0.66±0.07 (0.35, 1.0)	0.69±0.06 (0.48, 1.02)
Start to end	29/04/08	0-363	0.55±0.05 (0.36, 0.76)	0.55±0.03 (0.4, 0.69)	0.50±0.06 (0.22, 0.72)	0.55±0.05 (0.39, 0.81)

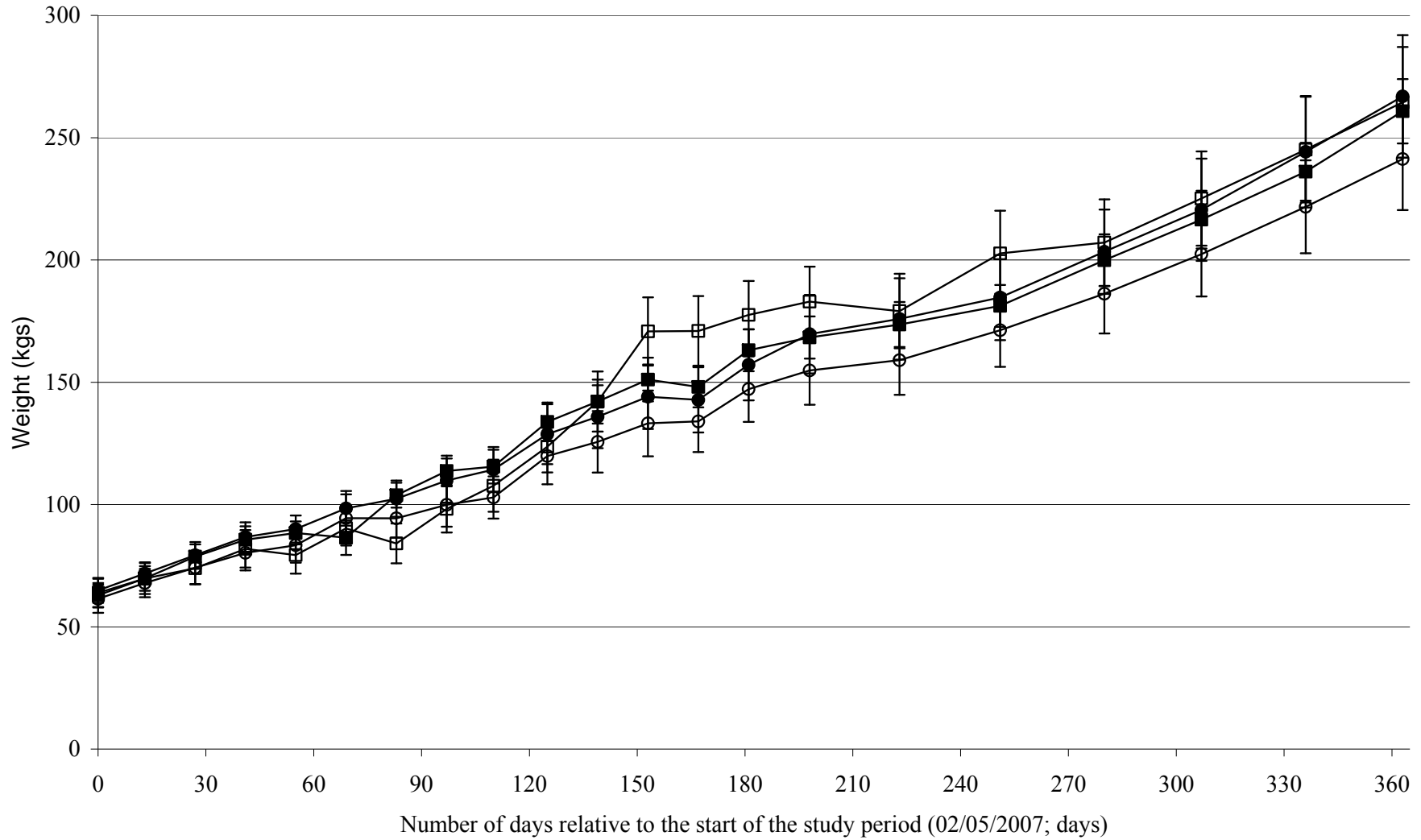


Figure 1.1: Mean±SEM weight (kgs) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vital* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

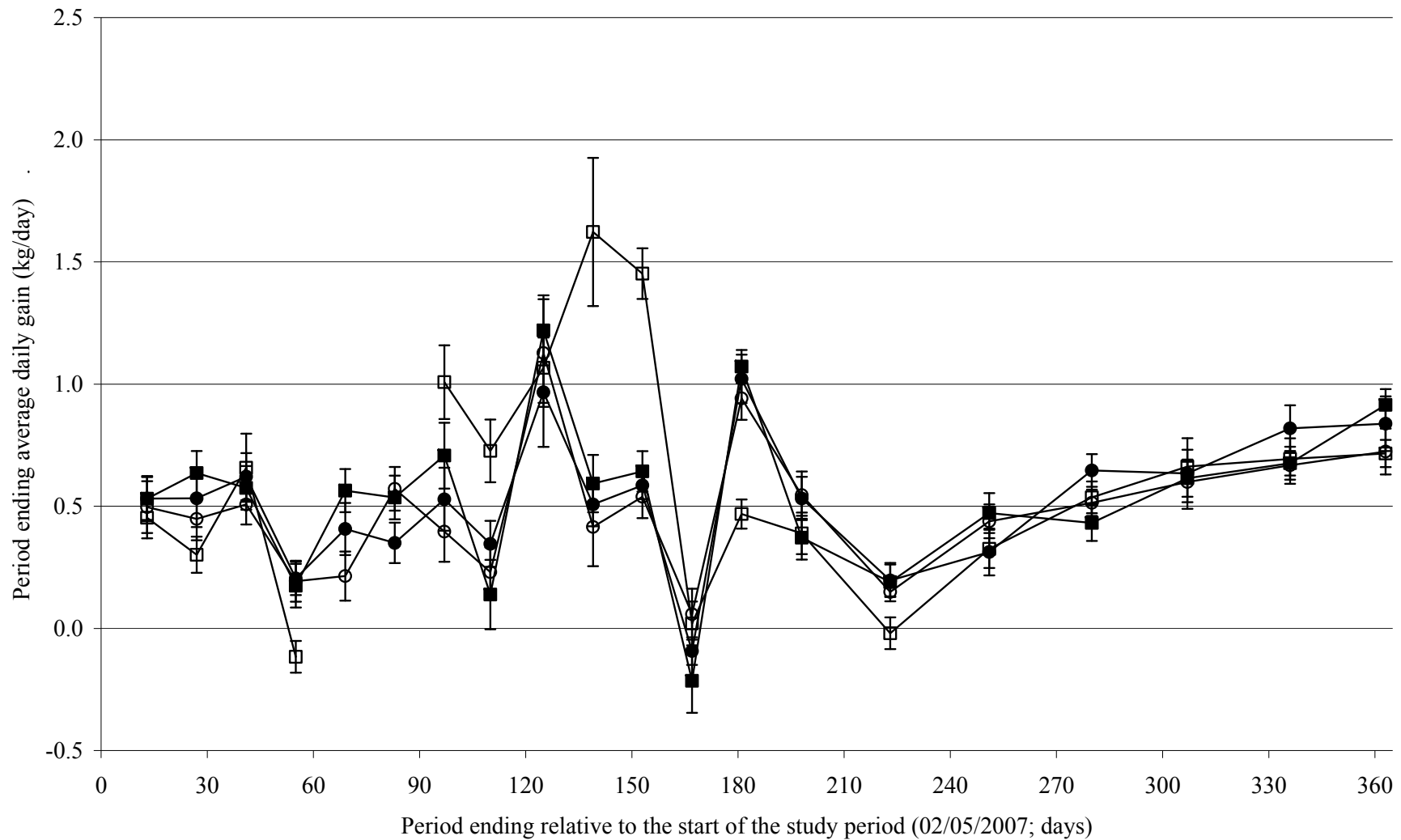


Figure 1.2: Mean±SEM average daily gain (ADG, kgs) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

2. Haematology

Table 2.1: The mean±SEM (range) of white blood cells ($\times 10^9/l$) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

White blood cells ($\times 10^9/l$)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	7.84±0.84 (3.47, 11)	8.09±0.74 (5.61, 12.70)	7.36±0.54 (5.13, 10.60)	10.04±1.39 (4.50, 18.40)
Turn out to pasture	29/05/07	27	6.04±0.43 (3.76, 8.06)	7.15±0.61 (4.01, 9.63)	6.0±0.43 (4.06, 8.60)	9.48±1.32 (4.94, 17.0)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	7.83±0.64 (4.43, 11.4)	7.54±0.56 (4.41, 9.10)	8.88±0.82 (4.46, 13.0)	10.30±0.89 (6.31, 13.80)
Mid grazing	20/08/07	110	9.47±0.86 (5.57, 14.40)	9.46±0.95 (4.22, 13.20)	8.67±0.52 (6.37, 10.90)	9.43±0.95 (6.17, 13.89)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	9.70±0.69 (7.01, 13.90)	8.62±0.77 (4.55, 13.0)	7.64±0.63, 4.77, 11.0)	9.67±1.03 (6.39, 14.90)
Winter housing	30/10/07	181	9.16±0.70 (5.2, 12.5)	8.10±0.68 (4.71, 11.20)	8.71±0.61 (5.86, 12.50)	9.14±0.73 (6.44, 13.0)
Mid winter housing	06/02/08	280	7.40±0.87 (4.28, 11.2)	5.87±0.56 (2.75, 8.40)	6.66±0.53 (4.26, 9.67)	6.40±0.6 (3.58, 8.73)
End date	29/04/08	363	9.74±0.70 (6.88, 13.40)	8.84±0.84 (5.24, 14.90)	8.24±0.40 (5.94, 10.70)	8.85±0.73 (5.64, 10.90)

Table 2.2: The mean±SEM (range) of lymphocytes (%) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Lymphocytes (%)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	35.36±3.41 (22.6, 55.5)	34.93±3.21 (21.1, 50)	42.6±5.36 (17.8, 64.7)	34.30±4.26 (15.3, 61.1)
Turn out to pasture	29/05/07	27	42.24±1.53 (33.5, 51.4)	41.98±2.45 (29.2, 57.1)	45.47±4.09 (28.2, 72.0)	44.23±5.35 (26.8, 72.5)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	54.78±5.74 (28.6, 83.4)	54.02±6.62 (29.7, 88.5)	43.87±4.20 (25.9, 78.3)	41.2±4.67 (19.8, 67.1)
Mid grazing	20/08/07	110	46.80±3.62 (26.4, 65.0)	46.03±4.07 (28.8, 66.7)	45.93±3.25 (34, 68.6)	43.9±6.19 (29.3, 78.2)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	43.31±3.08 (32.2, 64.0)	39.64±2.55 (25.8, 58.0)	45.41±3.34 (27.1, 65.1)	41.78±2.36 (31.0, 51.5)
Winter housing	30/10/07	181	41.43±3.20 (24.7, 63)	49.17±5.90 (29.0, 81.3)	43.51±4.30 (29.5, 72.9)	48.48±2.53 (37.9, 59.7)
Mid winter housing	06/02/08	280	54.79±3.68 (43.0, 70.0)	60.9±3.59 (42.6, 72.6)	57.19±2.72 (44.1, 76.8)	59.19±3.50 (44.3, 76.4)
End date	29/04/08	363	60.13±3.62 (45.0, 73.0)	61.4±3.79 (40.0, 77.0)	59.82±2.82 (47.0, 79.0)	55.33±3.97 (41.0, 69.0)

Table 2.3. The mean±SEM (range) of monocytes (%) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Monocytes (%)				Treatment group			
Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>	
Start date	02/05/07	0	20.54±2.6 (11.6, 38)	16.11±1.57 (10.5, 24.8)	12.78±1.79 (3.69, 22.0)	16.36±1.48 (9.72, 23.9)	
Turn out to pasture	29/05/07	27	25.72±2.79 (12.0, 42.0)	18.22±1.86 (11.4, 32.1)	18.95±2.47 (11.9, 39.0)	17.17±1.64 (10.4, 26.8)	
<i>Tx4OffFC</i> leave index farm	12/06/07	41	14.21±2.41 (5.26, 32.0)	12.62±1.99 (2.62, 23.4)	16.75±2.35 (10.0, 37.6)	14.5±1.31 (9.94, 21.2)	
Mid grazing	20/08/07	110	20.57±3.28 (9.43, 43.3)	20.43±3.02 (7.85, 33.9)	20.9±2.01 (11.7, 28.6)	18.37±2.44 (9.29, 29.40)	
<i>Tx4OffFC</i> return to index farm	16/10/07	167	11.65±1.54 (7.5, 23.5)	10.33±2.02 (5.14, 28.1)	11.98±1.33 (7.59, 20.8)	11.25±0.66 (8.26, 13.9)	
Winter housing	30/10/07	181	14.20±1.84 (6.9, 27.2)	11.87±0.91 (7.98, 17.9)	15.6±2.27 (6.17, 30.9)	13.08±1.36 (9.05, 22.5)	
Mid winter housing	06/02/08	280	13.58±1.71 (7.35, 21.9)	11.67±0.95 (8.27, 17.60)	12.57±0.59 (9.29, 15.0)	11.99±0.88 (7.97, 16.9)	
End date	29/04/08	363	2.57±0.37 (1.0, 4.0)	3.38±0.78 (1.0, 7.0)	3.09±0.73 (1.0, 9.0)	2.63±0.65 (1.0, 6.0)	

Table 2.4. The mean±SEM (range) of eosinophils (%) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Eosinophils (%)				Treatment group			
Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>	
Start date	02/05/07	0	1.33±0.65 (0.0, 5.72)	0.44±0.23 (0.0, 2.15)	0.09±0.05 (0.0, 0.53)	0.09±0.03 (0.0, 0.29)	
Turn out to pasture	29/05/07	27	0.67±0.28 (0.02, 2.51)	0.3±0.14 (0.02, 1.19)	0.55±0.22 (0.02, 2.31)	0.33±0.14 (0.03, 1.16)	
<i>Tx4OffFC</i> leave index farm	12/06/07	41	0.39±0.12 (0.0, 1.22)	0.74±0.4 (0.06, 4.14)	0.84±0.27 (0.18, 2.71)	0.3±0.17 (0.0, 1.42)	
Mid grazing	20/08/07	110	0.99±0.42 (0.02, 4.08)	0.52±0.21 (0.02, 2.19)	0.71±0.26 (0.02, 2.75)	0.43±0.2 (0.09, 1.75)	
<i>Tx4OffFC</i> return to index farm	16/10/07	167	4.85±1.37 (0.02, 13.0)	5.21±1.28 (0.02, 10.40)	6.49±1.46 (0.32, 15.7)	0.89±0.47 (0.0, 4.09)	
Winter housing	30/10/07	181	1.91±0.62 (0.03, 5.44)	1.54±0.6 (0.0, 4.52)	1.75±0.54 (0.1, 5.02)	1.22±0.56 (0.2, 4.66)	
Mid winter housing	06/02/08	280	1.49±0.8, (0.04, 6.58)	0.76±0.31 (0.06, 3.22)	20.9±0.83 (0.0, 9.49)	1.07±0.39 (0.0, 3.35)	
End date	29/04/08	363	4.29±1.15 (1.0, 10.0)	3.0±0.77 (1.0, 5.0)	2.5±0.6 (1.0, 6.0)	4.11±1.18 (1.0, 11.0)	

Table 2.5. The mean±SEM (range) of basophils (%) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Basophils (%)		Treatment group				
Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	0	1.64±0.29 (0.18, 3.09)	1.43±0.12 (0.57, 1.96)	1.09±0.15 (0.25, 1.79)	1.04±0.12 (0.3, 1.44)
Turn out to pasture	29/05/07	27	0.79±0.21 (0.0, 2.71)	0.46±0.12 (0.04, 1.17)	0.62±0.12 (0.0, 1.26)	0.57±0.06 (0.34, 0.87)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	1.15±0.17 (0.39, 1.94)	1.25±0.28 (0.18, 3.45)	1.29±0.17 (0.86, 2.82)	1.12±0.22 (0.54, 2.67)
Mid grazing	20/08/07	110	0.40±0.13 (0.0, 1.16)	0.57±0.16 (0.0, 1.37)	0.52±0.11 (0.03, 1.17)	1.33±0.19 (0.63, 2.10)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	1.25±0.29 (0.32, 3.31)	0.81±0.15 (0.11, 1.50)	1.06±0.24 (0.22, 2.88)	0.50±0.07 (0.27, 0.90)
Winter housing	30/10/07	181	1.23±0.21 (0.03, 2.04)	1.12±0.21 (0.13, 2.31)	1.25±0.14 (0.05, 1.91)	1.24±0.18 (0.66, 2.09)
Mid winter housing	06/02/08	280	1.30±0.22 (0.79, 2.73)	1.18±0.16 (0.66, 2.55)	1.41±0.13 (0.83, 2.12)	1.25±0.18 (0.66, 2.55)
End date	29/04/08	363				

Table 2.6. The mean±SEM (range) of neutrophils (%) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Neutrophils (%)		Treatment group				
Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	0	41.13±3.26 (25.66, 61.94)	47.09±3.46 (36.33, 67.83)	43.42±5.18 (23.08, 78.27)	48.21±3.48 (26.45, 59.96)
Turn out to pasture	29/05/07	27	30.58±3.27 (13.49, 51.14)	39.04±2.39 (28.07, 49.57)	34.41±3.32 (15.37, 54.34)	37.70±5.63 (10.24, 59.84)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	29.48±4.13 (8.16, 48.70)	31.37±4.89 (6.83, 50.45)	37.25±4.27 (10.31, 57.66)	42.88±4.15 (19.64, 61.22)
Mid grazing	20/08/07	110	31.24±2.83 (20.14, 44.47)	32.45±2.48 (19.84, 44.63)	32.75±2.61 (17.04, 50.43)	35.96±5.61 (2.81, 53.20)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	38.94±3.33 (17.9, 57.89)	44.02±2.51 (24.93, 54.08)	35.06±4.81 (5.0, 61.25)	45.58±2.69 (37.48, 56.6)
Winter housing	30/10/07	181	41.24±2.88 (27.46, 54.08)	36.30±5.32 (7.49, 57.09)	37.90±3.39 (20.48, 52.22)	35.98±2.94 (23.04, 46.15)
Mid winter housing	06/02/08	280	28.84±2.62 (19.25, 38.11)	25.49±2.77 (15.73, 42.11)	26.74±2.16 (11.44, 38.10)	26.51±2.91 (12.05, 39.46)
End date	29/04/08	363	33.88±3.18 (21.0, 47.0)	33.2±3.19 (22.0, 48.0)	38.82±2.72 (17.0, 50.0)	38.22±3.73 (22.0, 52.0)

Table 2.7 The mean±SEM (range) of red blood cells (RBC, $\times 10^{12}$) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Red blood cells ($\times 10^{12}$)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	9.41±0.26 (7.35, 10.3)	9.36±0.35 (7.98, 11.0)	9.13±0.45 (6.14, 11.3)	9.40±0.41 (7.43, 11.0)
Turn out to pasture	29/05/07	27	9.22±0.23 (8.19, 10.5)	9.5±0.32 (7.90, 11.1)	9.39±0.3 (7.73, 11.5)	9.98±0.53 (7.42, 12.5)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	9.19±0.19 (8.17, 9.99)	9.5±0.34 (8.14, 11.9)	9.61±0.31 (7.97, 11.6)	9.59±0.58 (6.81, 12.2)
Mid grazing	20/08/07	110	9.48±0.39 (8.23, 11.50)	9.37±0.23 (8.57, 10.8)	9.80±0.33 (8.33, 11.6)	8.86±0.35 (7.19, 10.5)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	7.80±0.34 (6.45, 9.37)	7.66±0.27 (6.3, 9.72)	7.66±0.28 (5.88, 9.17)	8.15±0.25 (7.16, 9.31)
Winter housing	30/10/07	181	8.88±0.44 (6.2, 11.5)	8.69±0.33 (6.08, 9.87)	8.96±0.29 (7.62, 11.1)	9.58±0.37 (7.22, 10.9)
Mid winter housing	06/02/08	280	8.17±0.26 (7.42, 9.22)	8.13±0.26 (6.46, 9.6)	8.39±0.26 (7.07, 9.78)	8.15±0.3 (6.74, 9.74)
End date	29/04/08	363	7.54±0.21 (6.85, 8.54)	7.73±0.2 (6.51, 8.77)	7.88±0.23 (6.6, 8.74)	7.65±0.22 (6.7, 8.88)

Table 2.8. The mean±SEM (range) pack cell volume (l/l) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Pack cell volume (l/l)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	0.3±0.01 (0.24, 0.36)	0.31±0.01 (0.26, 0.36)	0.3±0.01 (0.24, 0.34)	0.3±0.01 (0.26, 0.33)
Turn out to pasture	29/05/07	27	0.3±0.01 (0.26, 0.35)	0.31±0.01 (0.26, 0.35)	0.3±0.01 (0.27, 0.34)	0.32±0.01 (0.29, 0.36)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	0.3±0.01 (0.26, 0.34)	0.3±0.01 (0.24, 0.37)	0.3±0.01 (0.27, 0.35)	0.3±0.01 (0.24, 0.34)
Mid grazing	20/08/07	110	0.31±0.01 (0.26, 0.39)	0.31±0.01 (0.28, 0.35)	0.32±0.01 (0.25, 0.39)	0.31±0.01 (0.28, 0.33)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	0.27±0.01 (0.22, 0.32)	0.26±0.01 (0.23, 0.29)	0.26±0.01 (0.21, 0.31)	0.29±0.0 (0.27, 0.3)
Winter housing	30/10/07	181	0.31±0.01 (0.25, 0.38)	0.31±0.01 (0.25, 0.35)	0.31±0.01 (0.28, 0.37)	0.34±0.01 (0.28, 0.39)
Mid winter housing	06/02/08	280	0.29±0.01 (0.27, 0.31)	0.29±0.01 (0.26, 0.32)	0.3±0.01 (0.26, 0.32)	0.29±0.01 (0.25, 0.32)
End date	29/04/08	363	0.3±0.0 (0.29, 0.33)	0.31±0.01 (0.26, 0.33)	0.31±0.01 (0.27, 0.36)	0.3±0.01 (0.28, 0.34)

Table 2.9. The mean±SEM (range) hemoglobin (g/dl) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Hemoglobin (g/dl)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	10.36±0.37 (8.03, 12.3)	10.4±0.44 (8.2, 12.0)	10.23±0.33 (8.1, 12.0)	10.26±0.27 (8.75, 11.3)
Turn out to pasture	29/05/07	27	10.05±0.3 (8.71, 11.6)	10.44±0.34 (8.74, 12.0)	10.27±0.23 (9.06, 12.0)	10.64±0.45 (8.26, 12.6)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	10.8±0.31 (8.6, 11.5)	10.37±0.39 (8.32, 12.7)	10.41±0.27 (9.27, 12.4)	10.27±0.51 (7.82, 12.1)
Mid grazing	20/08/07	110	10.89±0.57 (8.85, 13.8)	10.74±0.29 (9.41, 11.9)	11.19±0.4 (8.64, 13.5)	10.61±0.25 (9.08, 11.7)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	9.8±0.4 (8.11, 11.8)	9.65±0.24 (8.39, 10.9)	9.59±0.38 (7.27, 11.6)	10.6±0.16 (9.87, 11.1)
Winter housing	30/10/07	181	10.52±0.43 (8.18, 13.0)	10.43±0.35 (7.93, 11.6)	10.66±0.31 (9.29, 12.9)	11.53±0.37 (9.43, 13.4)
Mid winter housing	06/02/08	280	9.8±0.18 (9.01, 10.60)	9.88±0.22 (8.51, 10.7)	9.99±0.26 (8.71, 10.9)	10.91±0.29 (10, 12.3)
End date	29/04/08	363	10.74±0.21 (9.22, 12.0)	10.91±0.2 (9.45, 11.6)	11.02±0.37 (9.56, 13.0)	10.91±0.29 (10, 12.3)

Table 2.10. The mean±SEM (range) mean cell volume (fl) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Mean cell volume (fl)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	32.5±0.69 (29.4, 36.4)	33.37±0.88 (30.4, 39.1)	33.45±1.58 (28.9, 47.6)	32.78±1.37 (26.3, 39.6)
Turn out to pasture	29/05/07	27	32.3±0.56 (29.8, 35.4)	32.21±0.6 (29.9, 36.3)	32.2±0.78 (28.7, 37.2)	31.43±1.19 (25.8, 33.7)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	32.48±0.45 (30.2, 34.3)	32.11±0.63 (29.3, 35.8)	32.77±0.83 (28.9, 38.8)	31.84±1.31 (25.6, 37.1)
Mid grazing	20/08/07	110	32.79±0.4 (30.8, 33.9)	33.0±0.69 (28.7, 36.1)	32.21±0.59 (29.3, 34.6)	35.07±1.36 (29.6, 40.2)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	34.15±0.42 (32.5, 36.8)	34.48±0.65 (31.5, 37.3)	33.68±0.35 (31.7, 35.1)	35.29±1.04 (31.6, 38.6)
Winter housing	30/10/07	181	35.31±0.65 (33.1, 39.8)	35.98±0.77 (32.6, 40.9)	35.18±0.46 (32.7, 38.4)	35.61±1.07 (31.7, 39.4)
Mid winter housing	06/02/08	280	35.91±0.76 (34.0, 39.9)	36.28±0.82 (32.4, 40.1)	35.32±0.64 (32.5, 39.4)	35.64±1.12 (30.6, 39.3)
End date	29/04/08	363	40.1±0.68 (38.3, 43.5)	39.51±0.69 (35.7, 41.7)	39.23±0.6 (35.7, 41.8)	40.01±1.12 (35.4, 43.7)

Table 2.11. The mean±SEM (range) mean cell hemoglobin (MCH, pg) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Mean cell hemoglobin (pg)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	10.98±0.2 (9.72, 12.1)	11.1±0.27 (9.98, 12.6)	11.34±0.36 (10.1, 14.6)	11.01±0.35 (9.48, 12.4)
Turn out to pasture	29/05/07	27	10.89±0.16 (9.93, 11.7)	11.0±0.18 (10.5, 12.2)	10.95±0.16 (10.1, 11.7)	10.73±0.31 (9.45, 12.1)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	10.96±0.15 (10.0, 11.6)	10.91±0.17 (10.1, 11.9)	10.85±0.16 (10.0, 11.8)	10.81±0.41 (9.32, 12.6)
Mid grazing	20/08/07	110	11.46±0.17 (10.7, 12.0)	11.47±0.2 (10.4, 12.2)	11.43±0.24 (10.4, 12.9)	12.1±0.46 (10.4, 13.6)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	12.59±0.17 (11.9, 13.5)	12.71±0.17 (11.9, 13.4)	12.5±0.17 (11.3, 13.0)	13.09±0.4 (11.4, 14.7)
Winter housing	30/10/07	181	11.91±0.2 (11.3, 13.2)	12.04±0.2 (10.9, 13.0)	11.92±0.13 (11.3, 12.5)	12.1±0.36 (10.8, 13.6)
Mid winter housing	06/02/08	280	12.05±0.26 (11.2, 13.3)	12.22±0.24 (11.0, 13.2)	11.95±0.23 (11.1, 13.4)	11.98±0.35 (10.1, 13.1)
End date	29/04/08	363	14.25±0.24 (13.3, 15.6)	14.14±0.22 (12.9, 14.9)	13.99±0.22 (12.9, 15.0)	14.32±0.4 (12.6, 15.8)

Table 2.12. The mean±SEM (range) mean cell hemoglobin (MCHC, g/dl) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Mean cell hemoglobin (g/dl)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	33.83±0.38 (31.8, 35.2)	33.32±0.37 (30.9, 34.5)	34.20±0.52 (30.7, 36.8)	33.71±0.54 (30.8, 26.0)
Turn out to pasture	29/05/07	27	33.77±0.26 (31.6, 34.7)	34.2±0.2 (33.4, 35.3)	34.15±0.46 (31.5, 36.0)	34.33±0.64 (31.3, 37.0)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	33.75±0.21 (32.2, 34.7)	34.02±0.2 (33.2, 34.9)	34.16±0.44 (31.9, 37.2)	34.04±0.84 (31.0, 39.0)
Mid grazing	20/08/07	110	35.0±0.28 (33.6, 36.0)	34.64±0.48 (31.4, 36.2)	35.58±0.37 (33.3, 38.0)	34.56±0.28 (33.0, 35.4)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	36.89±0.12 (36.4, 37.7)	36.9±0.27 (35.2, 38.2)	37.14±0.4 (34.9, 39.0)	37.1±0.25 (36.0, 38.1)
Winter housing	30/10/07	181	33.84±0.16 (33.1, 34.6)	33.54±0.25 (31.9, 34.6)	33.91±0.28 (32.6, 35.1)	33.98±0.29 (32.5, 35.5)
Mid winter housing	06/02/08	280	33.56±0.21 (32.3, 34.1)	33.68±0.21 (32.8, 34.8)	33.84±0.13 (32.9, 34.5)	33.63±0.22 (32.8, 34.7)
End date	29/04/08	363	35.58±0.25 (34.7, 36.6)	35.82±0.12 (35.1, 36.4)	35.6±0.19 (34.3, 36.4)	35.8±0.18 (34.5, 36.4)

Table 2.13. The mean±SEM (range) of platelets ($X10^9/l$) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Platelets ($X10^9/l$)			Treatment group			
	Period of interest	Date	Day	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>
Start date	02/05/07	0	1106.55±75.42 (838, 1736)	1280.6±65.48 (1050, 1767)	1218.18±167.09 (298, 2426)	1385.11±258.48 (537, 2999)
Turn out to pasture	29/05/07	27	1046.73±71.32 (683, 1343)	1161.1±64.1 (891, 1506)	1161.09±119.17 (526, 2092)	1713.44±363 (631, 3769)
<i>Tx4OffFC</i> leave index farm	12/06/07	41	1064.45±31.09 (926, 1243)	1190.4±120.74 (712, 2059)	1237.09±151.78 (498, 2386)	1638.0± 425.89 (698, 4513)
Mid grazing	20/08/07	110	689.22±79.24 (184, 966)	770.6±78.41 (340, 1242)	857.36±113.72 (197, 1431)	827.11±130.54 (367, 1468)
<i>Tx4OffFC</i> return to index farm	16/10/07	167	727.3±87.81 (337, 1095)	763.7±92.9 (421, 1204)	790.27±89.82 (478, 1306)	691.0±77.41 (406, 1089)
Winter housing	30/10/07	181	603.9±64.12 (303, 943)	526.7±59.97 (197, 810)	509.55±70.53 (133, 878)	576.63±59.84 (336, 809)
Mid winter housing	06/02/08	280	562.29±44.55 (455, 809)	464.1±50.68 (221, 668)	5995.82±64.62 (251, 991)	614.56±65.66 (362, 928)
End date	29/04/08	363	498.43±70.62 (84.4, 733)	588.1±51.91 (321, 849)	646.82±52.52 (410, 1209)	617.33±59.5 (343, 958)

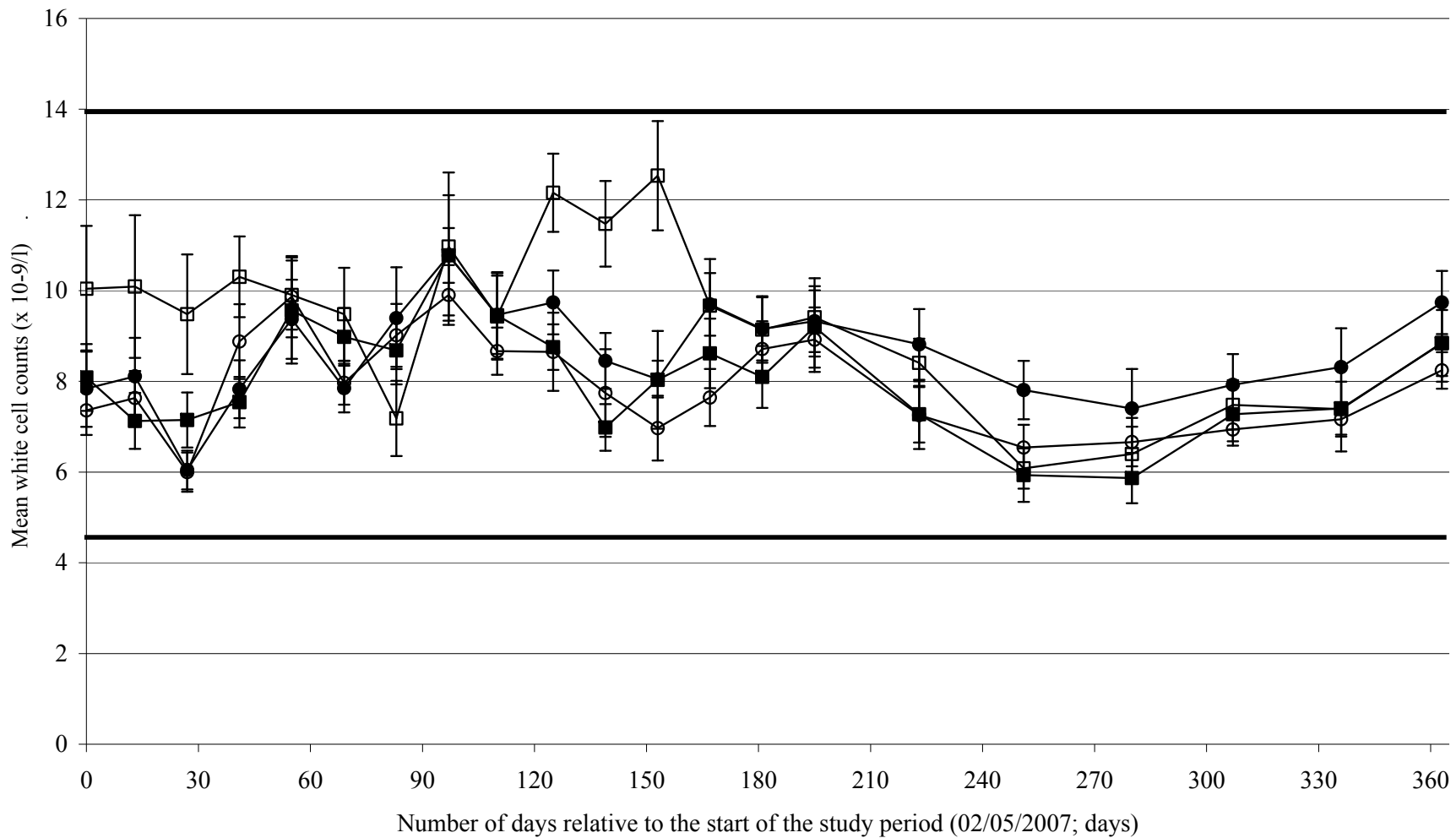


Figure 2.1: Mean±SEM white cell count (WBC, x10⁹) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●); a selenium injection, *Tx2BVP* supplemented (■) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (○), or were moved off the index farm for a period of time, *Tx4OffFC* (□) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

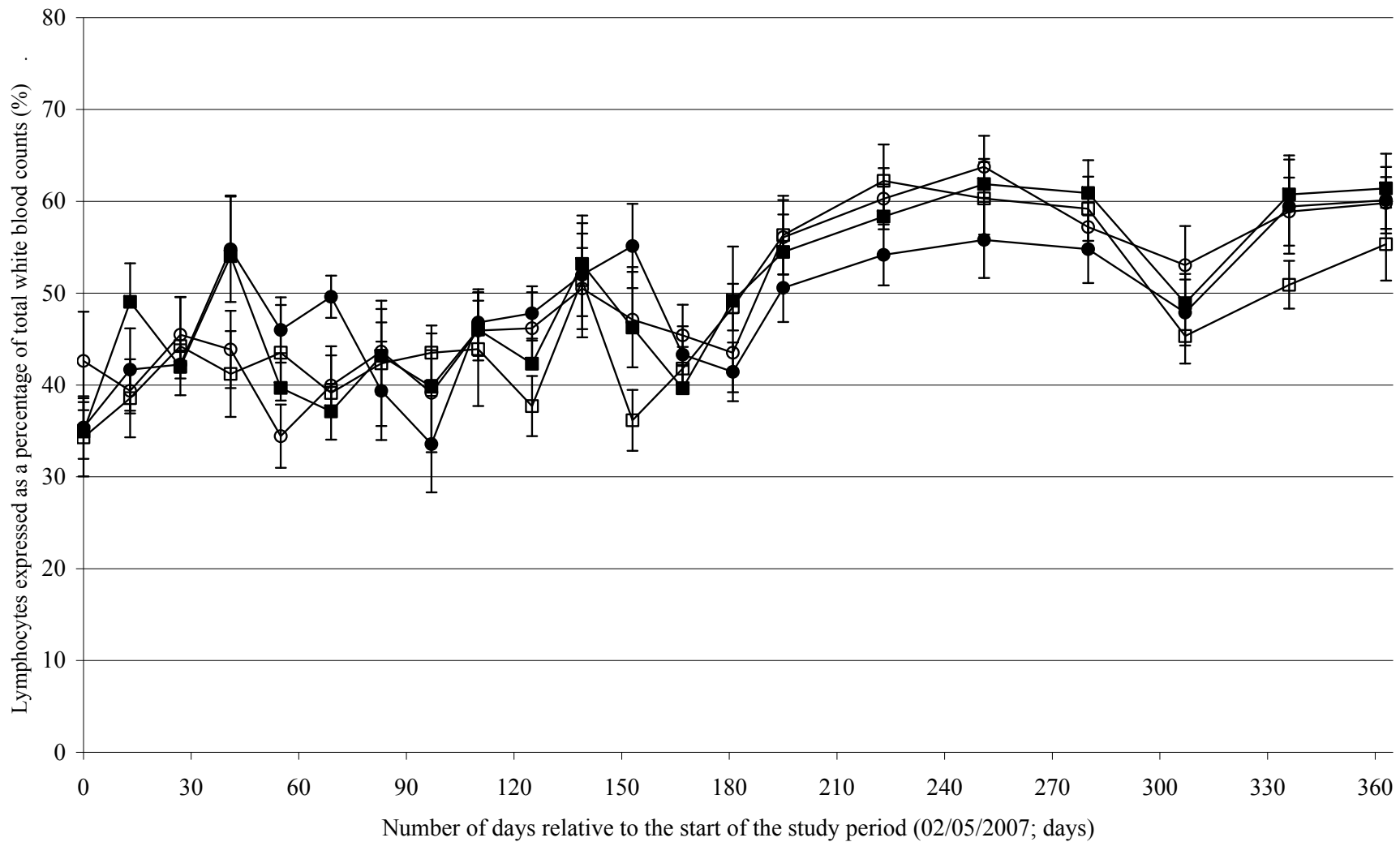


Figure 2.2: Mean±SEM percentage lymphocytes (%) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

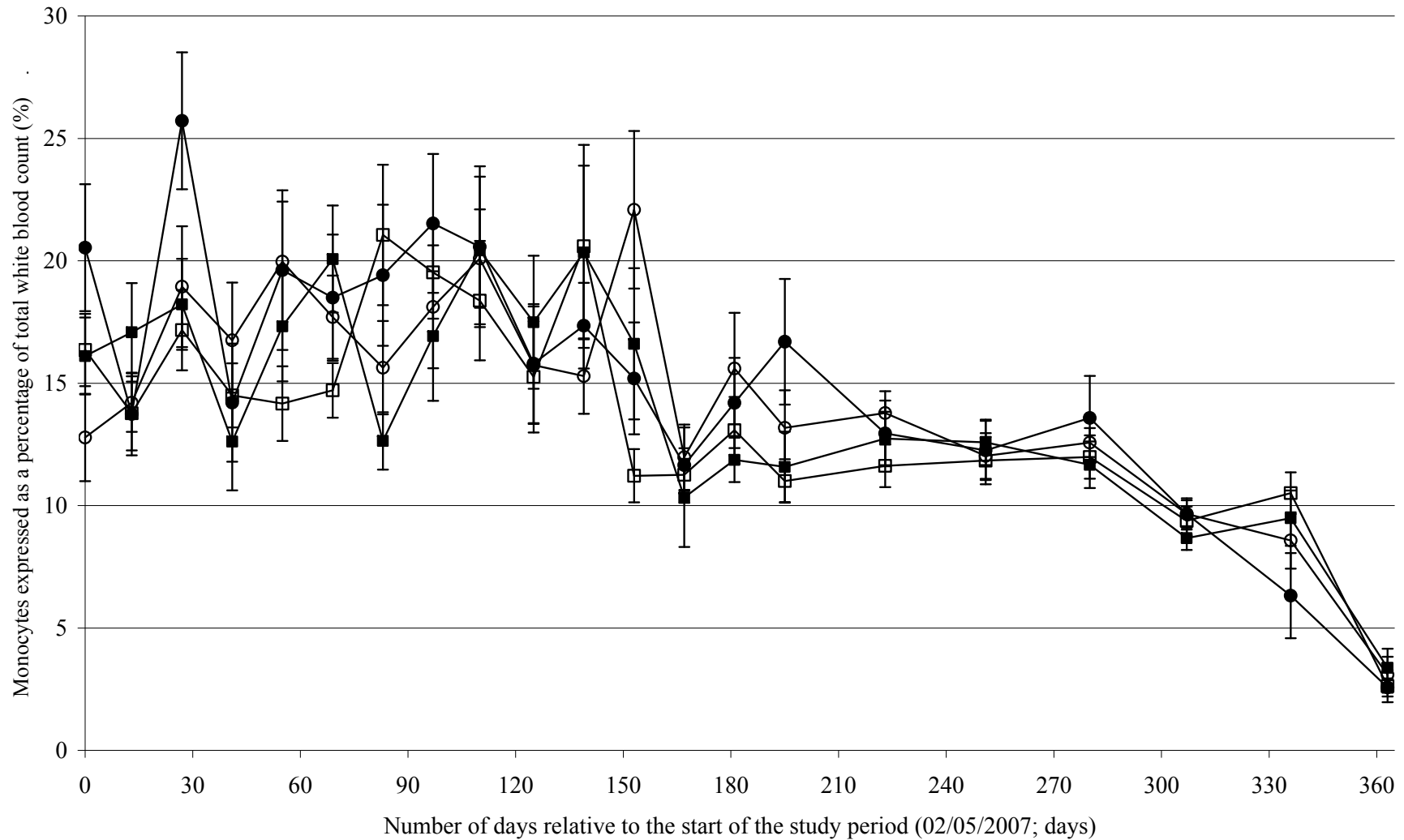


Figure 2.3: Mean±SEM percentage monocytes (%) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

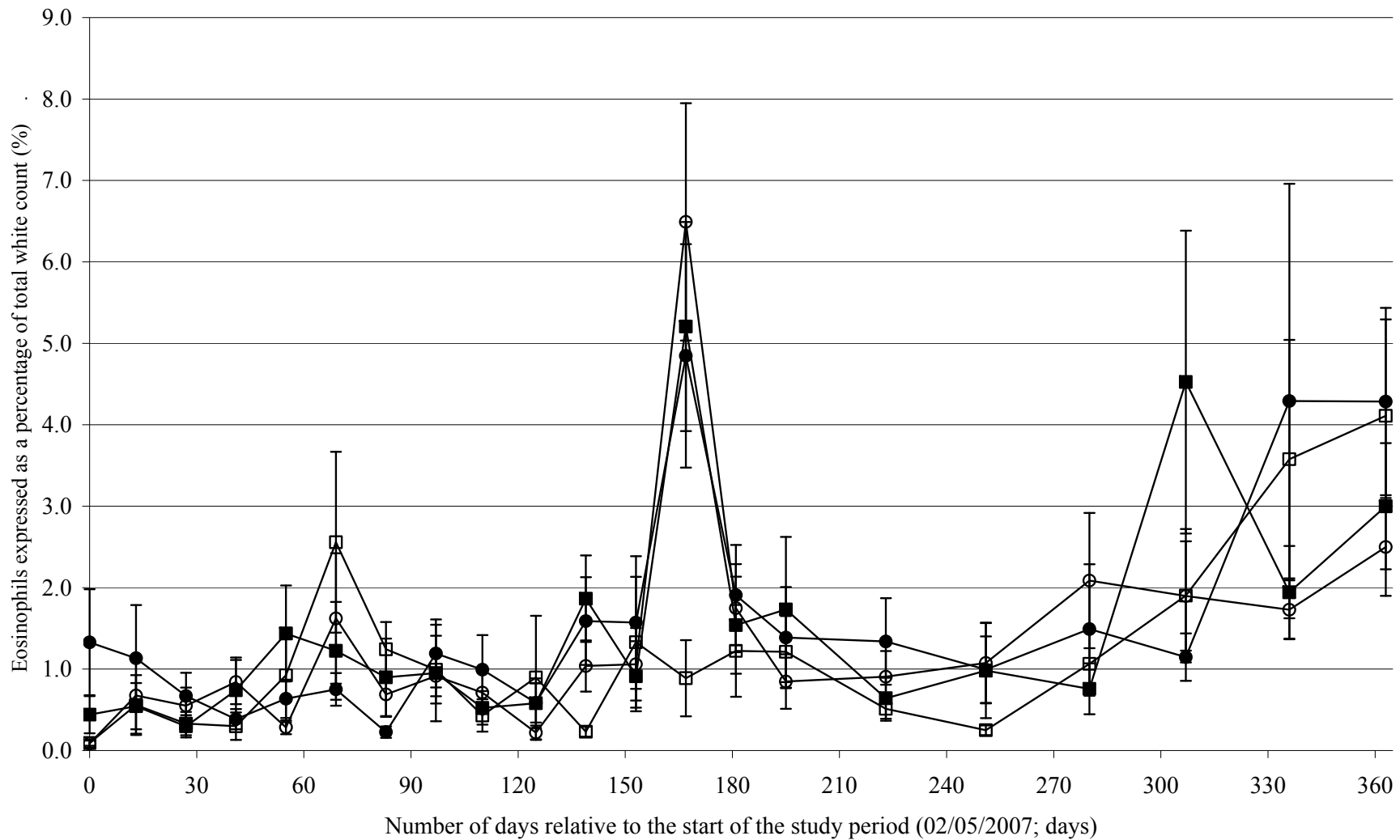


Figure 2.4: Mean±SEM percentage eosinophils (%) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vital* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

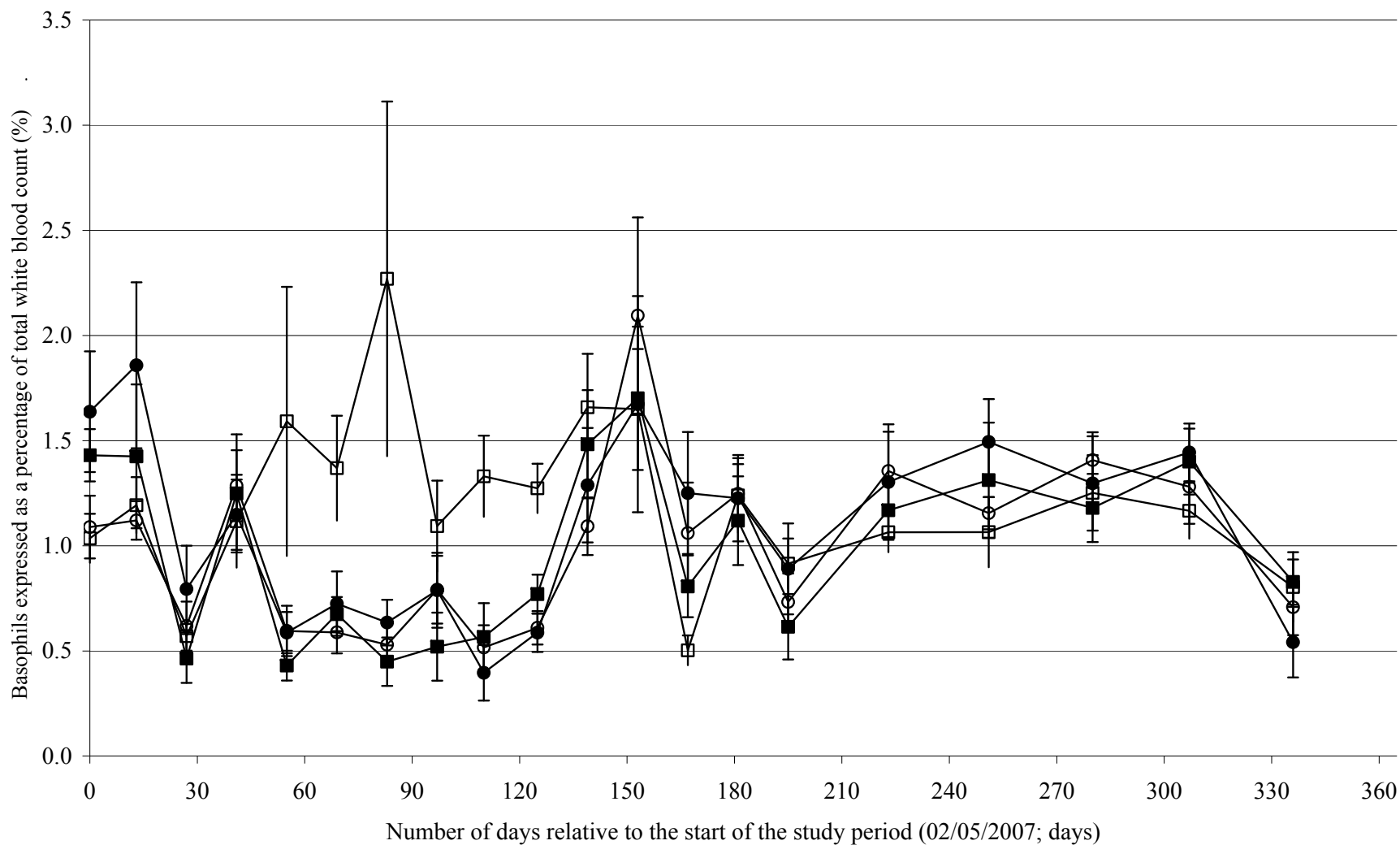


Figure 2.5: Mean±SEM percentage basophils (%) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

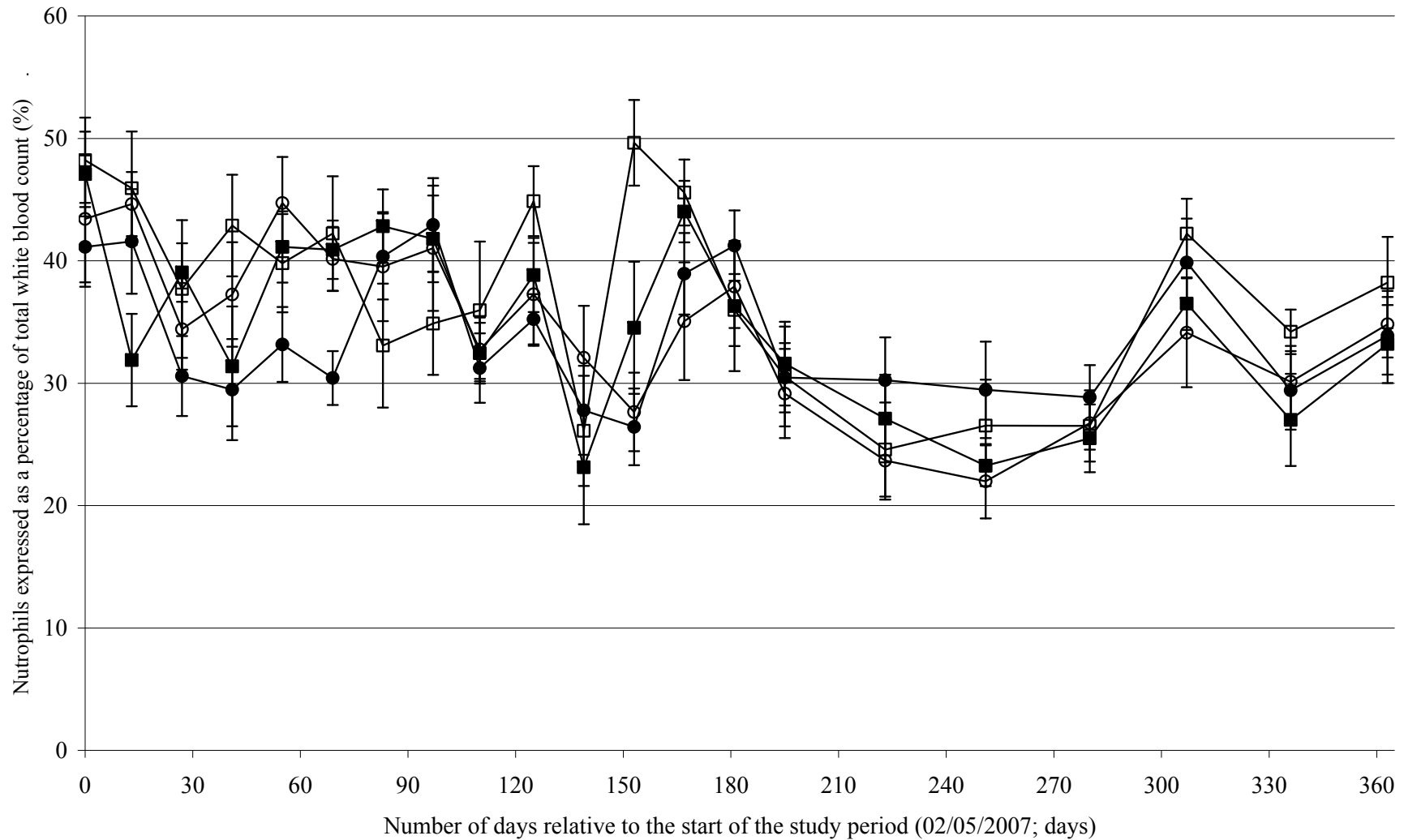


Figure 2.6: Mean±SEM percentage neutrophils (%) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vital* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

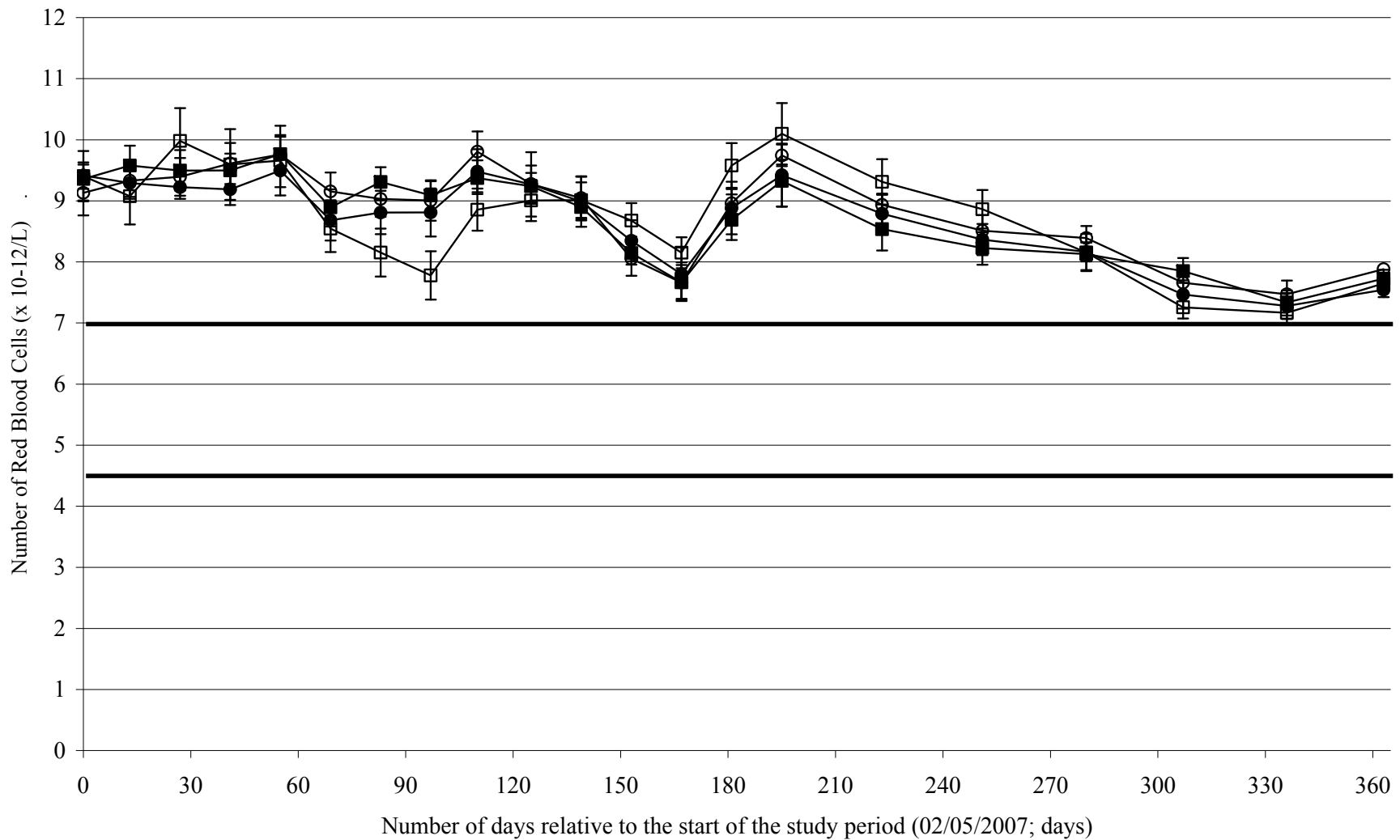


Figure 2.7: Mean±SEM number of red blood cells (RBC, $\times 10^{12}/l$) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

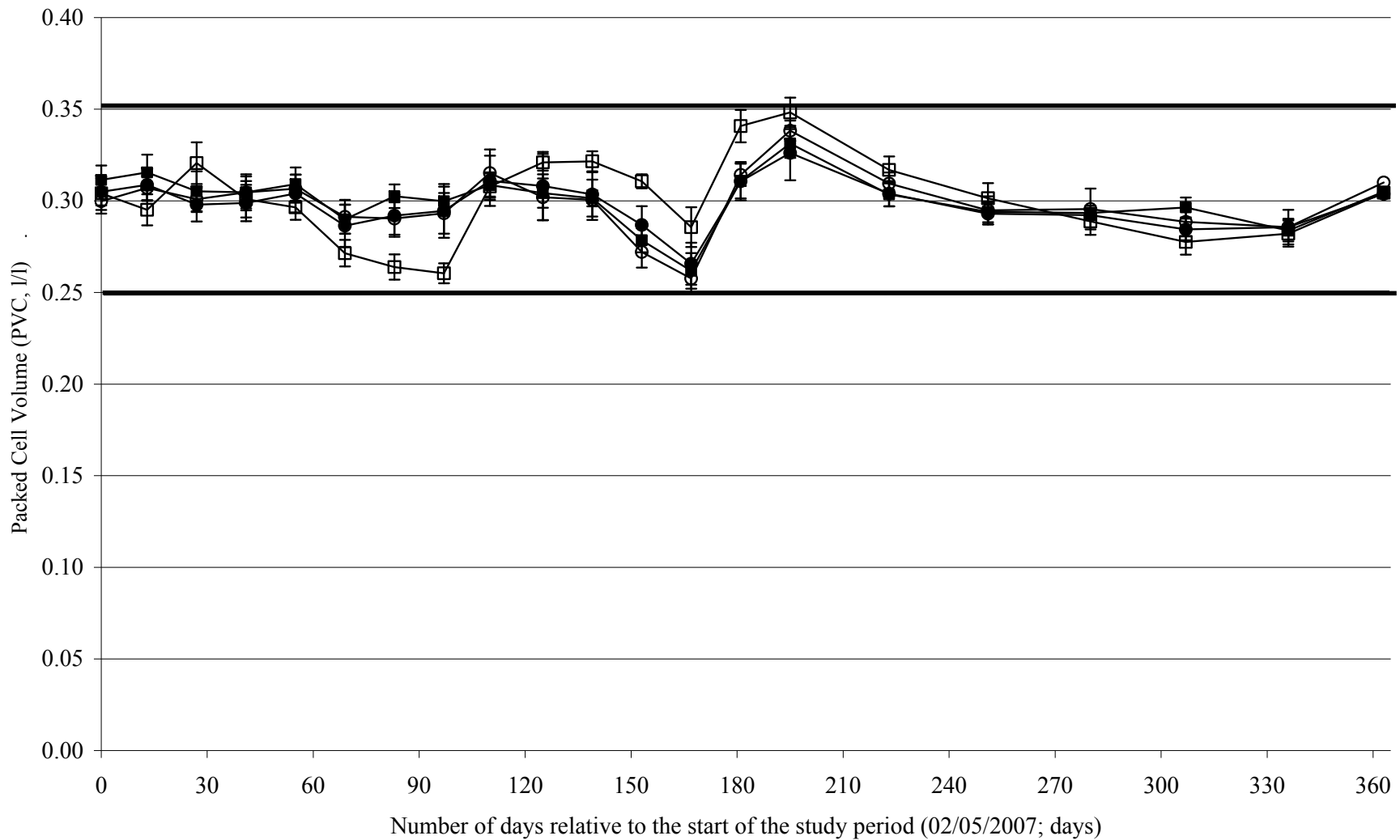


Figure 2.8: Mean±SEM packed cell volume (PCV, l/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

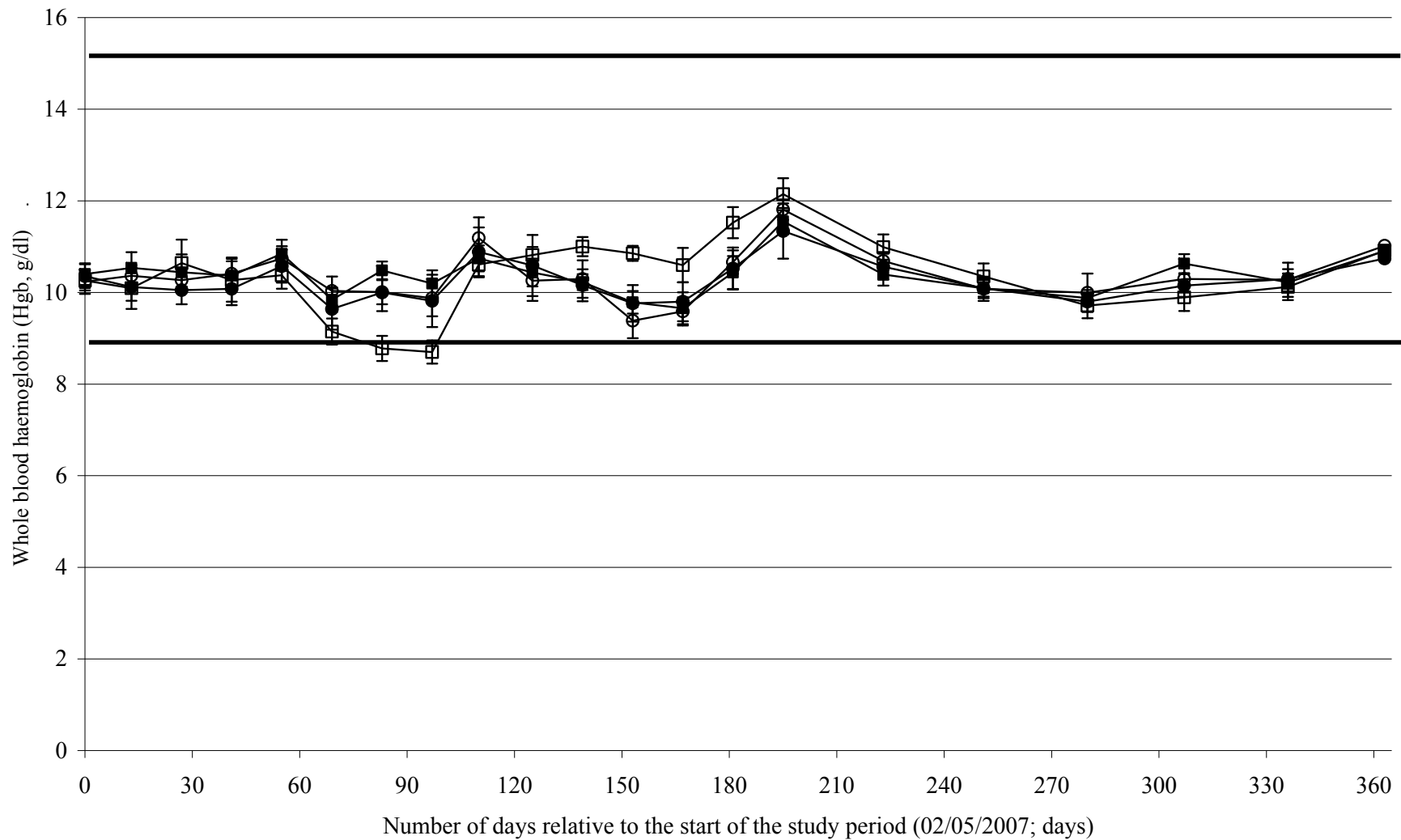


Figure 2.9: Mean±SEM whole blood haemoglobin (Hgb, g/dl) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

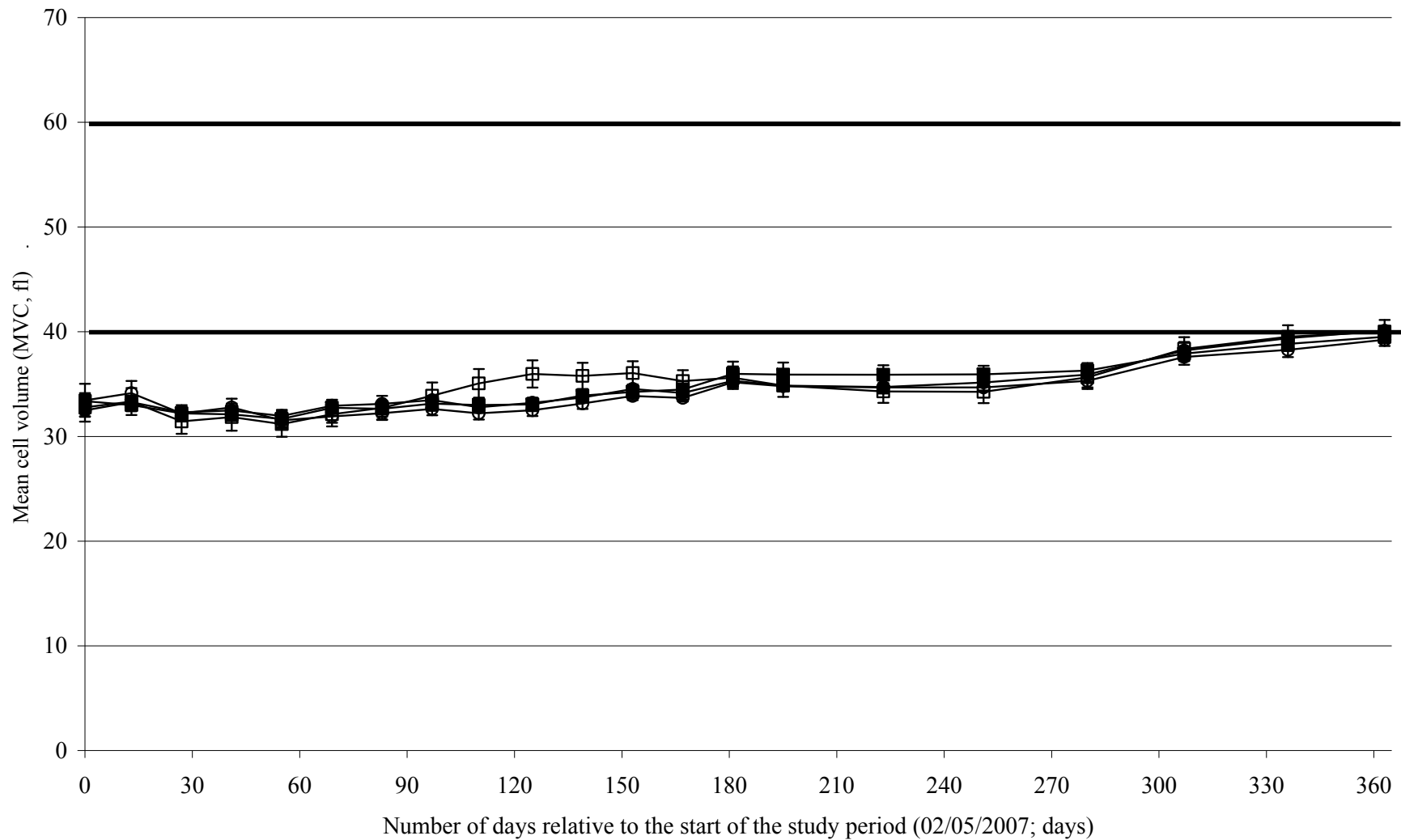


Figure 2.10: Mean±SEM cell volume (MCV, fl) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●-); a selenium injection, *Tx2BVP* supplemented (■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

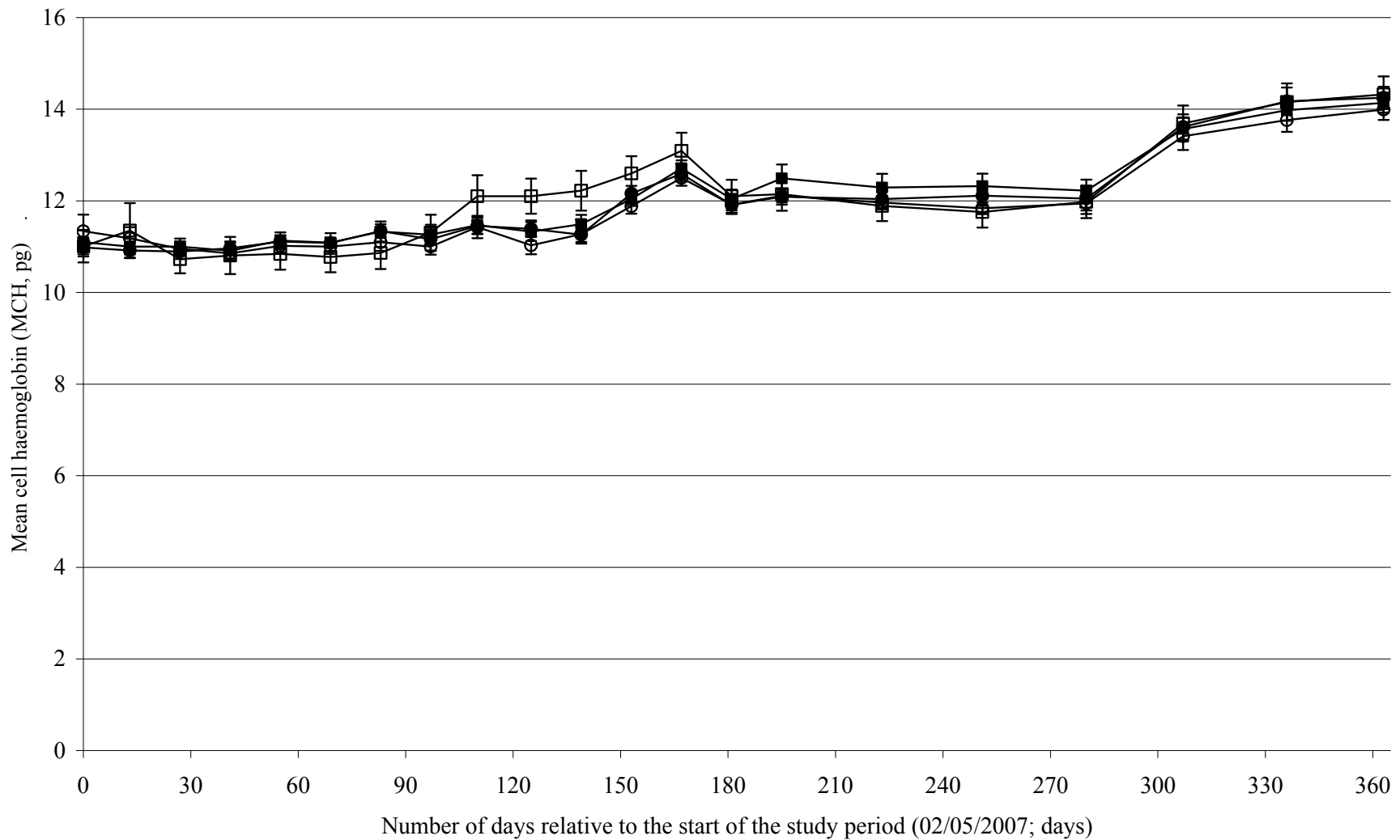


Figure 2.11: Mean±SEM cell haemoglobin (MCH, fl) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black line.

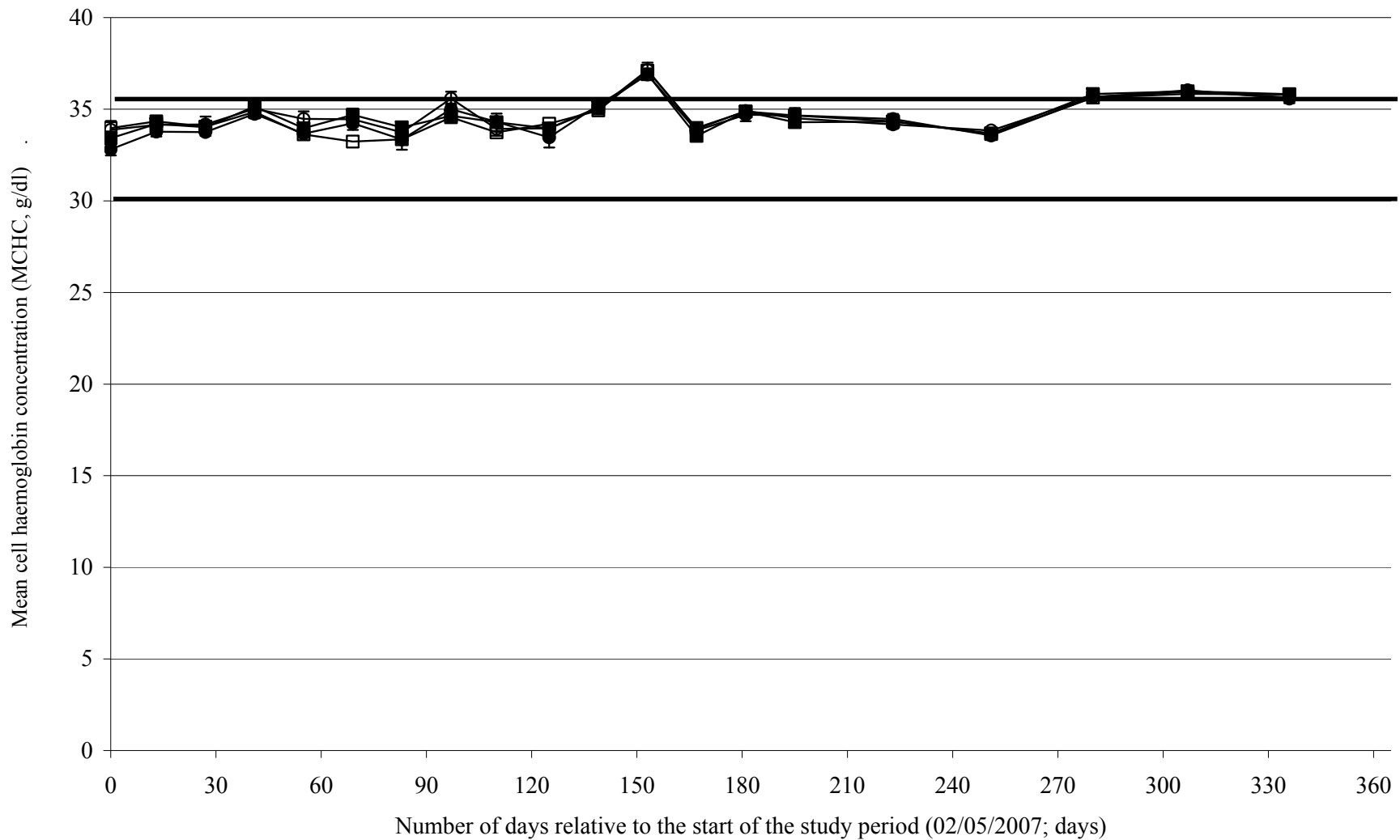


Figure 2.12: Mean±SEM cell haemoglobin concentration (MCHC, g/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

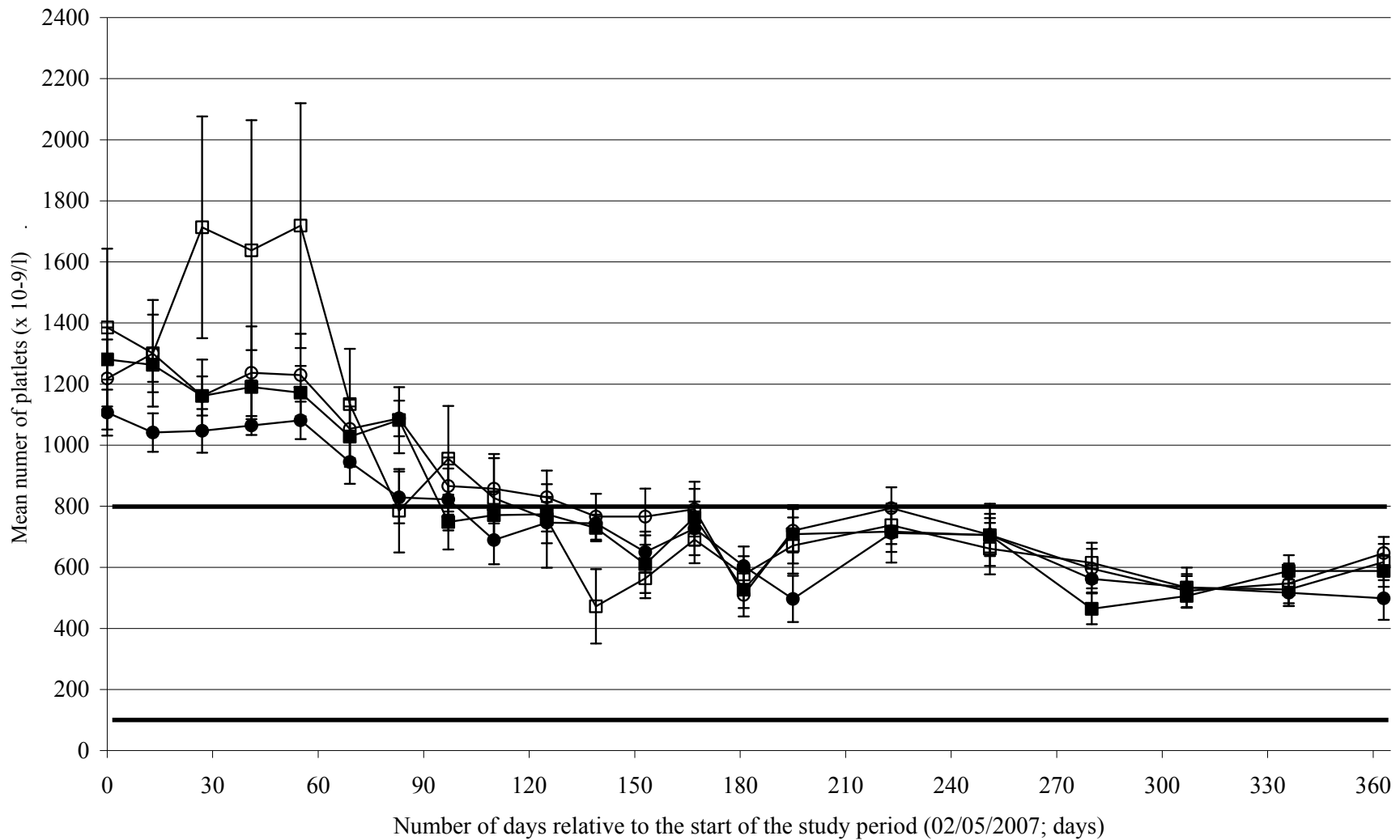


Figure 2.13: Mean±SEM number of platelets (Plt, x10⁹/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

3. Minerals – selenium, sulphur and cadmium

Table 3.1. The mean±SEM (range) selenium levels (Se, µg/kg) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Selenium (µg/kg)		Treatment group				
Period of interest	Date	Bleed No.	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	1	178.91±5.87 (149, 215)	181.1±11.33 (119, 232)	169.82±14.35 (93, 245)	181.44±8.83 (145, 228)
Turn out to pasture	29/05/07	3	124.73±5.43 (99, 161)	140.6±9.7 (92, 182)	122.18±8.75 (86, 170)	134.22±11.08 (73, 187)
<i>Tx4OffFC</i> leave index farm	12/06/07	4	152.36±3.79 (135, 171)	175.2±7.02 (149, 212)	158.91±7.70 (128, 195)	194.78±32.79 (123, 229)
Mid grazing	20/08/07	9	95.30±10.26 (60, 150)	125.1±6.97 (84, 161)	93.55±8.29 (60, 146)	118.67±6.7 (87, 143)
<i>Tx4OffFC</i> return to index farm	16/10/07	13	82.7±11.58 (50, 153)	120.6±7.31 (92, 159)	92.18±8.97 (64, 143)	124.33±6.9 (98, 149)
Winter housing	30/10/07	14	78.8±8.24 (59, 133)	117.4±7.73 (75, 159)	79.60±5.06 (63, 111)	119.67±5.07 (92, 143)
Mid winter housing	06/02/08	18	88.63±13.51 (53, 171)	109.2±4.16 (92, 133)	83.73±4.32 (66, 110)	87.78±8.26 (62, 128)
End date	29/04/08	21	126.75±10.5 (75, 177)	142.0±6.85 (107, 166)	127.64±5.91 (97, 160)	115.0±6.71 (85, 144)

Table 3.2. The mean±SEM (range) sulphur levels (S, mg/kg) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Sulphur (mg/kg)		Treatment group				
Period of interest	Date	Bleed No.	<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	1	1156±29.75 (975, 1308)	1205.8±32.81 (1075, 1375)	1124.91±26.3 (1008, 1333)	1148.33±34.76 (992, 1317)
Turn out to pasture	29/05/07	3	1142.45±18.58 (1075, 1225)	1165±15.04 (1108, 1283)	1143.18±31.3 (983, 1350)	1177.78±31.59 (1058, 1317)
<i>Tx4OffFC</i> leave index farm	12/06/07	4	1176.55±20.21 (1075, 1317)	1200±20.01 (1075, 1300)	1195.55±14.6 (1117, 1292)	1242.56±42.48 (1058, 1467)
Mid grazing	20/08/07	9	1103.4±32.11 (942, 1250)	1095.1±44.18 (793, 1217)	1066±35.31 (850, 1192)	1057.33±32.51 (875, 1183)
<i>Tx4OffFC</i> return to index farm	16/10/07	13	1125.8±14.88 (1033, 1192)	1155±18.26 (1058, 1214)	1133.36±25.66 (967, 1267)	1148.11±21.14 (1050, 1225)
Winter housing	30/10/07	14	1047.2±17.7 (935, 1127)	1030.4±21.87 (905, 1150)	1060.82±21.89 (943, 1204)	1048.67±26.41 (943, 1204)
Mid winter housing	06/02/08	18	1035.88±49.35 (851, 1242)	1022.1±34.17 (882, 1188)	984.18±26.54 (813, 1127)	1007±37.94 (782, 1158)
End date	29/04/08	21	1150.88±48.58 (882, 1311)	1169.4±30.77 (1024, 1324)	1206.45±17.53 (1096, 1273)	1156±47.29 (813, 1288)

Table 3.3. The mean±SEM (range) cadmium levels (Cd, µg/kg) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Cadmium (µg/kg)	Date	Bleed No.	Treatment group			
			<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	1	6.64±2.17	4.0±0.77	2.82±0.74	5.67±1.14
Turn out to pasture	29/05/07	3	1.94±0.51	1.6±0.31	1.45±0.45	1.44±0.29
<i>Tx4OffFC</i> leave index farm	12/06/07	4	1.0±0.0	3.90±2.04	1.27±0.19	1.0±0.0
Mid grazing	20/08/07	9	213.1±73.0	179.5±63.3	189.2±63.4	183.7±59.6
<i>Tx4OffFC</i> return to index farm	16/10/07	13	1.0±0.0	1.0±0.0	1.36±0.36	1.22±0.15
Winter housing	30/10/07	14	1.0±0.0	1.3±0.21	1.27±0.27	1.22±0.22
Mid winter housing	06/02/08	18	1.25±0.16	1.5±0.2	1.45±0.25	1.56±0.24
End date	29/04/08	21	1.0±0.0	1.9±0.9	1.0±0.0	2.0±1.0

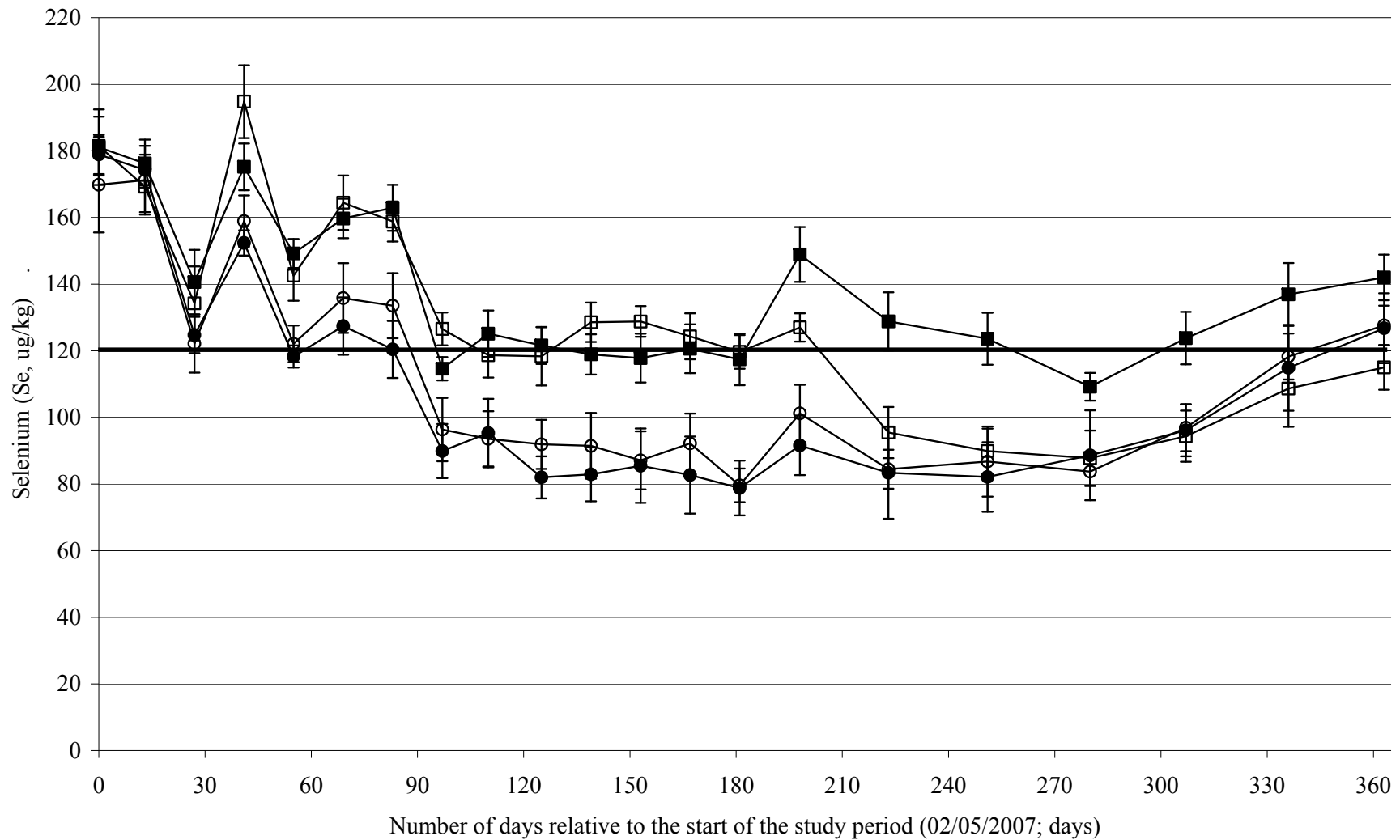


Figure 3.1. Mean±SEM whole blood selenium (Se, ug/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. Normal Se concentrations are above the solid black line.

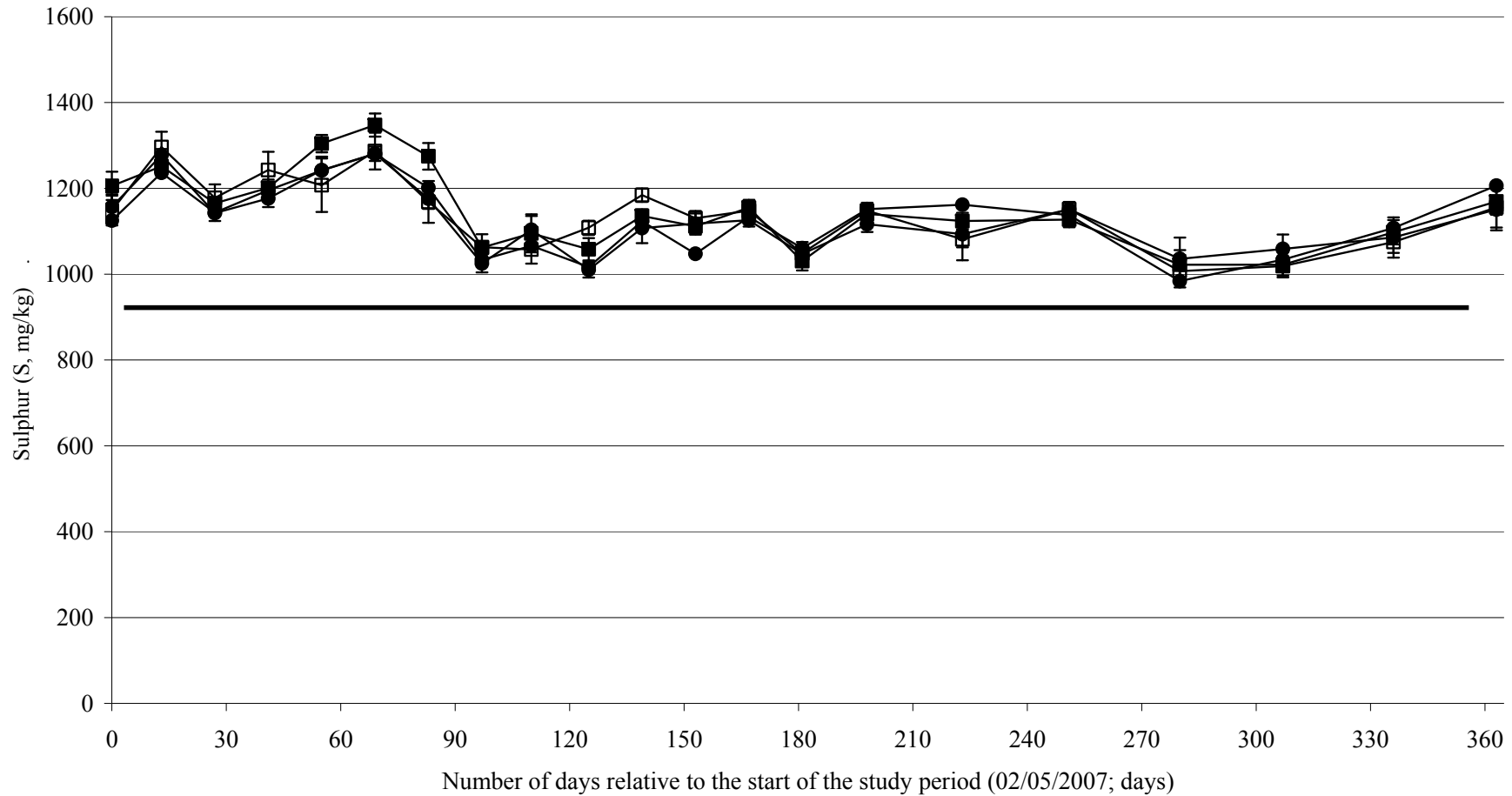


Figure 3.2. Mean±SEM whole blood sulphur (S, mg/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vital* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. Normal S concentrations are above the solid black line.

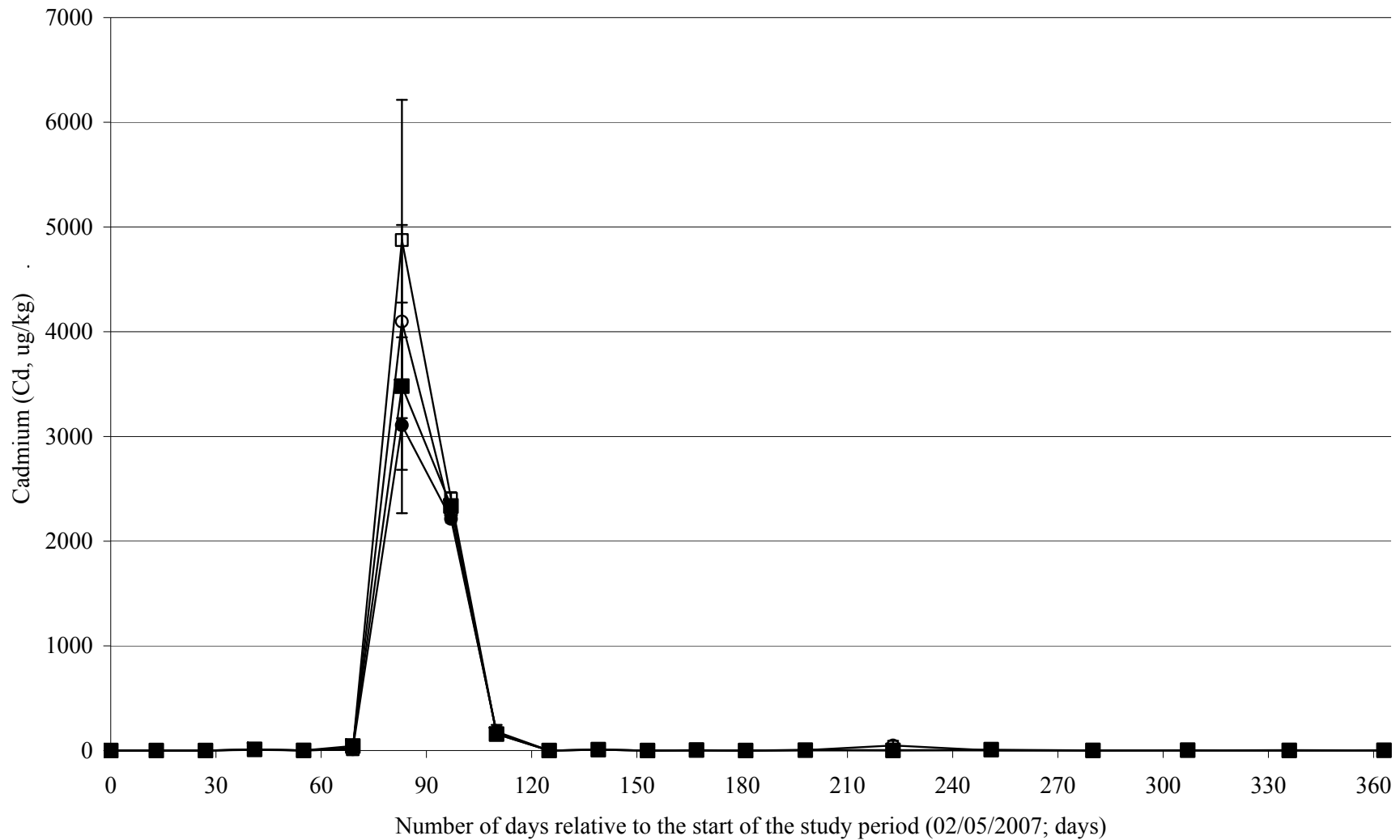


Figure 3.3. Mean±SEM whole blood cadmium (Cd, ug/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07.

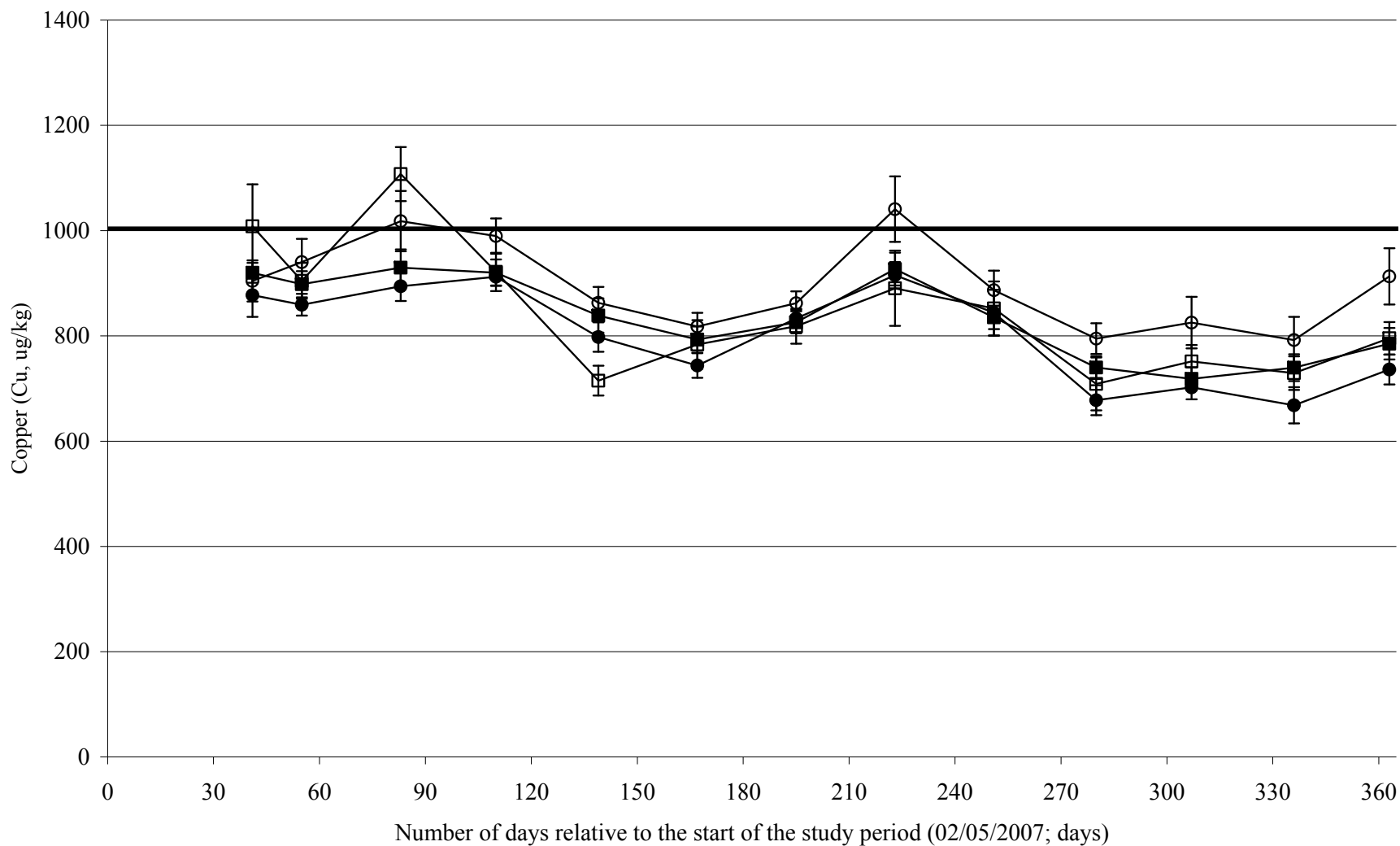


Figure 3.4. Mean±SEM whole blood copper (Cu, ug/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●); a selenium injection, *Tx2BVP* supplemented (■) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (○), or were moved off the index farm for a period of time, *Tx4OffFC* (□) from 12/06/07 to 15/10/07. Normal Cu concentrations are above the solid black line.

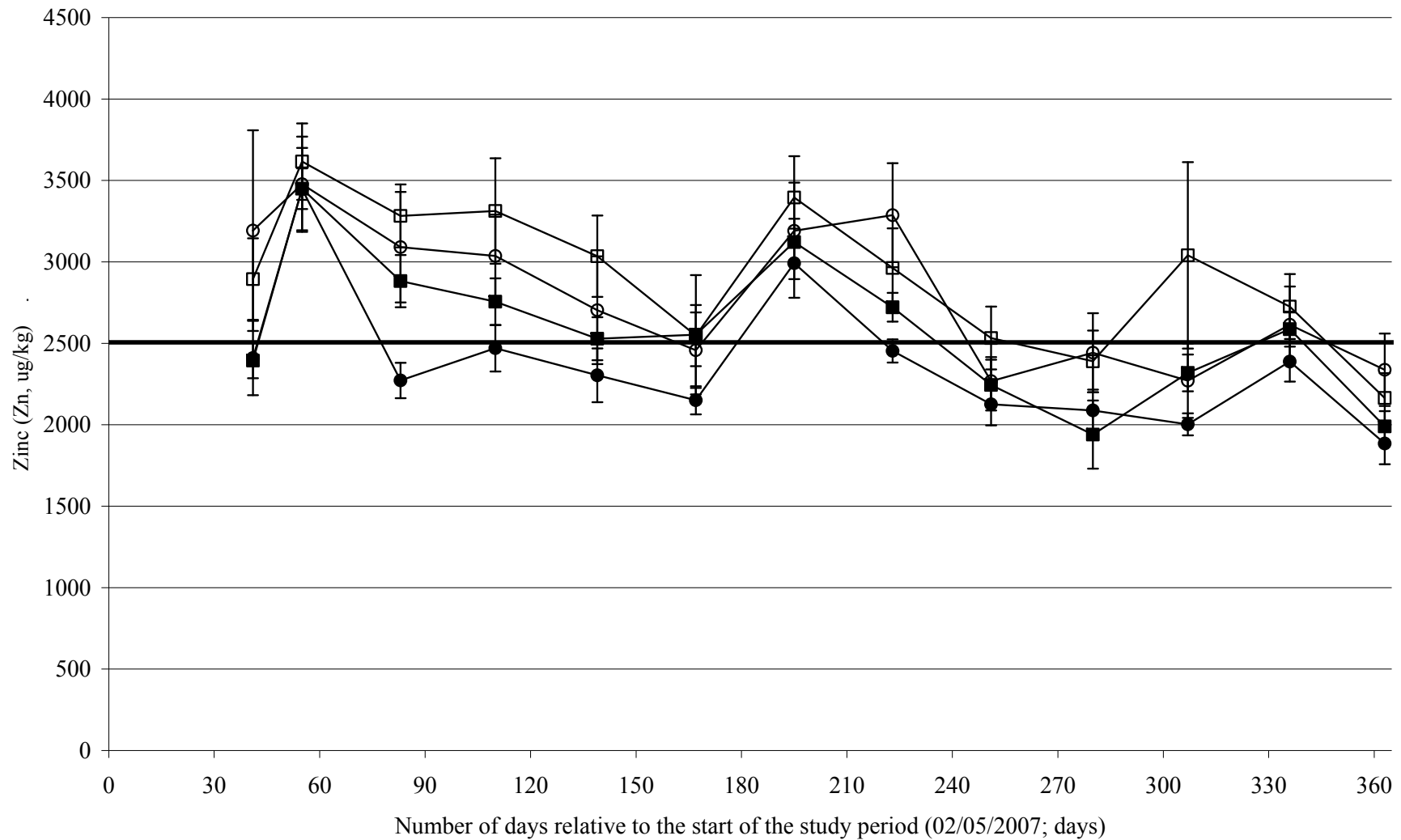


Figure 3.5. Mean±SEM whole blood zinc (Zn, ug/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. Normal Zn concentrations are above the solid black line.

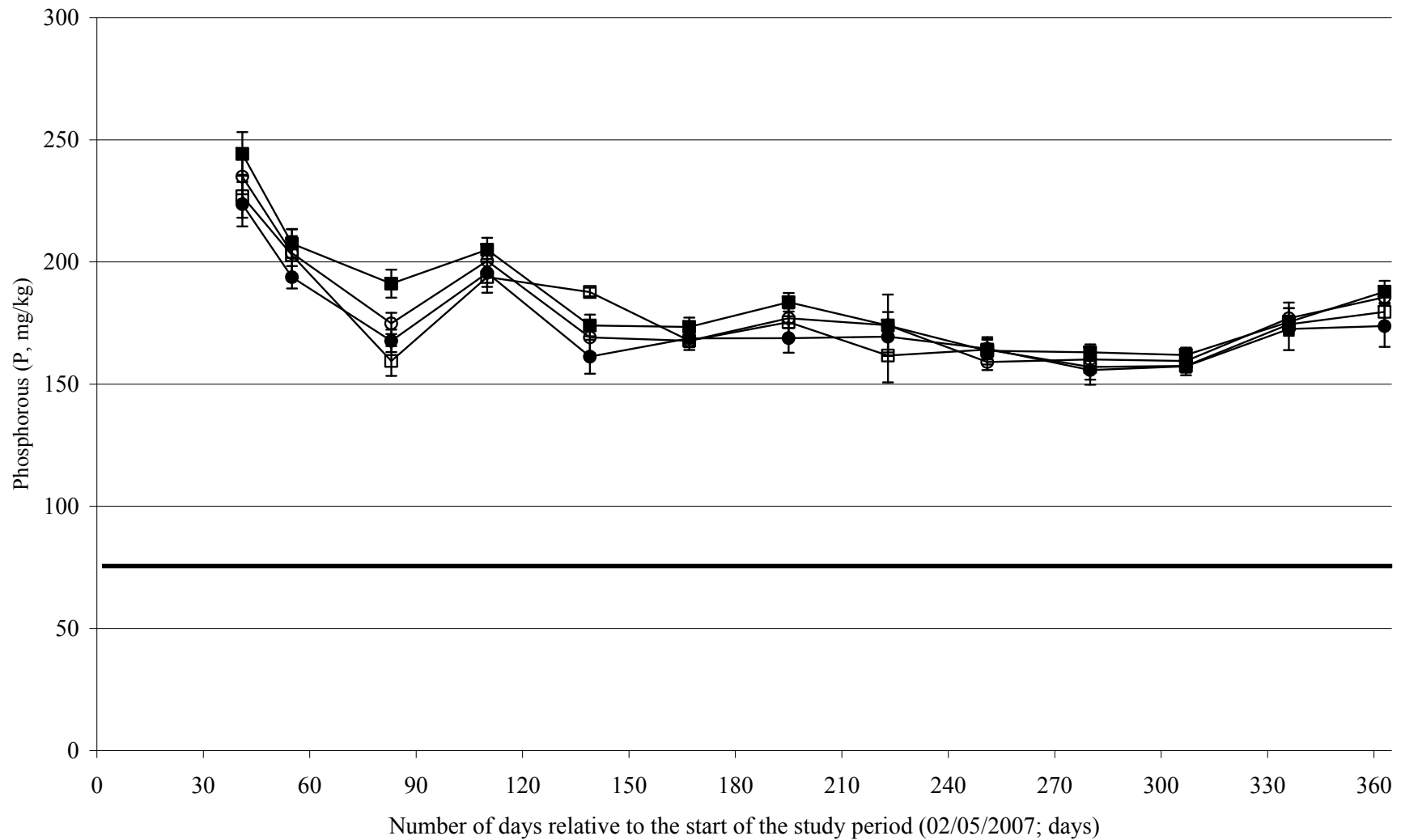


Figure 3.6. Mean±SEM whole blood phosphorous (P, mg/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. Normal P concentrations are above the solid black line.

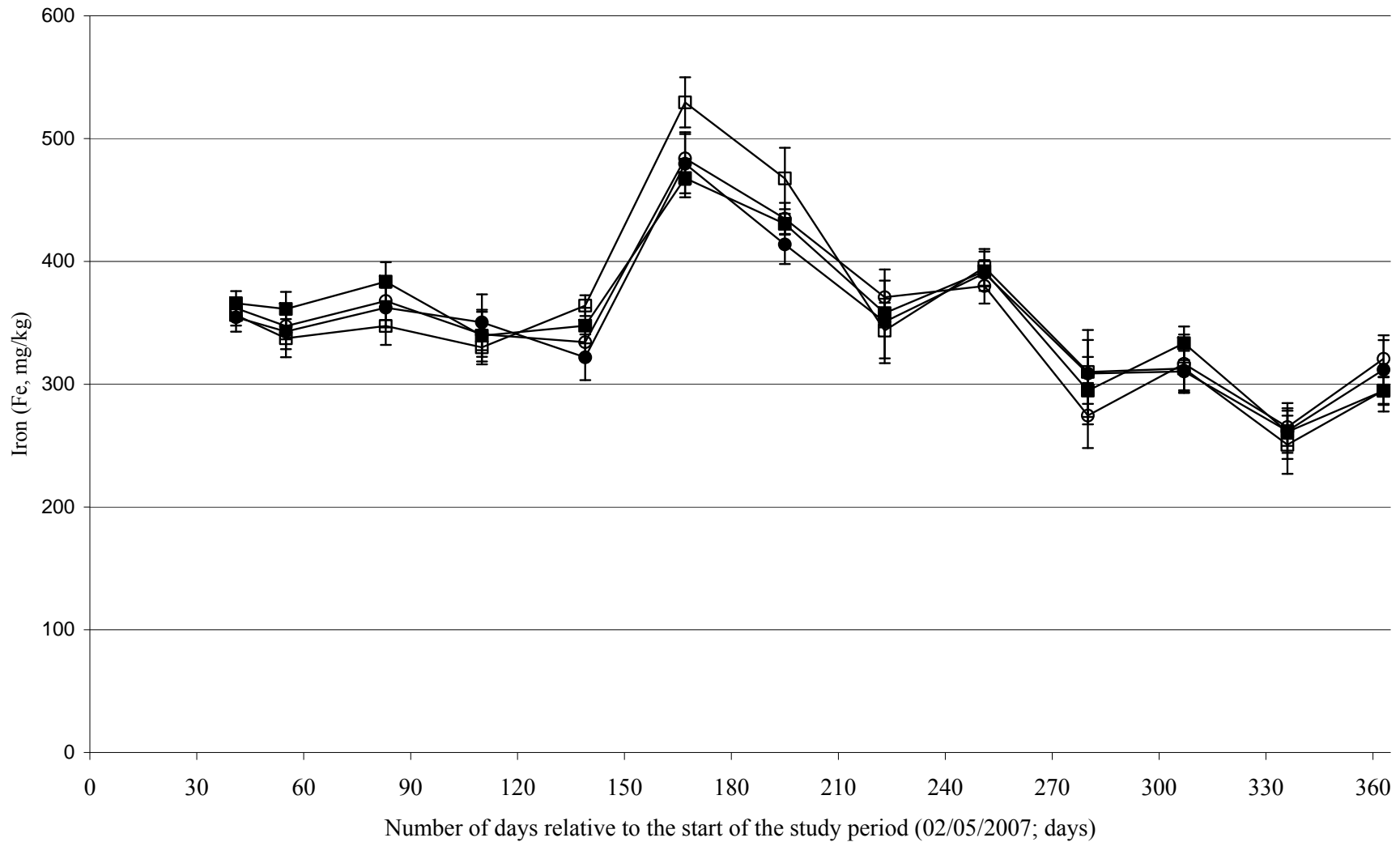


Figure 3.7. Mean±SEM whole blood iron (Fe, mg/kg) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black line.

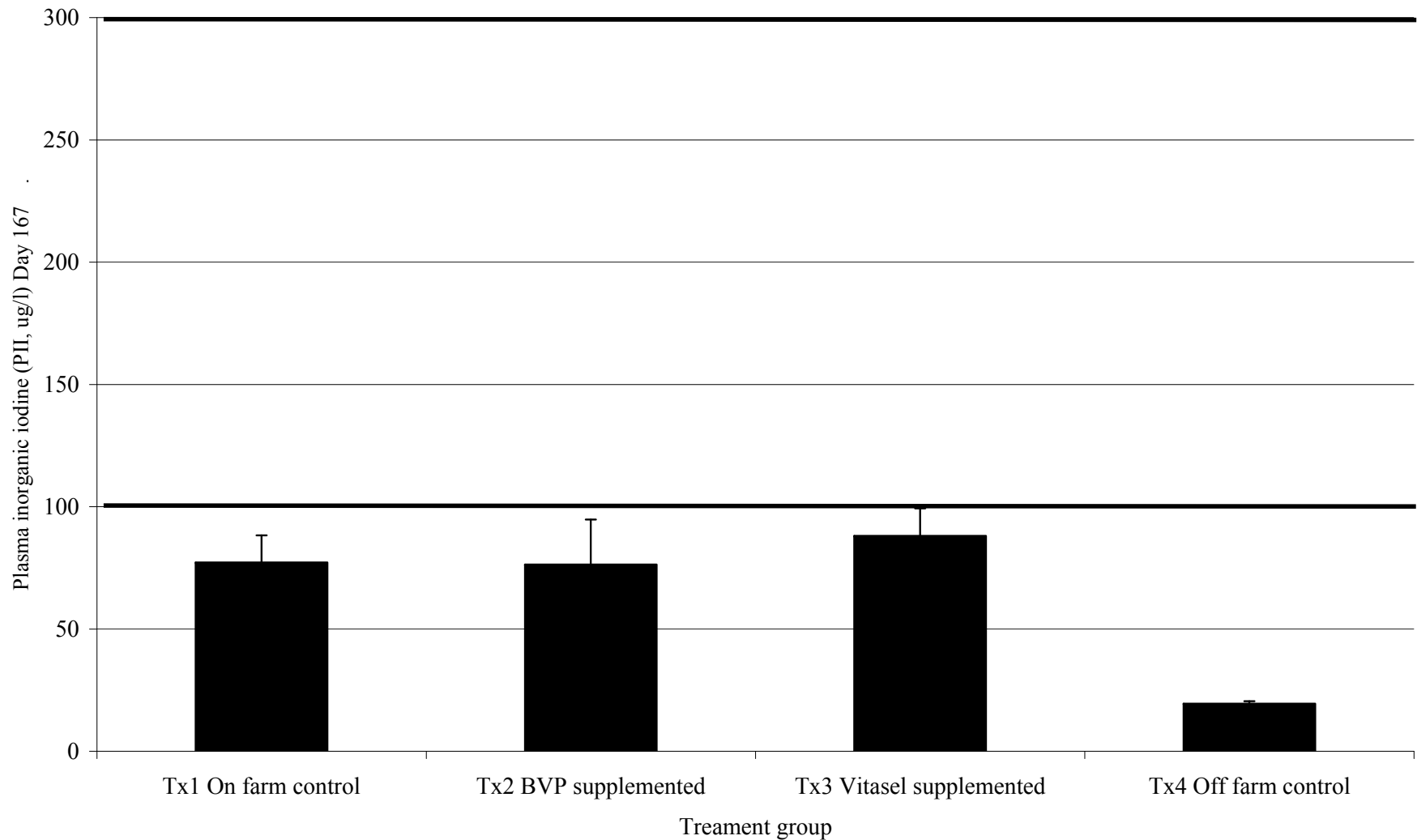


Figure 3.8. Mean±SEM plasma inorganic iodine (PII, ug/l) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. PII was measured on 16/10/07, the day after *Tx4OffFC* group returned to the index farm. The normal range is indicated by the solid black lines.

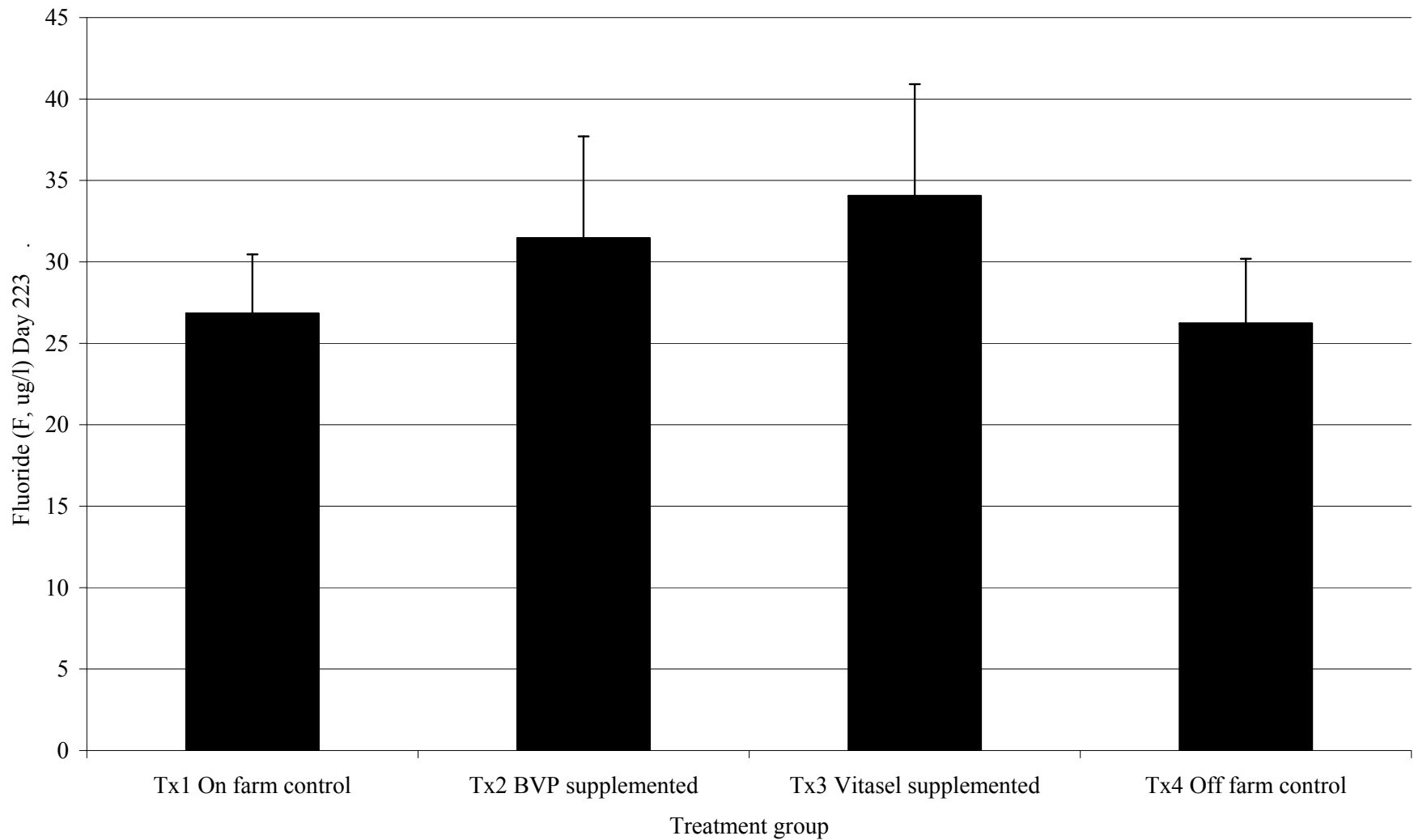


Figure 3.9. Mean±SEM serum fluoride (F, ug/l) levels for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* supplemented (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* supplemented (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. F was measured on 11/12/07.

4. Biochemistry

Table 4.1. The mean±SEM (range) glutathione peroxidase (GPx, U/ml PCV) at defined sampling points for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC*; a selenium injection, *Tx2BVP* or a selenium and vitamin E injection, *Tx3Vital*, or were moved off the index farm for a period of time, *Tx4OffFC* from 12/06/07 to 15/10/07.

Glutathione peroxidase (U/ml PCV)	Date	Bleed No.	Treatment group			
			<i>Tx1OnFC</i>	<i>Tx2BVP</i>	<i>Tx3Vital</i>	<i>Tx4OffFC</i>
Start date	02/05/07	1	120.97±6.39 (84.61, 164.55)	118.65±17.01 (13.94, 199.56)	115.14±15.90 (35.32, 201.13)	126.28±10.17 (104.15, 205.47)
Turn out to pasture	29/05/07	3	103.16±1.64 (94.73, 112.02)	117.07±5.35 (81.53, 135.22)	104.07±7.06 (65.07, 132.24)	104.92±5.12 (81.24, 126.73)
<i>Tx4OffFC</i> leave index farm	12/06/07	4	112.46±2.12 (103.72, 125.56)	127.51±5.66 (95.22, 150.77)	115.79±7.30 (76.77, 144.48)	117.16±6.67 (76.43, 145.78)
Mid grazing	20/08/07	9	84.29±12.34 (47.9, 145.82)	126.79±4.62 (102.07, 144.09)	90.99±9.71 (47.81, 146.53)	120.2±4.22 (97.58, 134.62)
<i>Tx4OffFC</i> return to index farm	16/10/07	13	69.53±13.27 (25.01, 137.93)	117.8±8.70 (78.9, 162.14)	74.73±10.72 (31.94, 133.01)	107.26±4.13 (90.4, 126.43)
Winter housing	30/10/07	14	56.28±11.54 (19.37, 120.86)	98.14±7.97 (66.55, 142.67)	59.64±8.34 (25.69, 99.07)	86.42±3.64 (72.58, 104.38)
Mid winter housing	06/02/08	18	72.48±12.06 (30.9, 128.34)	116.14±8.74 (86.25, 176.39)	70.92±5.30 (44.57, 111.27)	73.64±7.66 (44.76, 111.44)
End date	29/04/08	21	103.43±7.93 (59.72, 130.94)	126.21±4.92 (112.56, 162.15)	96.43±4.4 (69.28, 115.95)	95.53±5.58 (74.48, 120.74)

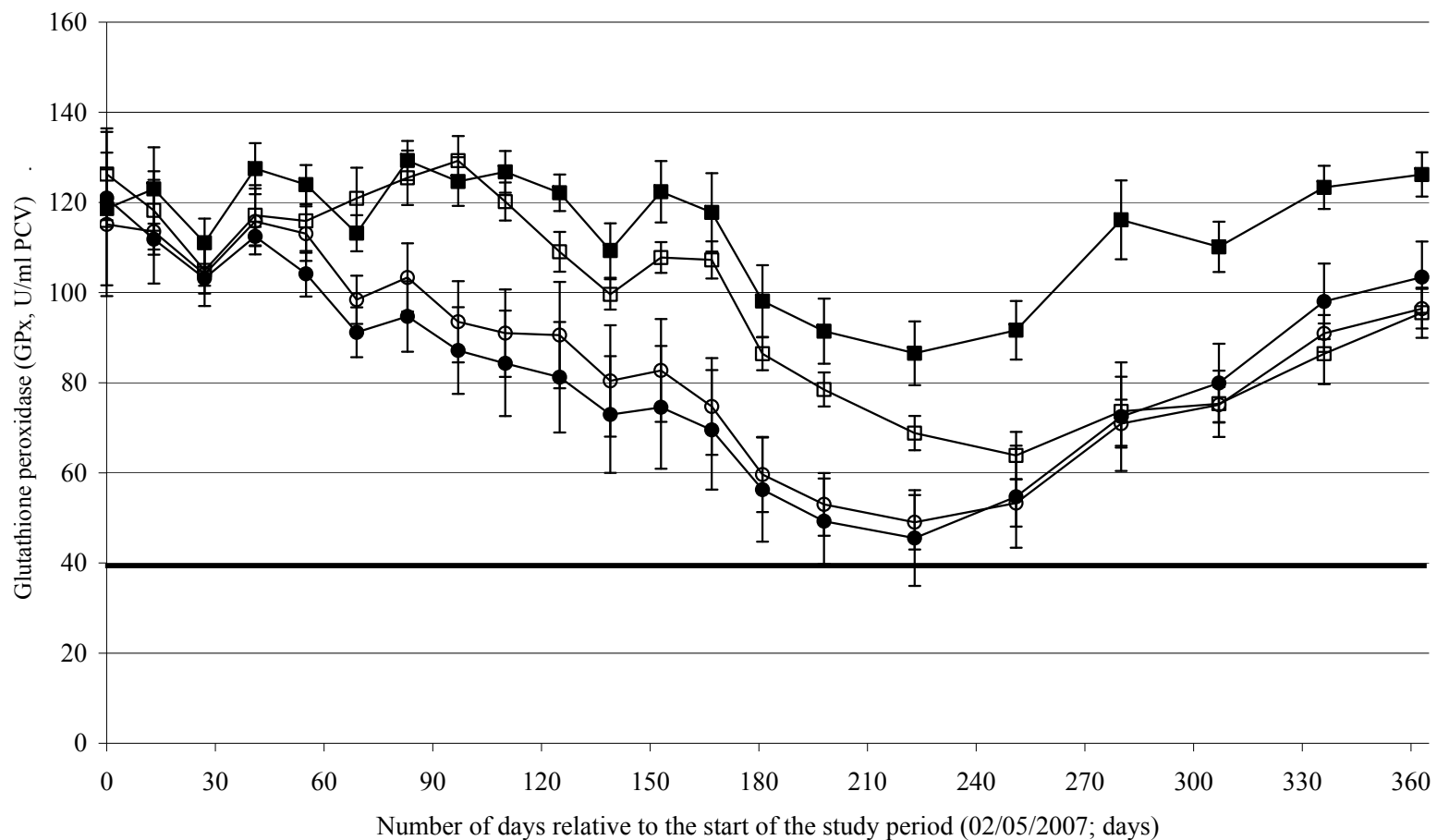


Figure 4.1. Mean±SEM whole blood glutathione peroxidase (GPx, U/ml PCV) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. Normal GPx concentrations are above the solid black line.

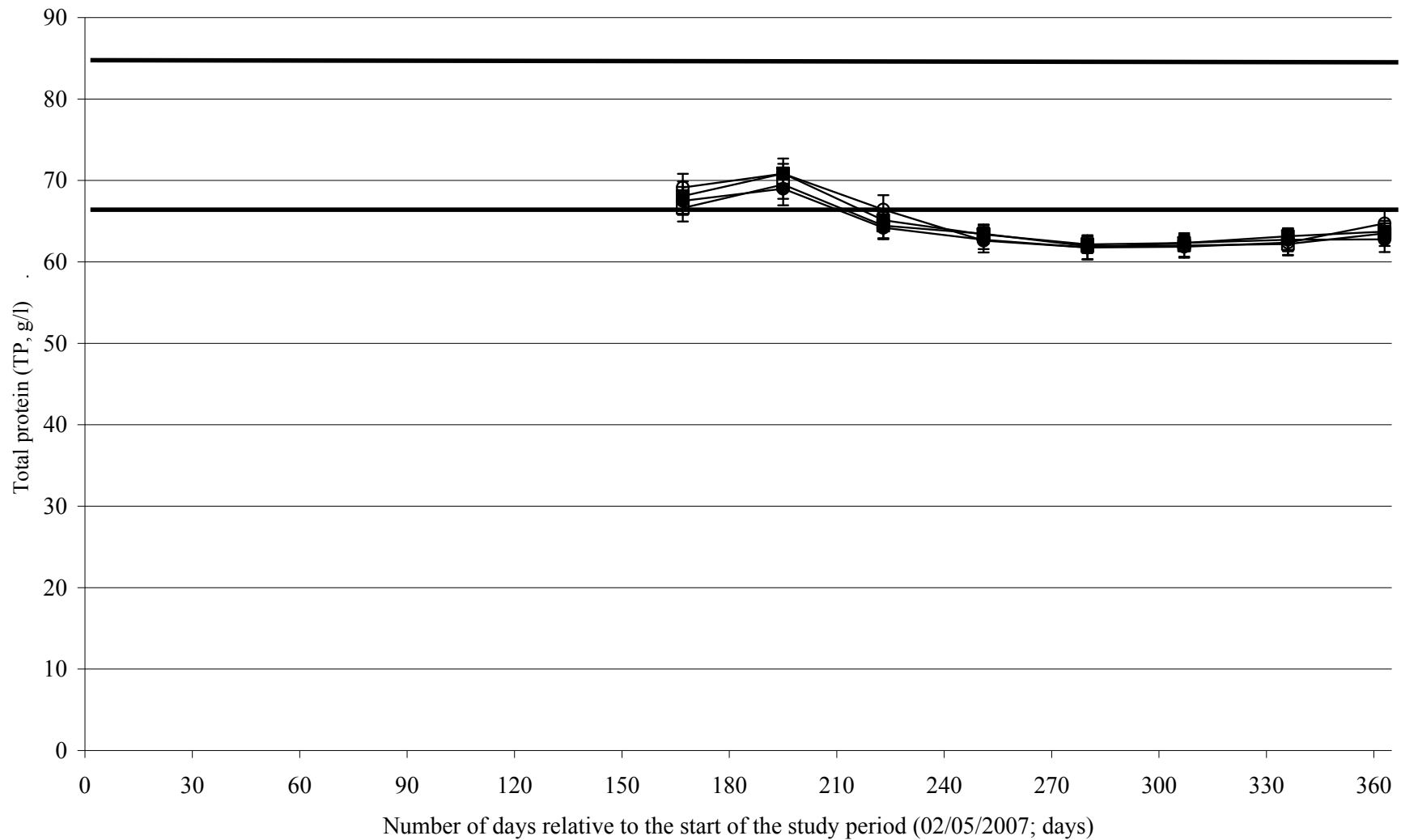


Figure 4.2. Mean±SEM serum total protein (TP, g/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

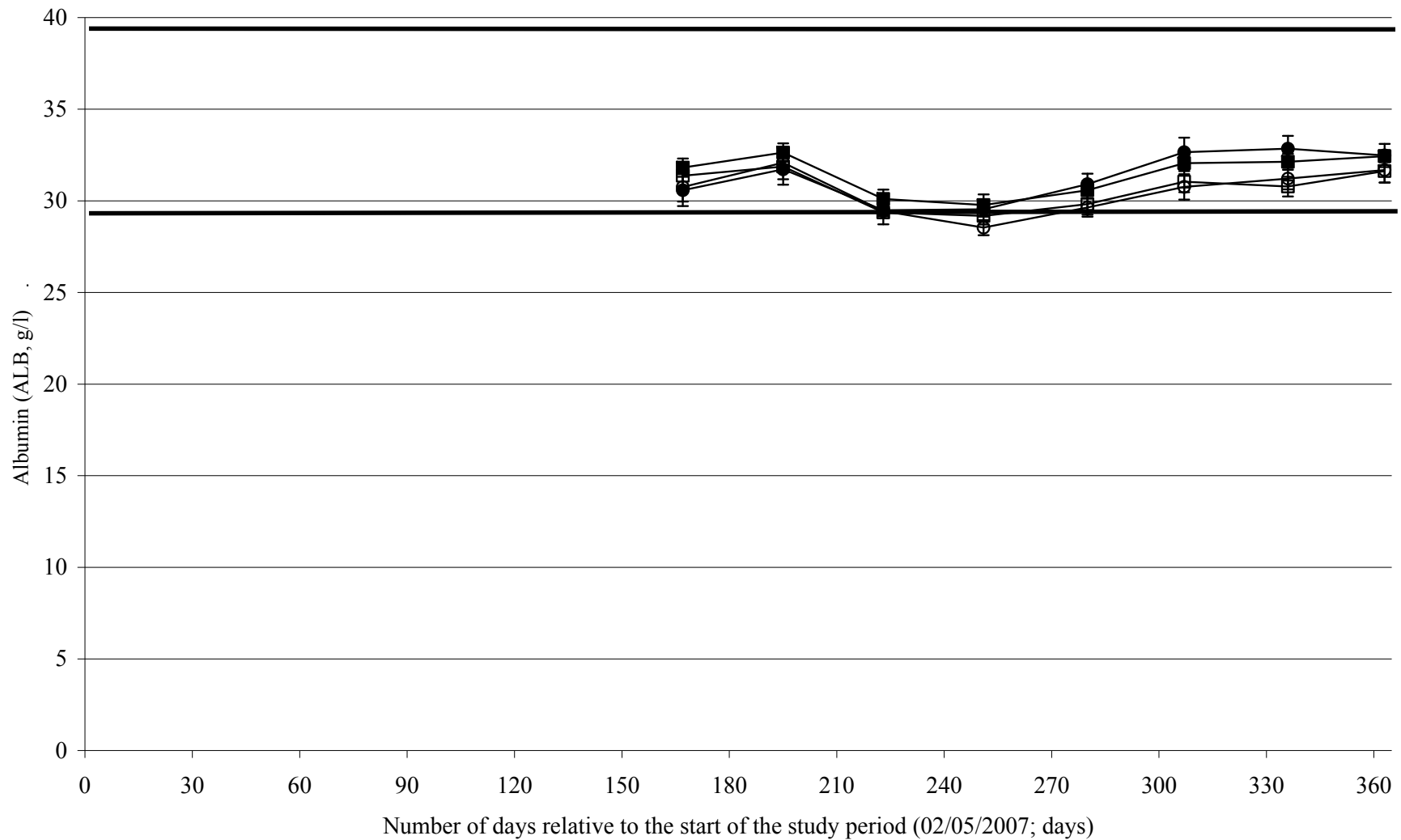


Figure 4.3. Mean±SEM serum albumin (ALB, g/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

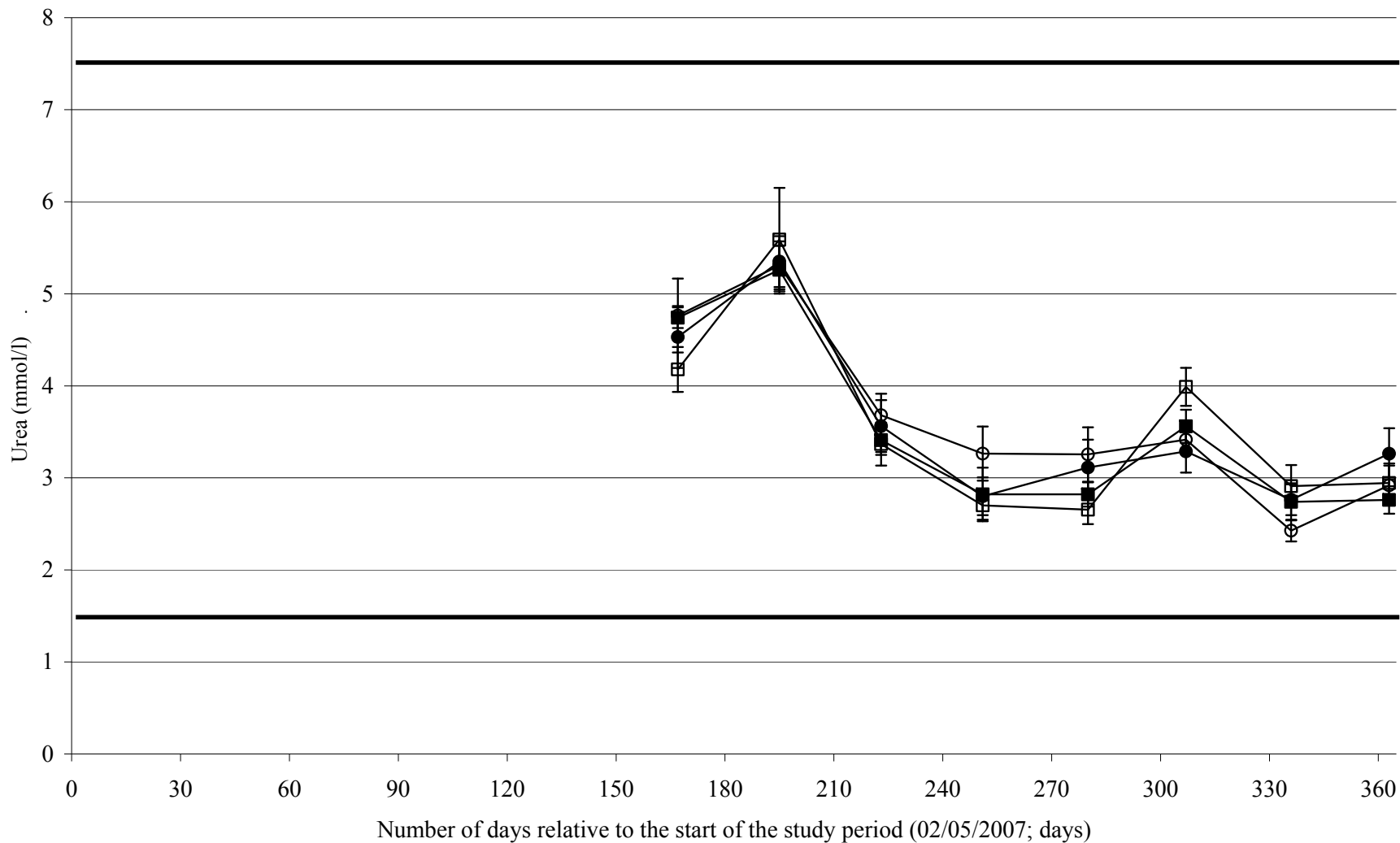


Figure 4.4. Mean±SEM serum urea (mmol/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

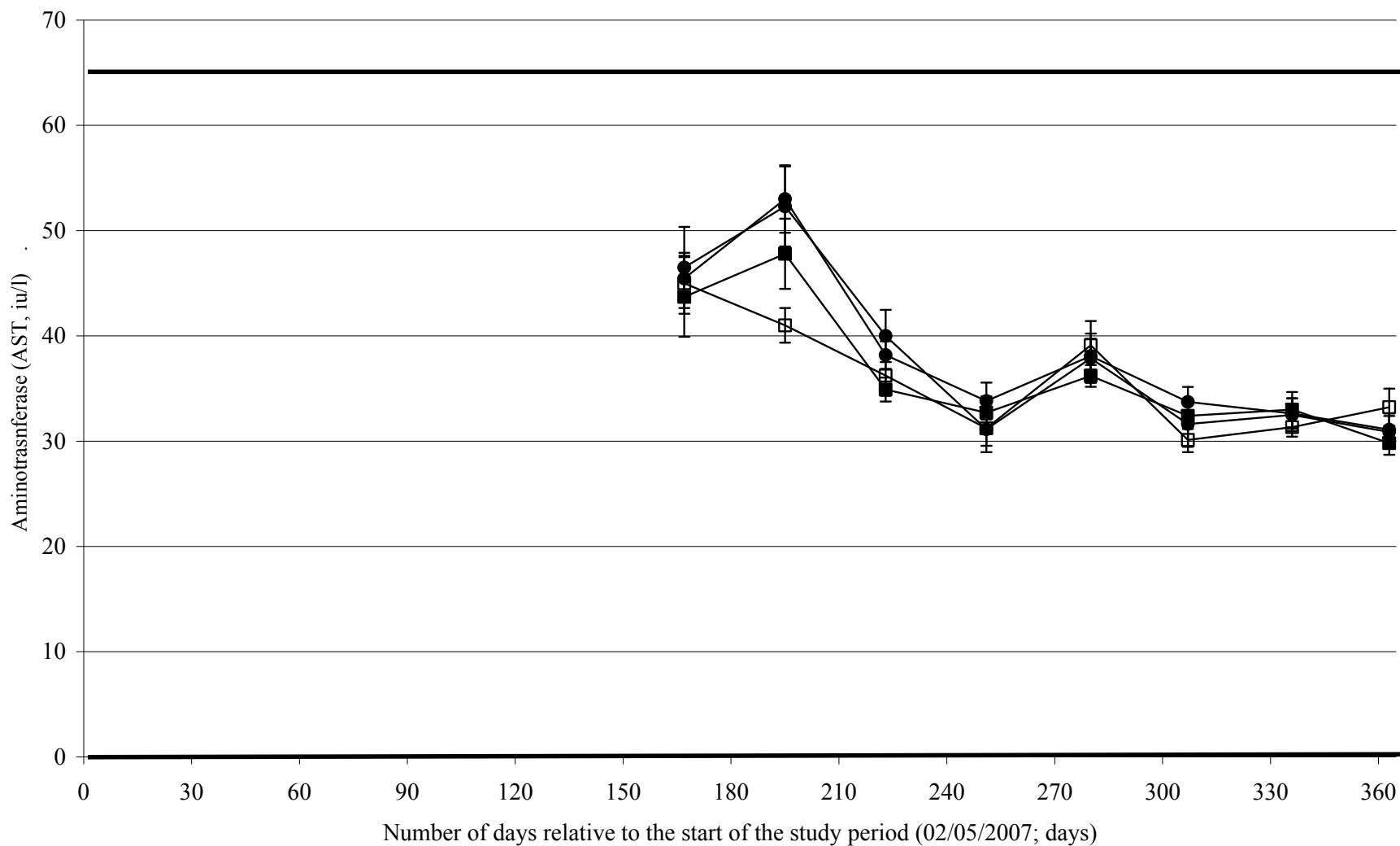


Figure 4.5. Mean±SEM serum aminotransferase (AST, iu/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vital* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

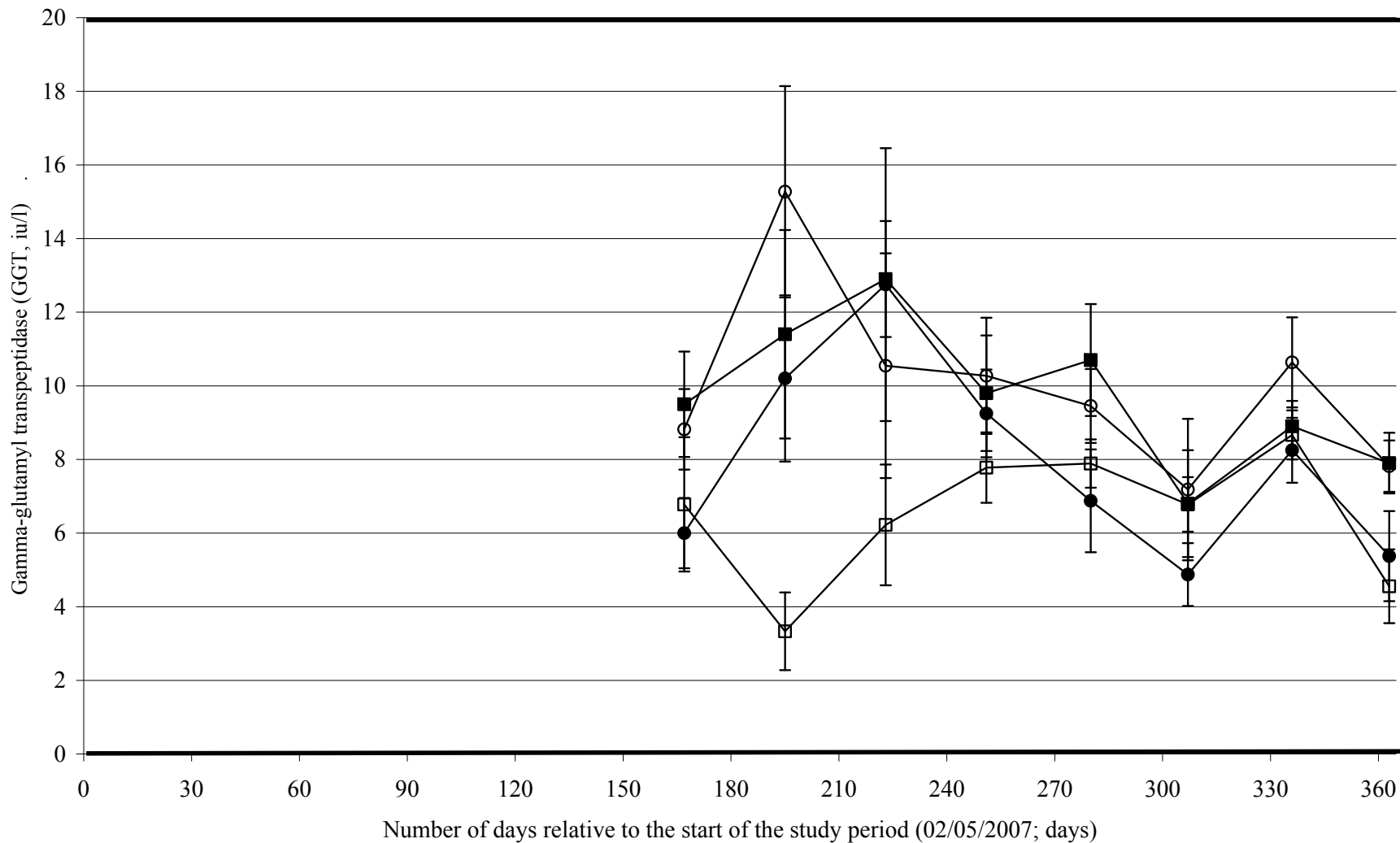


Figure 4.6. Mean±SEM serum gamma glutamyl transpeptidase (GGT, iu/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vital* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

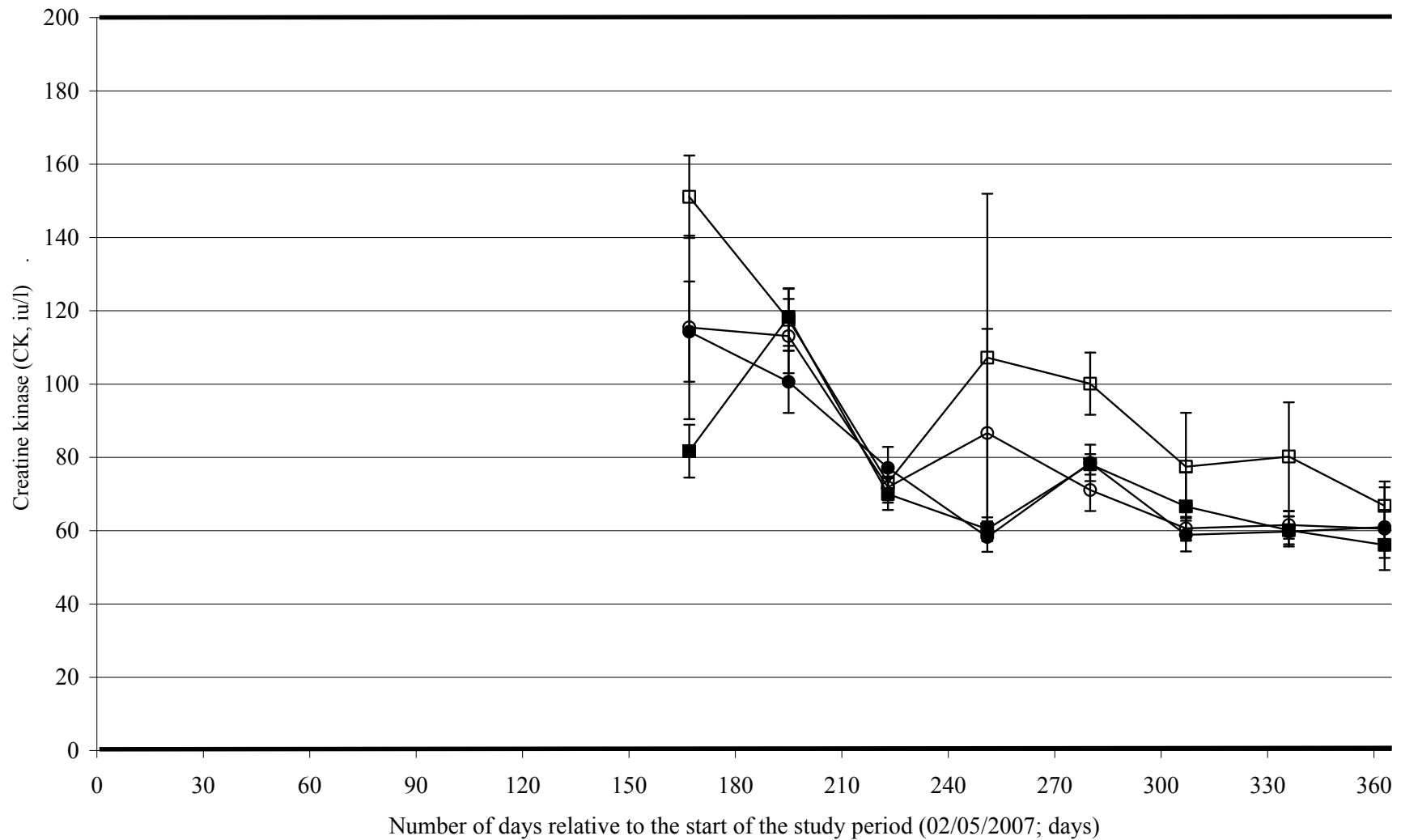


Figure 4.7. Mean±SEM serum creatine kinase (CK, iu/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●-); a selenium injection, *Tx2BVP* (■-) or a selenium and vitamin E injection, *Tx3Vitalis* (○-), or were moved off the index farm for a period of time, *Tx4OffFC* (□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

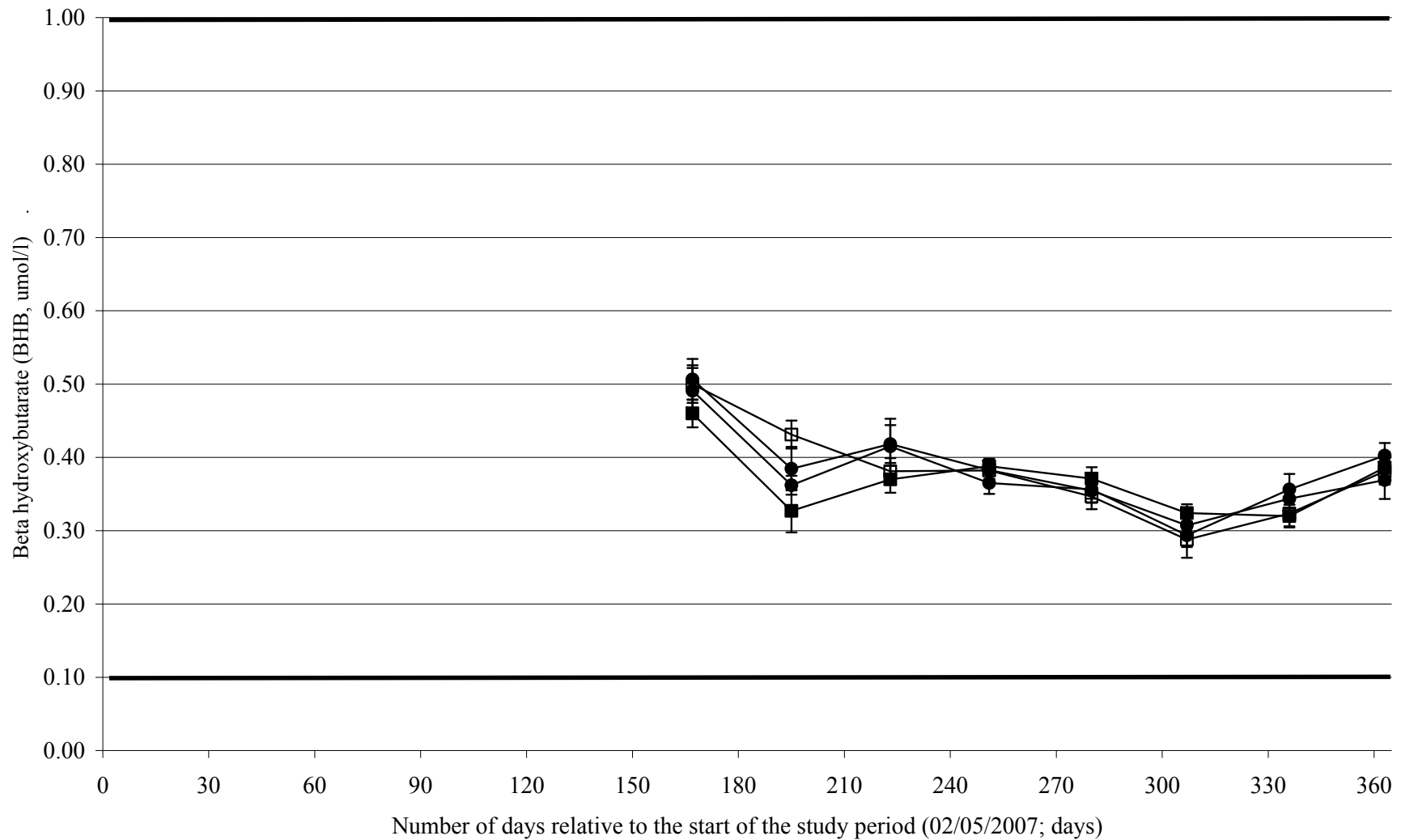


Figure 4.8. Mean±SEM serum beta hydroxybutyrate (BHB, umol/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 167 onwards, following the return of *Tx4OffFC* to the index farm

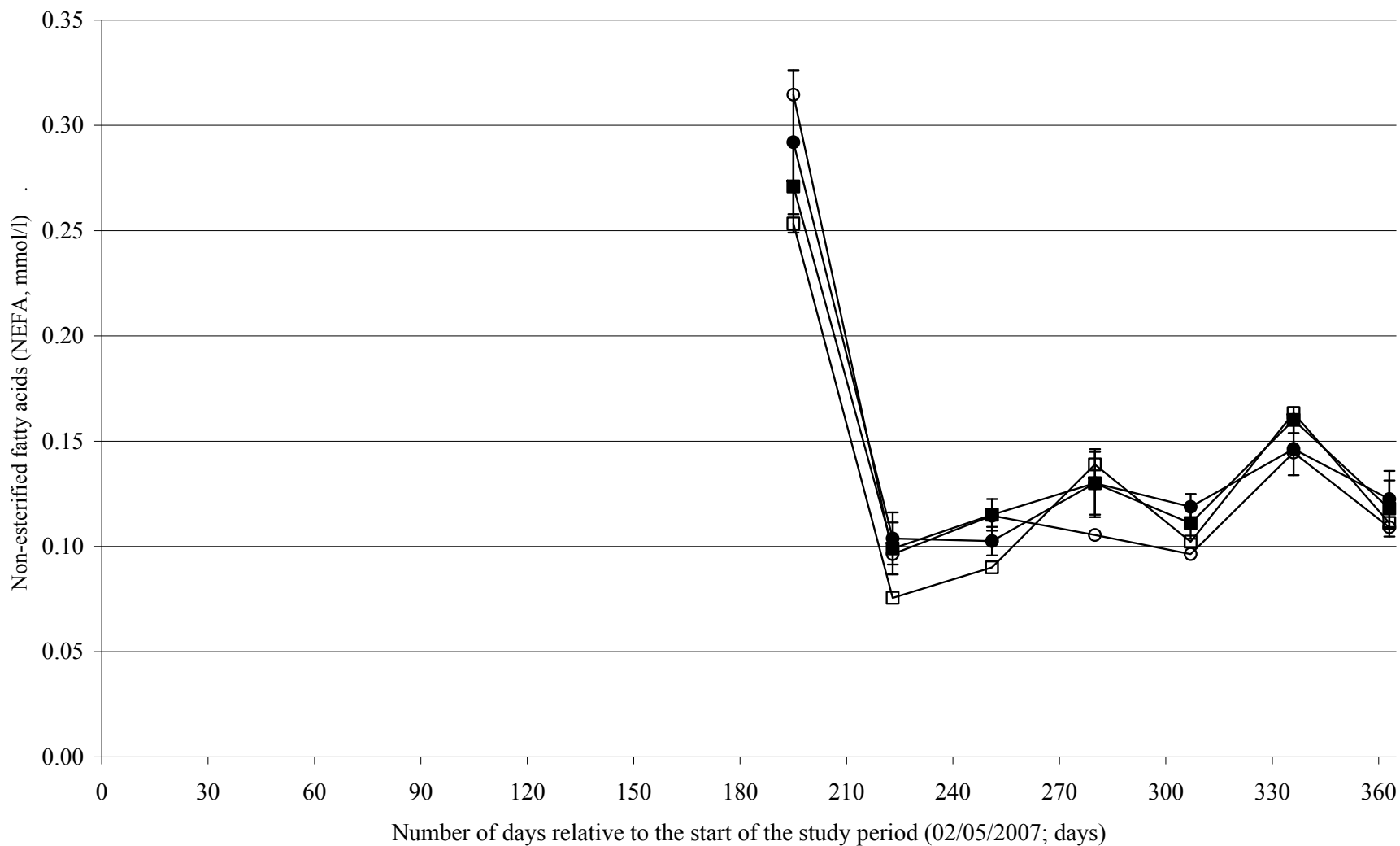


Figure 4.9. Mean±SEM serum non-esterified fatty acids (NEFA, mmol/l) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●-); a selenium injection, *Tx2BVP* (■-); or a selenium and vitamin E injection, *Tx3Vitasel* (○-), or were moved off the index farm for a period of time, *Tx4OffFC* (□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines. Samples collected from Day 195 to Day 363.

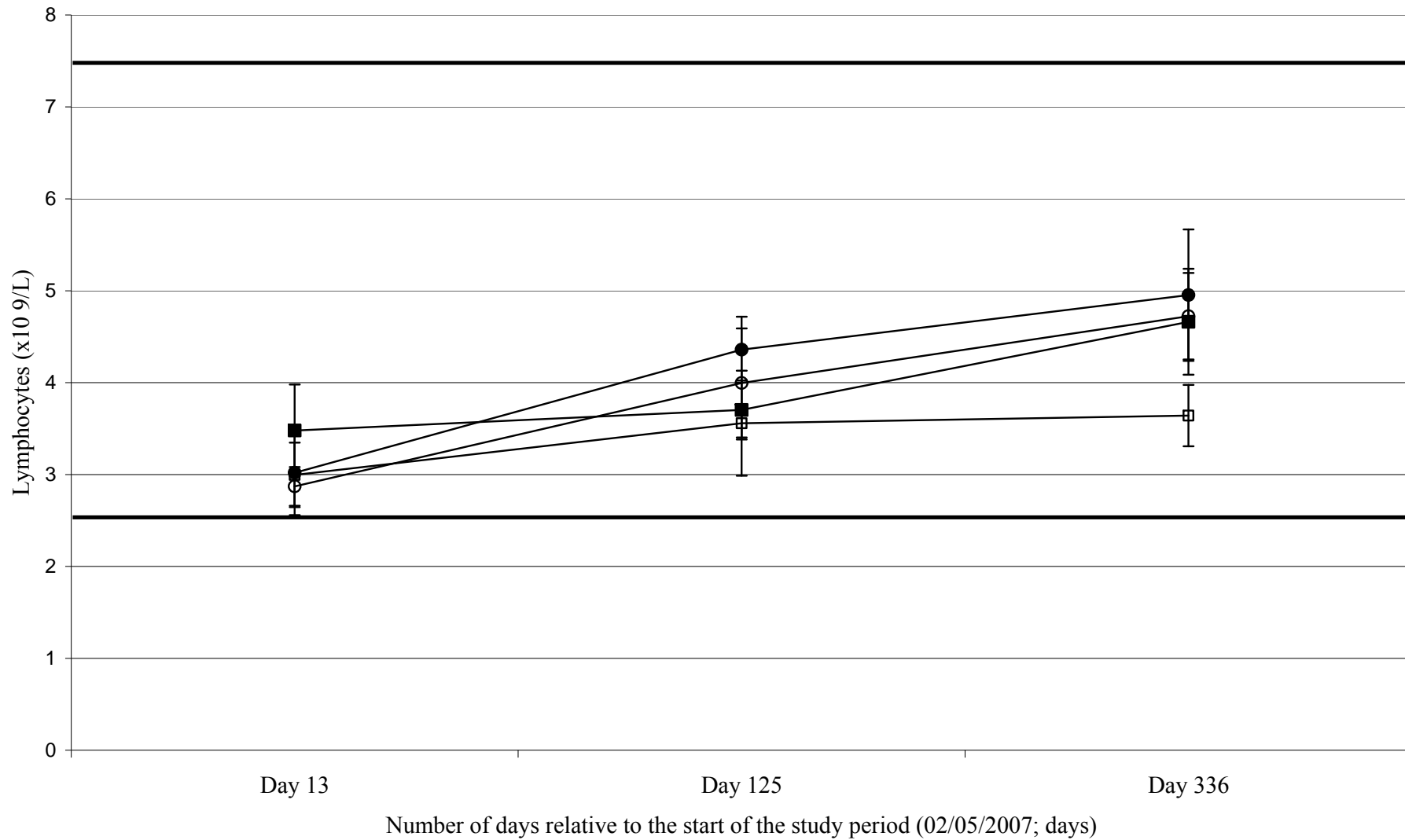


Figure 5.1: Representative mean±SEM lymphocytes ($\times 10^9/L$) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●); a selenium injection, *Tx2BVP* (■) or a selenium and vitamin E injection, *Tx3Vitasel* (○), or were moved off the index farm for a period of time, *Tx4OffFC* (□) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

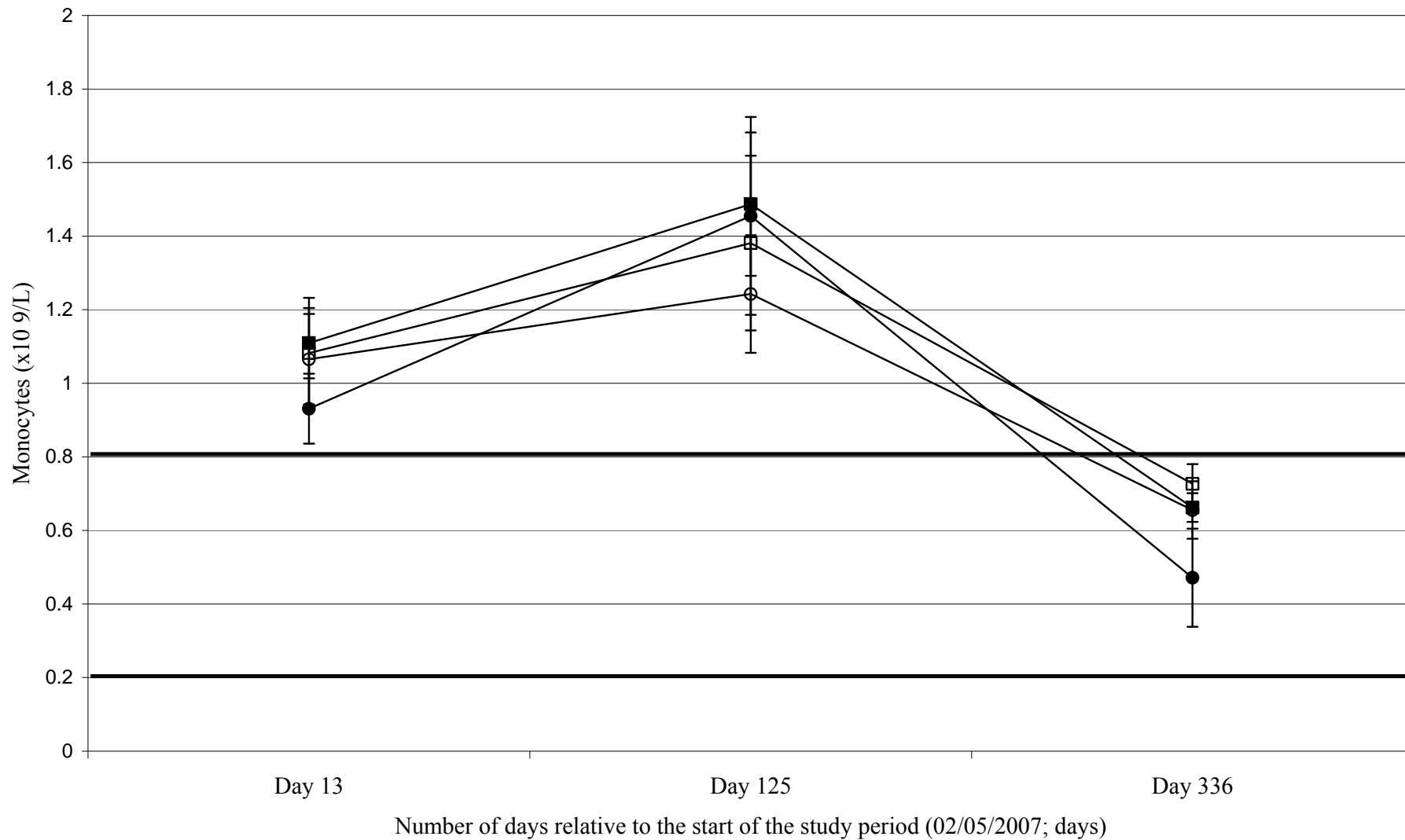


Figure 5.2: Representative mean±SEM monocytes (x10⁹/L) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (-●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

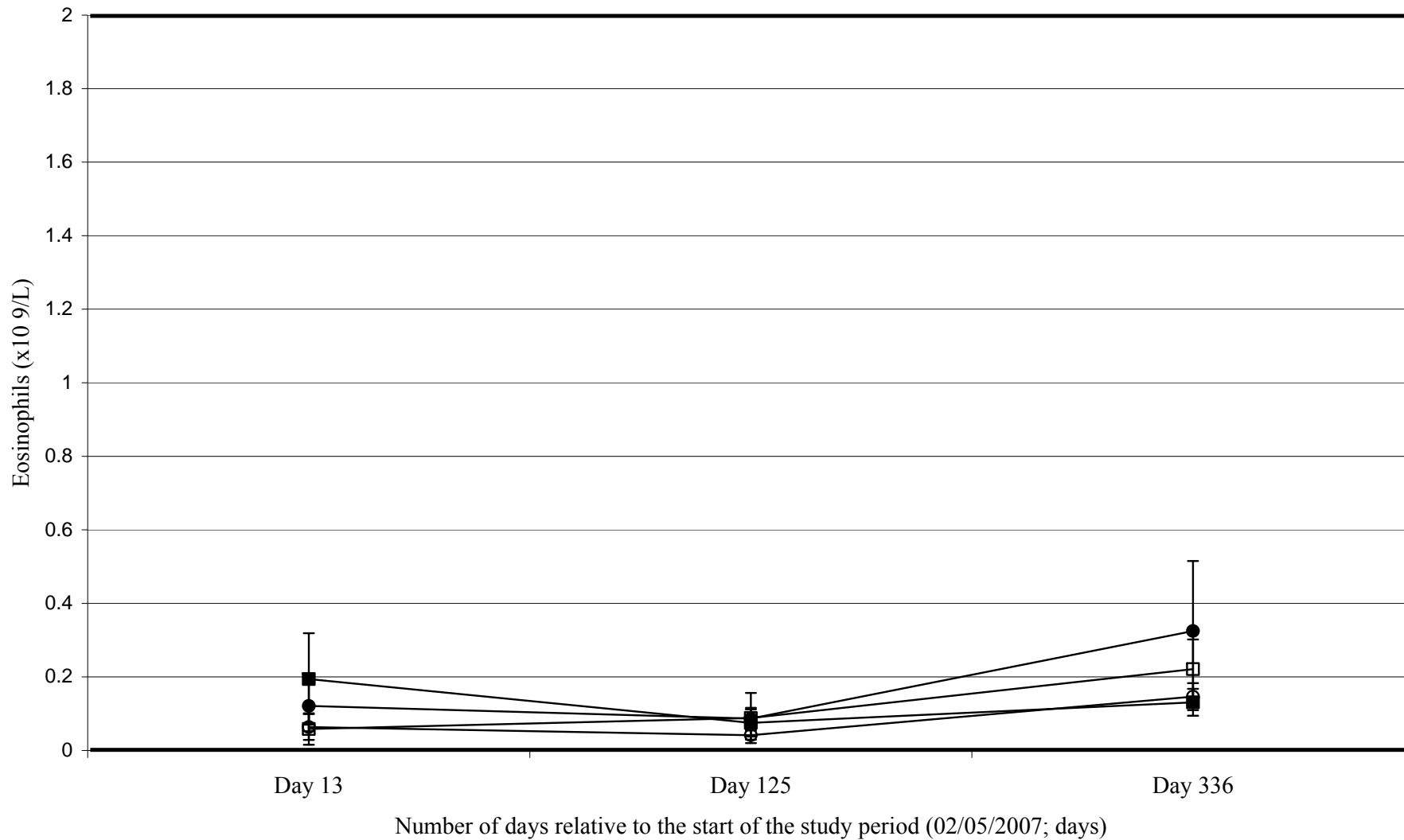


Figure 5.3: Representative mean±SEM eosinophils ($\times 10^9/L$) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●-); a selenium injection, *Tx2BVP* (-■-) or a selenium and vitamin E injection, *Tx3Vitasel* (-○-), or were moved off the index farm for a period of time, *Tx4OffFC* (-□-) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

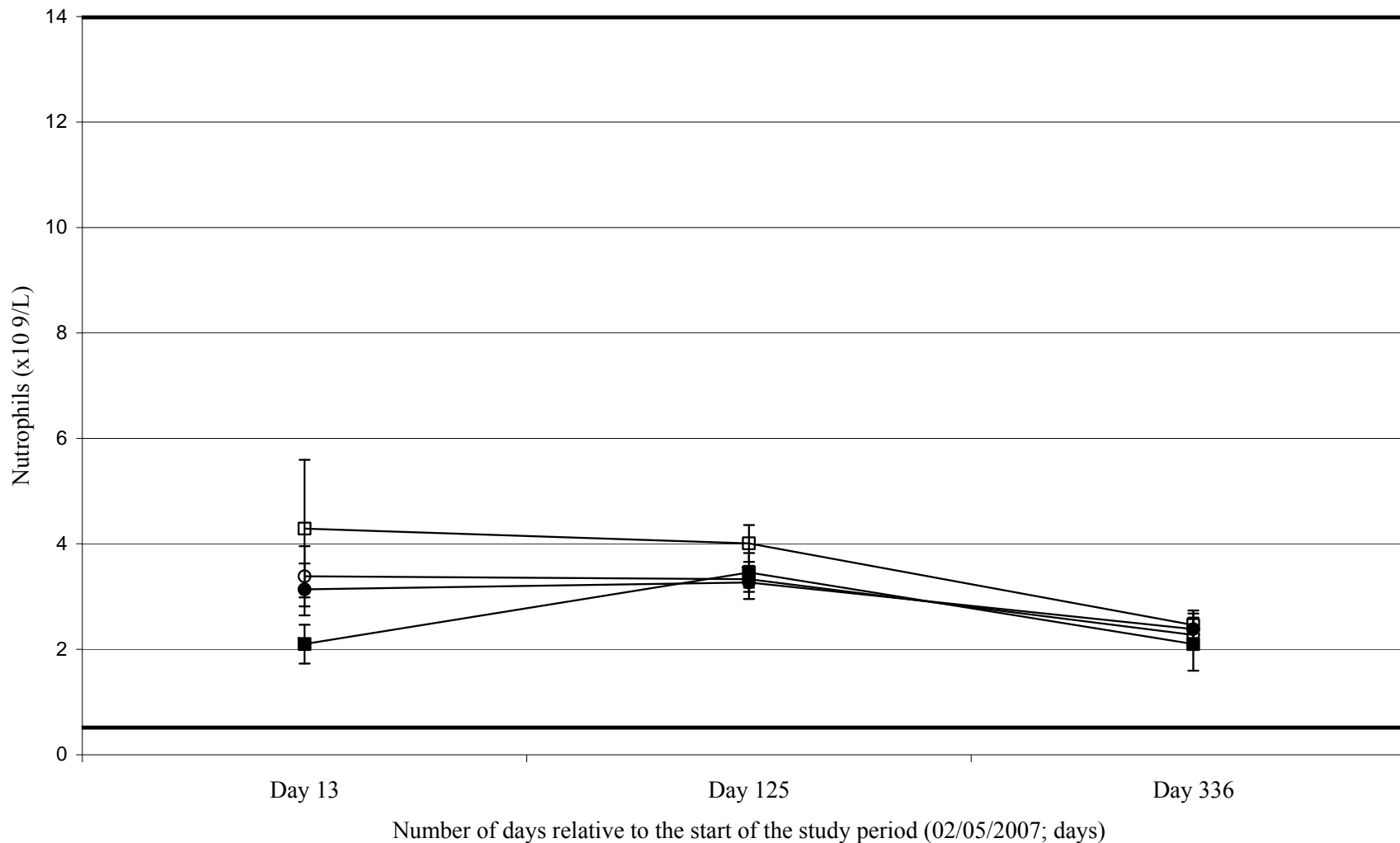


Figure 5.4: Representative mean±SEM neutrophils ($\times 10^9/L$) for four groups of animals that either remained on the index farm from 02/05/07 to 29/04/08 and received either no treatment, *Tx1OnFC* (●); a selenium injection, *Tx2BVP* (■) or a selenium and vitamin E injection, *Tx3Vitasel* (○), or were moved off the index farm for a period of time, *Tx4OffFC* (□) from 12/06/07 to 15/10/07. The normal range is indicated by the solid black lines.

5. Elemental screen

Table 5.1. Results from an elemental screen of fresh tissue samples from the two animals, A and B that were submitted for an elective post mortem in November 2007. Both animals were from the on farm control group (*Tx1OnFC*) that remained on the index farm for the duration of the study and received no supplementation.

Tissue type (Fresh)	Liver		Kidney		Lung		Adipose	
Element	Animal A	Animal B	Animal A	Animal B	Animal A	Animal B	Animal A	Animal B
Aluminium, mg/kg	0.7	1	1.9	1.1	1.2	1.7	1	1.1
Antimony, mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Arsenic, mg/kg	<0.03	<0.03	<0.03	0.05	<0.03	0.1	<0.03	<0.03
Barium, mg/kg	0.15	0.05	0.15	0.25	0.05	0.05	<0.05	0.05
Beryllium, mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Boron, mg/kg	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2
Cadmium, mg/kg	0.04	<0.03	0.12	0.11	<0.03	<0.03	<0.03	<0.03
Calcium, mg/kg	80	100	160	180	130	150	65	115
Chromium, mg/kg	0.1	0.2	1.1	0.2	1.2	0.2	0.3	0.2
Cobalt, mg/kg	0.08	0.16	0.04	0.06	<0.03	<0.03	0.9	<0.03
Copper, mg/kg	58	245	4.1	4.9	1.3	1.5	0.2	0.7
Fluoride (acid soluble), mg/kg	0.367	0.465	0.541	0.378	0.245	0.417	0.316	0.285
Iron, mg/kg	80	75	80	120	180	80	10	11
Lead, mg/kg	0.06	0.1	0.08	0.08	<0.03	0.1	<0.03	<0.03
Magnesium, mg/kg	175	170	170	140	110	140	17	30
Manganese, mg/kg	2.2	2.8	1.3	0.8	0.2	0.2	0.1	2.8
Mercury, mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03
Molybdenum, mg/kg	1	0.99	0.65	0.55	0.25	0.21	<0.03	0.99
Nickel, mg/kg	0.1	0.1	0.2	0.1	<0.10	0.2	<0.10	0.1
Phosphorous, mg/kg	2900	2900	2300	2200	1800	2250	240	360
Potassium, mg/kg	2700	2900	2200	2200	1850	2500	180	610
Selenium, mg/kg	0.12	0.14	0.8	0.64	0.15	0.12	0.04	0.05
Sodium, mg/kg	980	950	1800	2100	1860	1600	620	1800
Strontium, mg/kg	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1
Sulphur, mg/kg	1900	2200	1900	1700	1600	1500	310	500
Thallium, mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Tin, mg/kg	<0.10	<0.10	<0.10	<0.10	<0.03	<0.10	<0.10	<0.10
Vanadium, mg/kg	<0.05	<0.03	<0.05	<0.05	<0.03	<0.05	<0.05	<0.05
Zinc, mg/kg	24	50	13	13	10	13	1.8	3.3

Table 5.2. Results from an elemental screen of bone ash samples from the two animals, A (283 days old, 196kg LBW) and B (286 days old, 85kg LBW) that were submitted for an elective post mortem in November 2007. Both animals were from the on farm control group (*Tx1OnFC*) that remained on the index farm for the duration of the study and received no supplementation.

Bone type	Metatarsal		Rib	
	Animal A	Animal B	Animal A	Animal B
Aluminium, mg/kg	0.48	0.89	0.98	1.4
Antimony, mg/kg	<0.02	<0.02	<0.02	<0.03
Arsenic, mg/kg	<0.02	<0.02	<0.02	<0.03
Barium, mg/kg	721	270	735	809
Beryllium, mg/kg	<0.02	0.08	0.14	<0.03
Boron, mg/kg	<0.02	<0.02	<0.02	<0.03
Ca:P Ratio	2.07	2.05	1.99	1.98
Cadmium, mg/kg	<0.02	<0.02	<0.02	<0.03
Chromium, mg/kg	<0.02	<0.02	0.04	<0.03
Cobalt, mg/kg	0.21	0.13	0.15	0.17
Copper, mg/kg	<0.02	0.15	0.27	0.17
Fluoride ,mg/kg	7.73	12.65	7.41	5.43
Iron, mg/kg	20916	14281	15926	16298
Lead, mg/kg	0.17	0.12	0.59	0.16
Magnesium, mg/kg	70534	44651	62216	60594
Manganese, mg/kg	0.27	0.33	0.28	0.15
Mercury, mg/kg	<0.0002	<0.0002	<0.0002	0.1254
Molybdenum, mg/kg	0.16	0.07	0.23	<0.03
Nickel, mg/kg	1.37	0.91	1.01	1.01
Potassium, mg/kg	6735	5277	41062	34740
Selenium, mg/kg	0.52	0.66	0.51	0.28
Sodium, mg/kg	119766	95635	105822	137526
Strontium, mg/kg	2005	942	1337	1540
Thallium, mg/kg	<0.02	<0.02	<0.02	<0.03
Tin, mg/kg	<0.02	<0.02	<0.02	<0.03
Vanadium, mg/kg	<0.02	<0.02	<0.02	<0.03
Zinc, mg/kg	497	722	824	1030

6. Statistical models

Table 6.1: Health status, energy status, nutrition and growth models for analysis carried out to determine the effects of selenium and/or Vitamin E supplementation on calf performance on a farm in Ireland with reported shortfalls in animal performance

(i) Health status models

Group		Correlation structure	Model			sex	base	Trend
			Days	Tx	Tx.days			
Health status								
White blood Cells								
	WBC ^a	Pow	x	x	x		x	No
	Lymph	Pow	x				x	No
	Mono	Pow	x	x	x			No
	Eso ^a	Un	x	x	x		x	No
	Baso ^a	Sph	x	x	x		x	No
	Neut	Pow	x	x	x		x	No
Red blood cells								
	RBC ^b	Pow	x				x	No
	Hg ^b	Linl	x	x	x		x	No
	PCV	Linl	x	x	x		x	No
	MCV	Sph	x				x	No
	MCH	Pow	x	x	x		x	No
	MCHC	Pow	x				x	No
Platelets								
	Platelet	linl	x	x	x		x	No
Other								
	TP	Linl	x			x		No
	GGT ^b	Pow	x	x				No
	CPK	Un	x					No
	ALB	Pow	x					No
	AST ^a	Linl	x	x	x			No

a: The response variable was log transformed.

b: The response variable was Square-root transformed.

(ii) Energy status models

Group		Correlation structure	Model					
			Days	Tx	Tx.days	sex	base	Trend
Energy status								
	Urea	Pow	x			x		No
	Gluc	Cs	x					No
	BHB	Cs	x					No
	NEFA	Un	x					No

(iii) Nutrition models

Group		Correlation structure	Model					
			Days	Tx	Tx.days	sex	base	Trend
Nutrition								
Essential elements								
	Copper ^a	Pow	x	x	x			No
	Zinc ^a	Sph	x					No
	Selenium	Pow	x	x	x			No
	Sulphur	Pow	x					No
	Phosphorous ^a	Linl	x					No
	Iron ^a	Sph	x					No
	GPx	Sph	x	x	x		x	No
	PII ^b			x				
Heavy metals								
	Cadmium ^a	Cs	x					No

a: No baseline measurement taken

b: Only one measurement taken

(iv) Growth models

Group		Correlation structure	Model					
			Days	Tx	Tx.days	sex	base	Trend
Growth								
	Weight ^a	Sph	x	x	x	x	x	No
	ADG	Sph	x	x	x	x	x	No

a: The response variable was log transformed