

Supplementary Material

Maternal periconceptional and first trimester protein restriction in beef heifers: effects on maternal performance and early fetal growth

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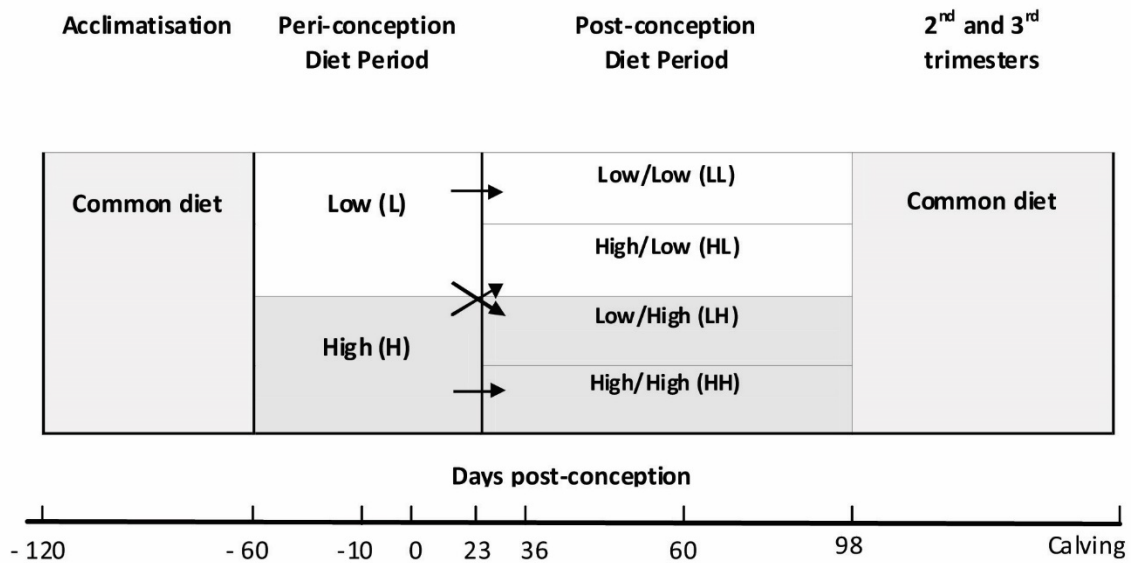
Figure S1. Diagrammatic representation of 2 x 2 factorial experimental design (not to scale).

Figure S2. Maternal plasma cortisol concentration profiles from 19 d before conception (-19 dpc) through to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during the periconception (a, b; PERI: -60 to 23 dpc) or post-conception (c, d; POST: 24 to 98 dpc) periods of gestation.

Figure S3. Plasma bovine pregnancy associated glycoprotein (bPAG) concentration profiles from 36 dpc to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during the periconception (a, b; PERI: -60 to 23 dpc) or postconception (c, d; POST: 24 to 98 dpc) periods of gestation.

Figure S4. Maternal plasma bovine placental lactogen (bPL) concentration profiles from 128 dpc to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during periconception (a, b; PERI: -60 to 23 dpc) or postconception (c, d; POST: 24 to 98 dpc) periods of gestation.

Table S1. Ingredients and nutrient content of heifer rations for induction period, the PERI (-60 to 23 dpc) and POST-conception period (24 to 98 dpc) and 2nd and 3rd trimester of gestation (99 dpc to term).



Animal husbandry time -points

- ∑ -10 dpc Estrus synchronisation (CUE -MATES inserted)
- ∑ 0 dpc Artificial Insemination
- ∑ 36 dpc Pregnancy status determined by ultrasound. Non -pregnant heifers removed
- ∑ 60 dpc Fetal sex determined by ultrasound
- ∑ 98 dpc Subset of heifers euthanised (singletons; n = 46)

Figure S1. Diagrammatic representation of 2 x 2 factorial experimental design (not to scale).

¹Abbreviations: PERI = Periconception diet period (-60 to 23 dpc); POST = Post-conception diet period (24 to 98 dpc); Low (L) = low protein diet; High (H) = high protein diet; Low/Low (LL) = low protein diet in the peri- and post-conception period; High/Low (HL) = high protein diet during periconception and low protein diet in post-conception period; Low/High (LH) = low protein diet during periconception and high protein diet in post-conception period; High/High (HH) = high protein diet in the peri- and post-conception period.

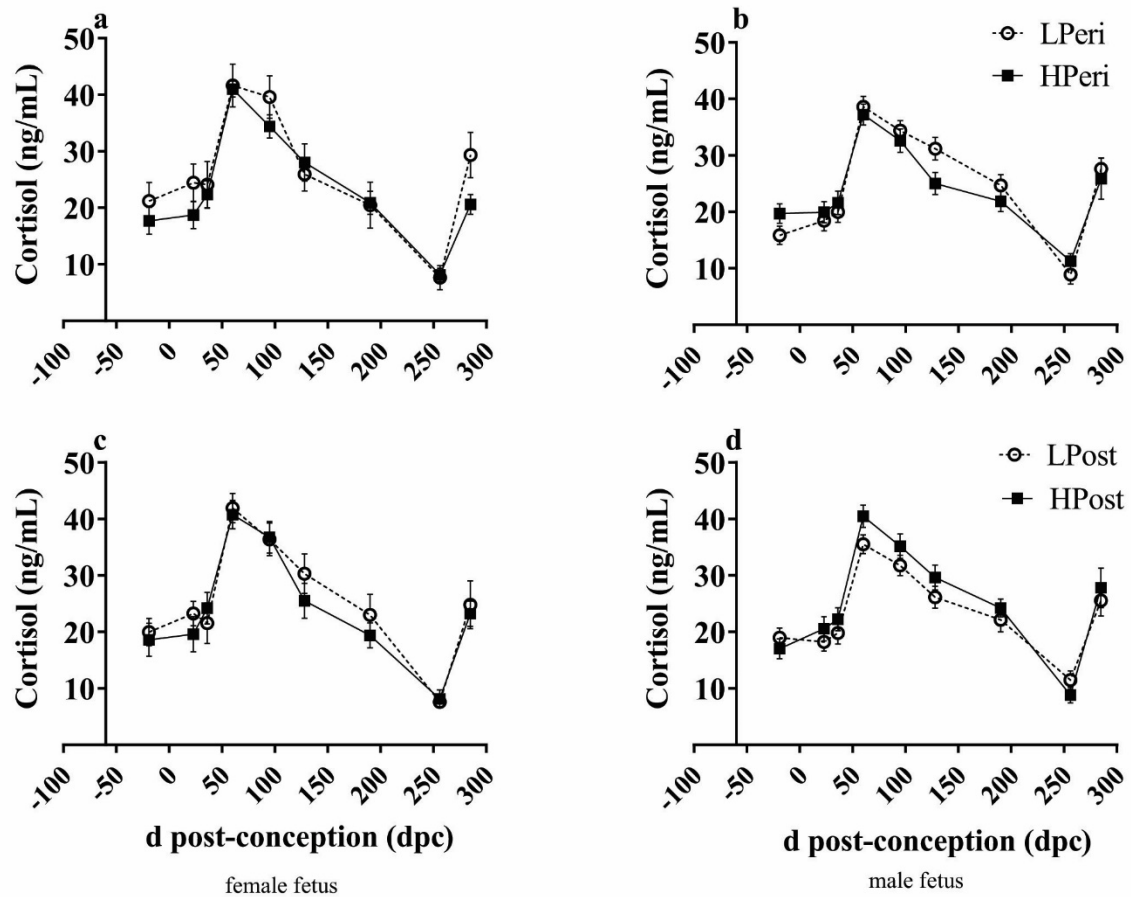


Figure S2. Maternal plasma cortisol concentration profiles from 19 d before conception (-19 dpc) through to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during the periconception (a, b; PERI: -60 to 23 dpc) or post-conception (c, d; POST: 24 to 98 dpc) periods of gestation. Data from heifers carrying female fetuses (a, c) are presented in the left panel and in right panel (b, d) for heifers with male fetuses. ¹Total number of heifers until 98 dpc (n = 109), after 98 dpc (n = 63). No differences within any time point ($P > 0.50$).

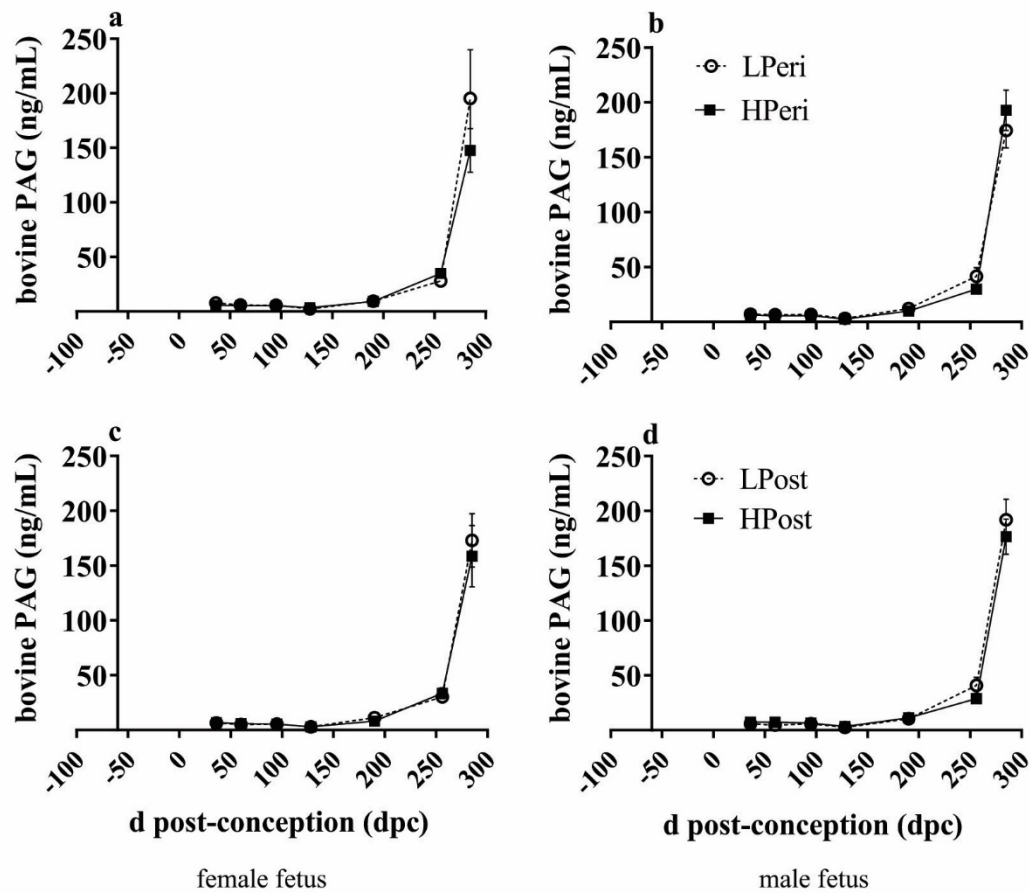


Figure S3. Plasma bovine pregnancy associated glycoprotein (bPAG) concentration profiles from 36 dpc to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during the periconception (a, b; PERI: -60 to 23 dpc) or postconception (c, d; POST: 24 to 98 dpc) periods of gestation. Data from heifers carrying female fetuses (a, c) are presented in the left panel and in right panel (b, d) for heifers carrying male fetuses. ¹Total number of heifers until 98 dpc (n = 109), after 98 dpc (n = 63). No differences within any time point ($P > 0.50$).

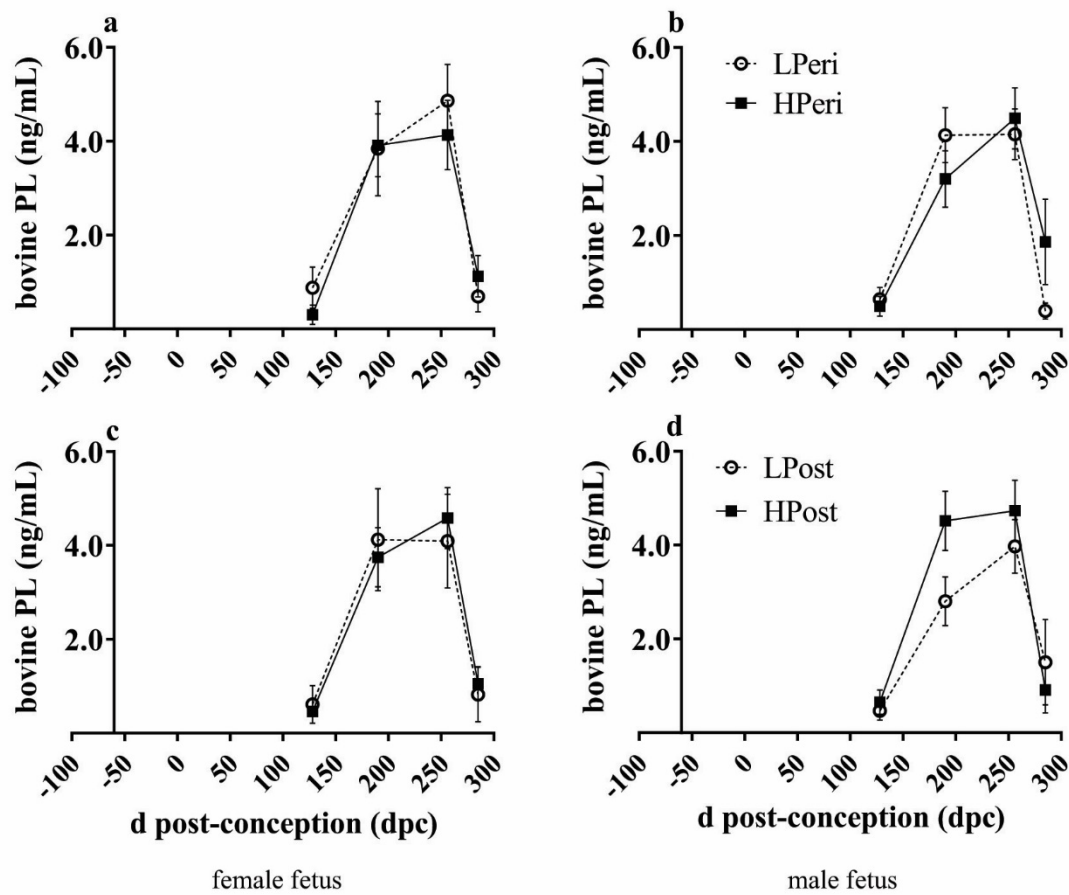


Figure S4. Maternal plasma bovine placental lactogen (bPL) concentration profiles from 128 dpc to term by fetal sex in heifers¹ fed diets low (L) or high (H) in protein during periconception (a, b; PERI: -60 to 23 dpc) or postconception (c, d; POST: 24 to 98 dpc) periods of gestation. Data from heifers carrying female fetuses (a, c) are presented in the left panel and in right panel (b, d) for heifers carrying male fetuses. ¹Total number of heifers after 98 dpc (n = 63). No differences within any time point ($P > 0.50$).

Table S1. Ingredients and nutrient content of heifer rations for induction period, the PERI (-60 to 23 dpc) and POST-conception period (24 to 98 dpc) and 2nd and 3rd trimester of gestation (99 dpc to term).

	Induction	PERI		POST		2nd and 3rd Trimester
		conception		conception		
		L	H	L	H	
Ration as fed						
Wheat (kg)	0.66	1.81	0.48	2.12	0.56	0.60
Canola meal (kg)	2.23	-	-	-	-	0.89
Soybean meal (kg)		0.48	1.83	0.56	2.14	0.44
Barley Straw (kg)	7 ¹	5.5	6.7	10.2	10.7	8.6
Molasses (g)	90	72	72	84	84	60
Biofos MDCP (g)	-	19	-	22	-	-
Salt (g)	15	12	12	14	14	10
Vitamin / trace mineral Premix (g)	3	2	2	3	3	2
Dry Matter (kg)	9.1 ²	7.2	8.3	11.8	12.3	9.6
Total energy (MJ ME)		63	71	98	102	79
% of energy requirements ³		85	96	136	142	125
Total crude protein (kg)		0.62	1.18	0.88	1.49	0.92
% of protein requirements ³		67	127	72	123	88
% CP (total diet)		8.6	14.2	7.4	12.1	9.6
% Fat ²		1.5	1.4	1.4	1.4	1.5
% Starch ²		15.1	4.7	10.9	3.8	4.8
Total calcium (g)		22	26	37	38	33
% of calcium requirements ³		110	130	185	190	132
Total phosphorus (g)		17	17	21	21	20
% of phosphorus requirements ³		130	130	160	160	125

¹assumed value

²predicted value

³Dietary requirements were calculated using Nutrient Requirements of Domesticated Ruminants (Freer 2007) .

Input values were based upon nutrient analysis of component ingredients in the total diet, liveweight and age of heifers at each diet change, mature cow weight of 550 kg and the desired growth target.

L = Low H = High

Key assumptions:

Calculations use the formulated values for pellets and actual values for straw.

PERI-conception diet is based upon 340 kg Santa Gertrudis heifer gaining 0.5 kg/day.

POST-conception diet is based upon 400 kg, 60 dpc Santa Gertrudis heifer gaining 0.5 kg/day.

Second and 3rd trimester diet is based upon 480 kg, 200 dpc Santa Gertrudis heifer gaining 0.5 kg/day.

References

Freer, M. (2007) 'Nutrient Requirements of Domesticated Ruminants.' (CSIRO Publishing: Melbourne.)