Convegno Annuale ASIC (Associazione Scientifica Italiana di Coniglicoltura)

La coniglicoltura italiana tra Green Deal e PNRR

Strategies to improve management of rabbit reproduction

8th September 2021

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https://veterinaria.ucm.es/conerepro

What is the situation where are we?

- Balance between the high costs and animal physiology and welafare in the context of the Green deal and circular economy for environment sustainability and to obtain quality products
- Attract consumers!!

www.vivus.es

https://thefoodtech.co

https://tontoton.com/

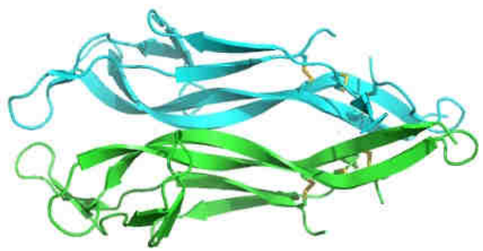
https://ecoviand.com/

Rabbit female reproductive challenges and strategies

- Low primiparous rabbit performance → Feeding restriction during second pregnancy

https://www.elmolinogetafe.com/

- Ovulation induction by hormonal preparations → Use of ovulating inducing factor Nerve Growth Factor (NGF)



Feeding restriction strategies in primiparous pregnant rabbit females

Feeding costs are 50-70% of the total farm costs

Moderate Maternal Feed Restriction (MFR) during second pregnancy (Day 0-21)

Embryo development, implantation, organogenesis and placenta development takes place

Primiparous rabbit females

High nutritional requirements (lactation and growth)

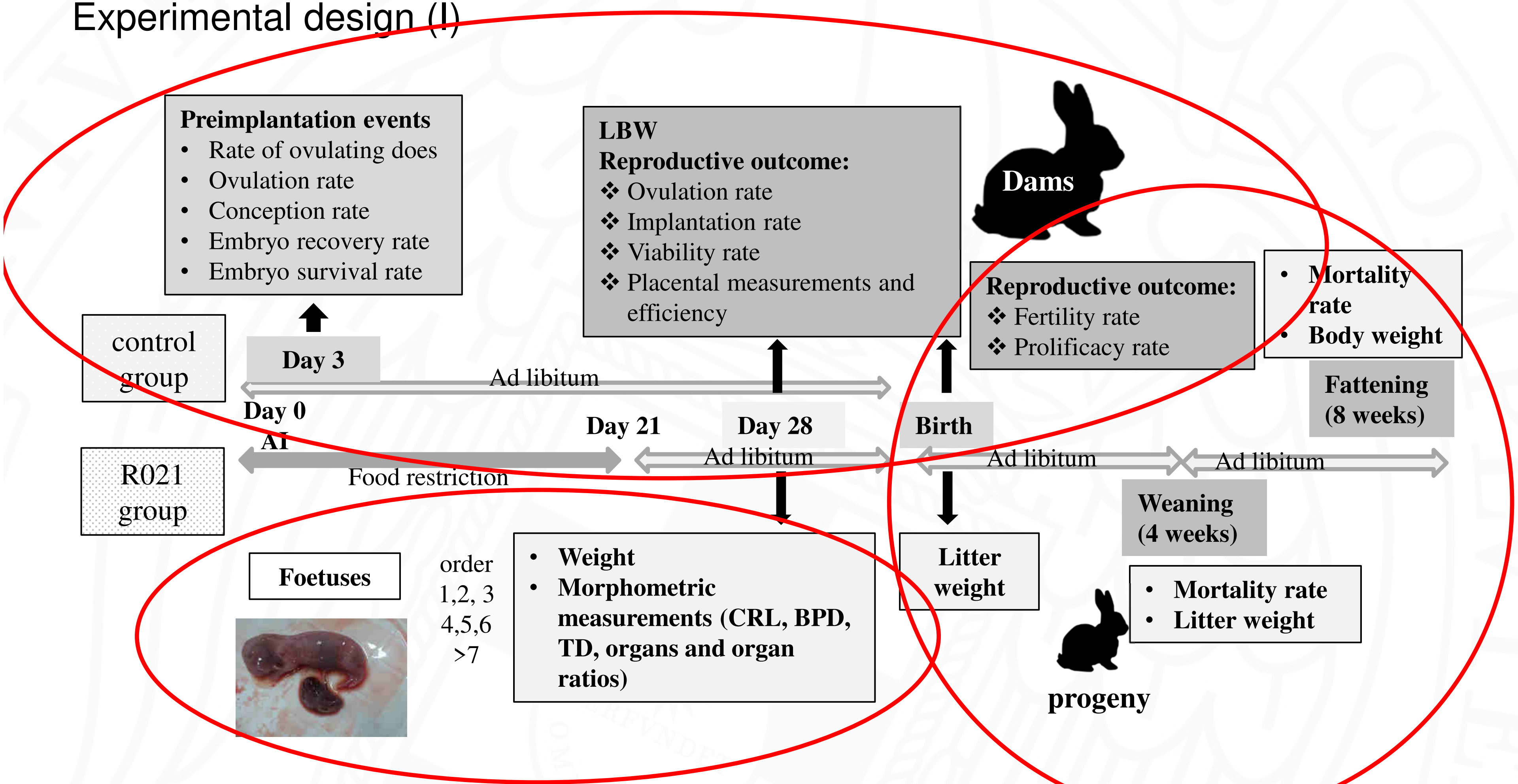
Extensive reproductive rhythm (artificial insemination at Day 30 post-partum)

Important risk of **fattening** that **impairs pregnancy rate**

Is maternal reproductive outcome affected? Is fetal growth and development and kits growth influenced by MFR?

Feeding restriction strategies in primiparous pregnant rabbit females

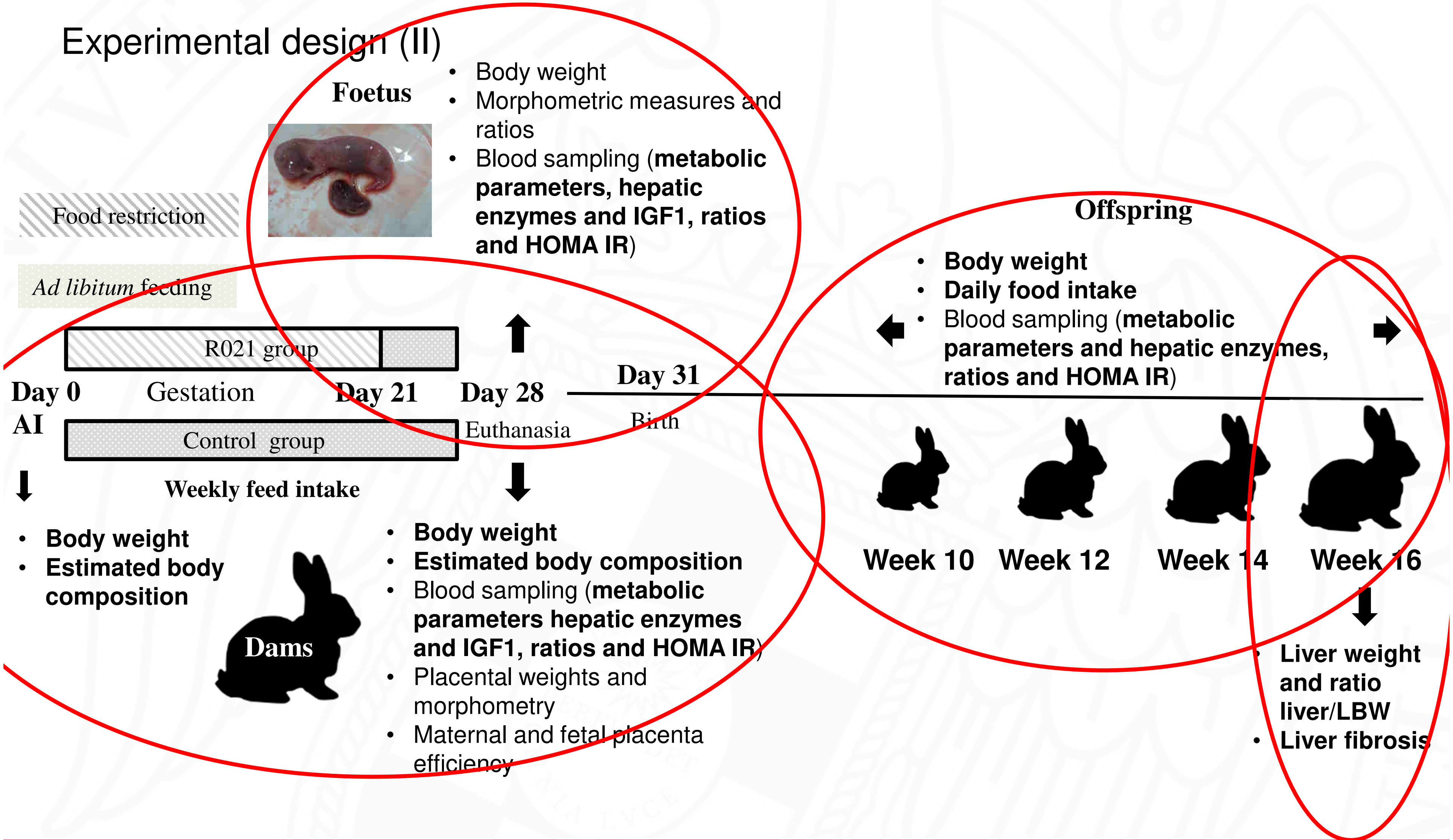
Experimental design (I)



MFR was set in the 60% of the measured voluntary feed intake of the first pregnancy (105g/day)

Feeding restriction strategies in primiparous pregnant rabbit females

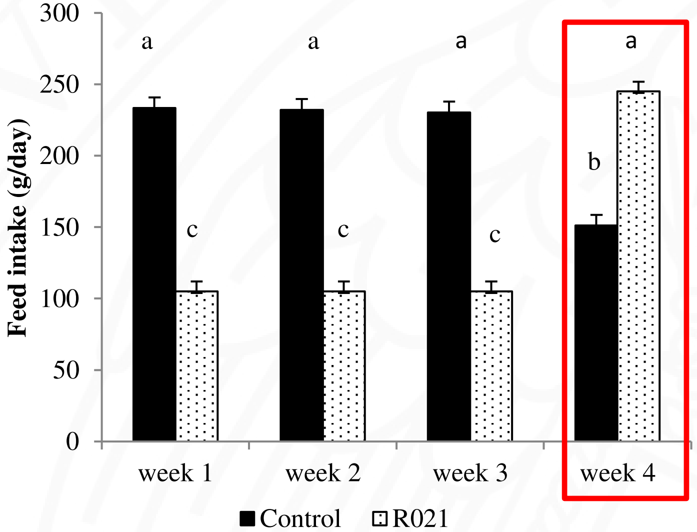
Experimental design (II)



Feeding restriction strategies in primiparous pregnant rabbit females

Dams

Food intake



Feeding consumption increased after the end of restriction period

Metabolic parameters

	Control (n = 7)	R021 (n = 7)	p > f
Glucose (mg/dL)	119.4 ± 8.29	102.3 ± 8.29	0.1715
Insulin (mU/L)	8.37 ± 2.10	12.34 ± 2.10	0.2078
Ratio glucose/insulin	18.1 ± 6.05	16.2 ± 2.10	0.8308
HOMA IR index[1]	2.46 ± 0.52	2.90 ± 0.52	0.5602
TG (mg/dL)	78.6 ± 12.9	88.2 ± 12.9	0.6096
Total cholesterol (mg/dL)	31.6 ± 4.62	23.9 ± 4.62	0.2597
Ratio TG/cholesterol	2.97 ± 0.72	4.06 ± 0.72	0.3074
AST(U/L)	58.4 ± 20.3	103 ± 20.3	0.1461
ALT (U/L)	9.14 ± 6.11	23.6 ± 6.11	0.1194
Ratio AST/ALT	6.77 ± 1.32	5.64 ± 1.32	0.5553
IGF1 (ng/mL)	267.9 ± 26.1	296.4 ± 26.1	0.4621

Metabolic status was not affected by restriction

Estimated body composition by bioimpedance

	Control (n = 7)		R021 (n = 7)		P_{time} > f	P_{MFR} > f	$P_{timexMFR}$ > f
	Day 0	Day 28	Day 0	Day 28			
LBW (g)	3990 ± 122.0	4692 ± 122.0	4049 ± 86.6	4608 ± 86.6	0.0001	0.9288	0.1989
Water (%)	58.8 ± 1.75	88.0 ± 1.75	58.8 ± 1.24	86.8 ± 1.24	0.0001	0.6609	0.7218
Ash (%)	3.30 ± 0.05	3.06 ± 0.05	3.30 ± 0.03	3.08 ± 0.03	0.0003	0.8481	0.8036
Lipids (%)	15.4 ± 1.78	11.9 ± 1.78	15.3 ± 1.26	12.1 ± 1.26	0.0835	0.9780	0.9454
Proteins (%)	19.36 ± 0.13	17.6 ± 0.13	19.38 ± 0.09	17.7 ± 0.09	0.0001	0.7102	0.7530
Energy (MJ/kg)	147.0 ± 80.6	955.7 ± 80.6	1144.0 ± 57.0	966.04 ± 57.0	0.0439	0.9518	0.9350

Body composition did not change by maternal feed restriction

Feeding restriction strategies in primiparous pregnant rabbit females

Preimplantation and preterm events

	Control	R021	*P* value
Day 3 post-IA			
Ovulating females (%)	100	90	0.336
Number of CL/ ovary	10.7 ± 1.09	7.42 ± 1.19	0.1870
Embryo viability (%)	75.4 ± 13.6	70.1 ± 14.4	0.7911
Day 28 post-IA			
Total number of foetuses	11.00	14.00	0.05
Implantation rate (%)[1]	88.91	96.21	0.0001
Viability rate (%)[2]	94.64	90.00	0.34

[1] (number of viable foetuses/number of CL) x100. CL: corpus luteum, [2] (number of viable foetuses/total number of foetuses) x100.

Reproductive outcome at delivery

	Control (n=61)	R021 (n=60)	*P* value
Fertility (%)[1]	73.78	76.67	0.83
Prolificacy			
Total of newborns	11.55	10.82	0.33
Born alive	11.22	10.58	0.41
Stillborns	0.33	0.24	0.59

1 (number of parturitions/number of AI) x100. AI: artificial insemination

More foetuses and more implantation rate for restricted mothers
(to preserve the species and maintain litter size)

Maternal reproductive outcome was not affected

Feeding restriction strategies in primiparous pregnant rabbit females

Morphometric measurements and calculated ratios

	Control (n = 7)	R021 (n = 7)	$p > f$
Morphometric measurements			
Biparietal diameter (mm)	19.4 ± 0.15	19.1 ± 0.13	0.2291
Crown-rump length (mm)	100.7 ± 0.76	99.3 ± 0.68	0.1998
Thoracic diameter (mm)	20.9 ± 0.30	20.6 ± 0.27	0.4534
Fetus weights			
Total (g)	39.4 ± 0.74	38.2 ± 0.67	0.2733
Head (g)	9.45 ± 0.15	9.23 ± 0.13	0.3245
Trunk (g)	28.5 ± 0.59	27.8 ± 0.52	0.4302
Liver (g)	2.52 ± 0.10	2.40 ± 0.08	0.3940
Gut (g)	1.89 ± 0.06	1.90 ± 0.05	0.8697
Brain (g)	0.91 ± 0.02	0.93 ± 0.01	0.4239
Weight ratios			
Brain ratio (%)	2.36 ± 0.06	2.48 ± 0.05	0.1385
Liver ratio (%)	6.40 ± 0.17	6.49 ± 0.14	0.7288
Brain: Liver ratio (%)	37.9 ± 1.98	39.9 ± 1.66	0.4546

Foetuses

Morphometric measurements of foetus and placenta development was not affected by feeding restriction

Metabolic parameters

	Control (n = 30)	R021 (n = 30)	$p > f$
Glucose (mg/dL)	46.26 ± 3.16	49.70 ± 3.99	0.5028
Insulin (mU/L)	3.80 ± 0.77	7.28 ± 0.87	0.0063
Ratio insulin/glucose	0.10 ± 0.18	0.15 ± 0.02	0.0600
HOMA IR index [1]	0.40 ± 0.09	0.87 ± 0.07	0.0001
TG (mg/dL)	95.00 ± 4.98	112.44 ± 6.07	0.0347
Total cholesterol (mg/dL)	112.39 ± 4.24	105.91 ± 5.38	0.3500
Ratio TG/cholesterol	0.85 ± 0.05	0.98 ± 0.06	0.0940
AST (U/L)	33.27 ± 2.55	33.28 ± 2.84	0.9977
IGF1 (ng/mL)	123.88 ± 7.45	140.82 ± 8.92	0.1564

Insulin and triglycerides (TG) profile was impaired by feeding restriction

Feeding restriction strategies in primiparous pregnant rabbit females

Offspring performance

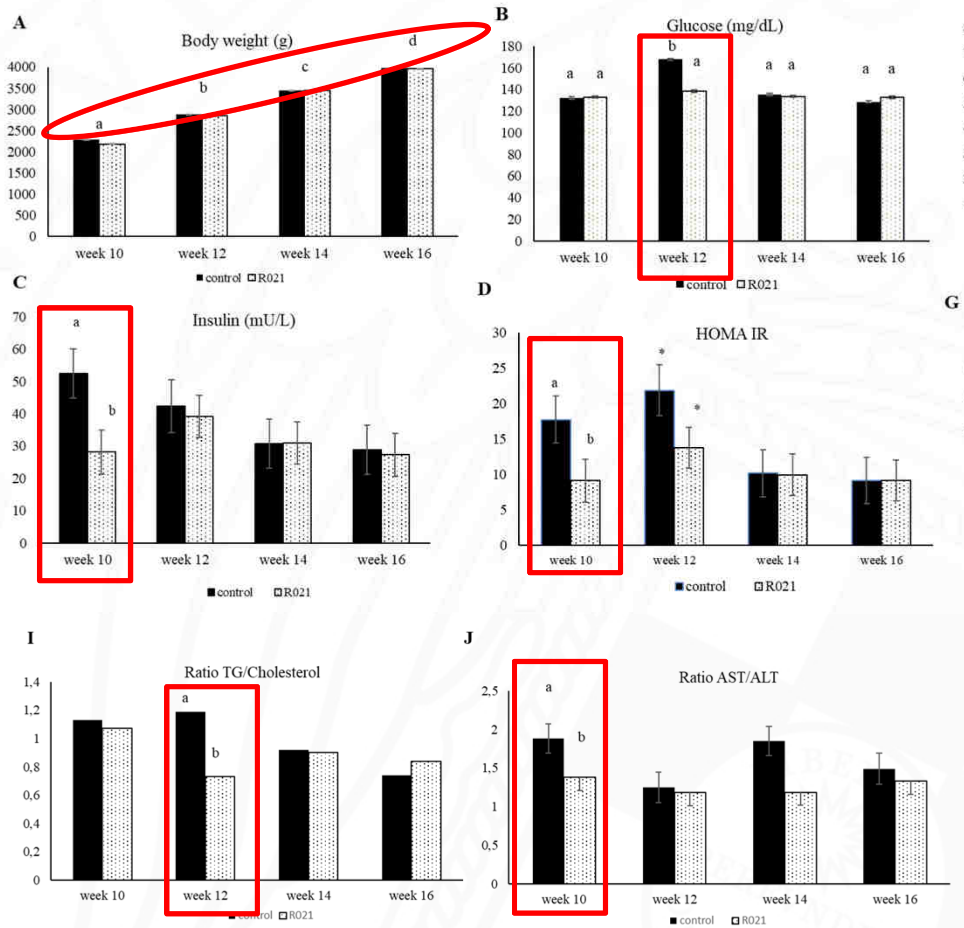
	Control (n=61)	R021 (n=60)	*P* value
Birth			
Litter weight (g)	607.44±121.3	637.14±102.2	0.31
Weaning (4 weeks)			
Weaned kits (n)	10.4±0.15	9.86±0.15	0.01
Litter weight (g)	6122 ± 189	5787 ± 183	0.2087
Mortality rate (%)	4.3±1.14	4.6±1.11	0.6865
Fattening (8 weeks)			
Body weight (g)	2295.36±45.60	2204.19±35.11	0.1190
Mortality rate (%)	0	0	1.0

Weight and viability were not influenced by feed restriction but more kits were weaned from females of the control group

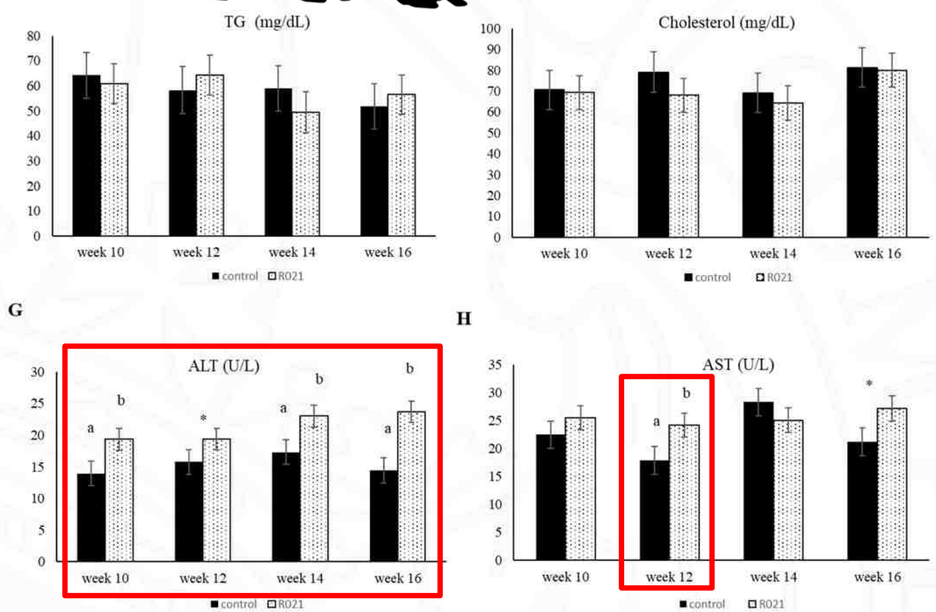
Offspring

Feeding restriction strategies in primiparous pregnant rabbit females

Metabolic status

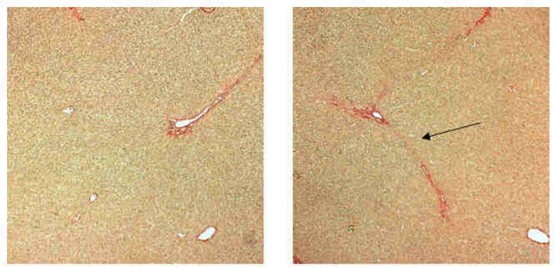


Female offspring



Liver health

Liver fibrosis at 16 weeks higher for R021 group



Control group (a) R021 group (b)

MFR affects mainly hepatic enzymes and liver fibrosis but weight was not impaired

Feeding restriction strategies in primiparous pregnant rabbit females

Summary

Maternal feed restriction during the less demanding part of gestation could be an interesting strategy to avoid excesive fattening of primiparous females AI under extensive reproductive rythm in order to reduce feeding cost without impairment of dam reproductive outcome and general offspring performace

https://delajusticia.com/

Use of nerve growth factor (NGF) for ovulation induction

Different hormonal preparations (analogues GnRH) to induce ovulation in rabbit does by intramuscular via

⇩

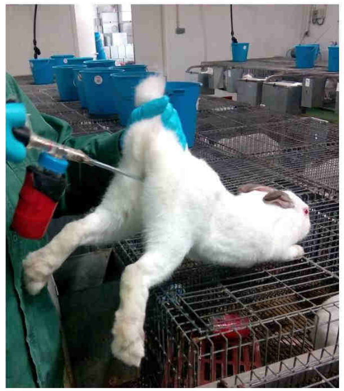
Avoid hormones in reproduction and more friendly methods are required

https://hgh-therapy-rx.com/

NGF is present in seminal plasma and it is an ovulation induction factor in other reflexively ovulators as camelids

Addition of NGF to the seminal dose would improve working time in the farm at AI momment and could be more physiological for the animals


https://onlinelibrary.wiley.com



Use of nerve growth factor (NGF) for ovulation induction

AI + recombinant β-NGF in the seminal dose

Groups NGF:
- ✔ 20 ng/ml
- ✔ 100 ng/ml
- ✔ 1 µg/ml
- ✔ 20 µg/ml
- ✔ 100 µg/ml

Positive control (20 µg/ml gonadoreline i.m.)
Negative control (cathether vagina)

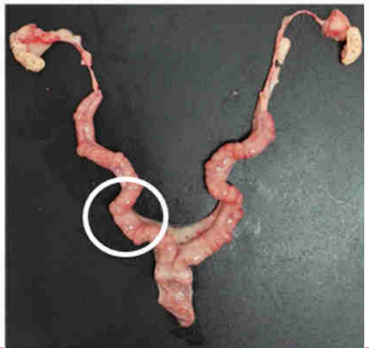
Day 0 — *Day 7*

LH peak measurement
0, 30, 60 and 120 min after NGF administration

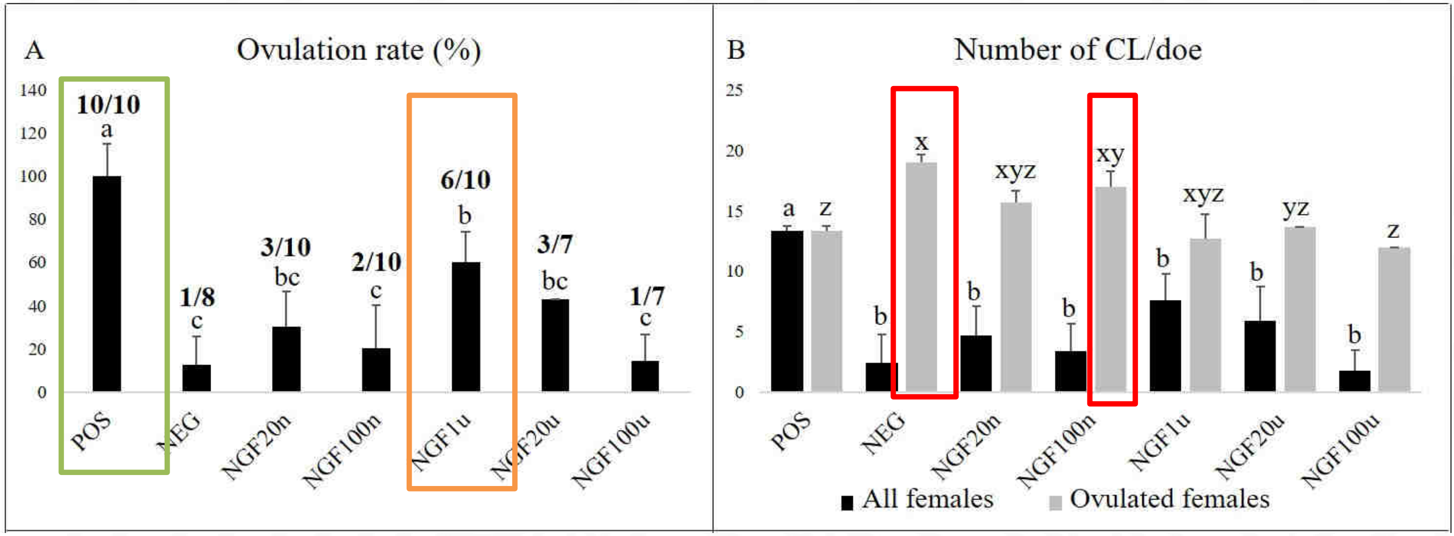
Blood sampling

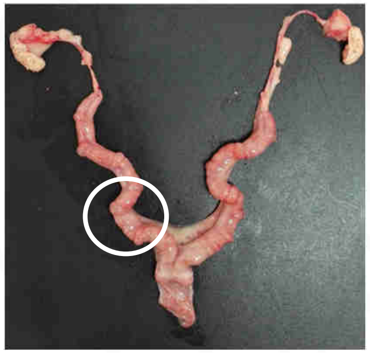
Progesterone measurement (blood sampling)

Euthanasia:
- ✔ Ovulation rate: (nº ovulated females/ nº females)*100
- ✔ Number of corpus luteum
- ✔ Embryonic vesicles

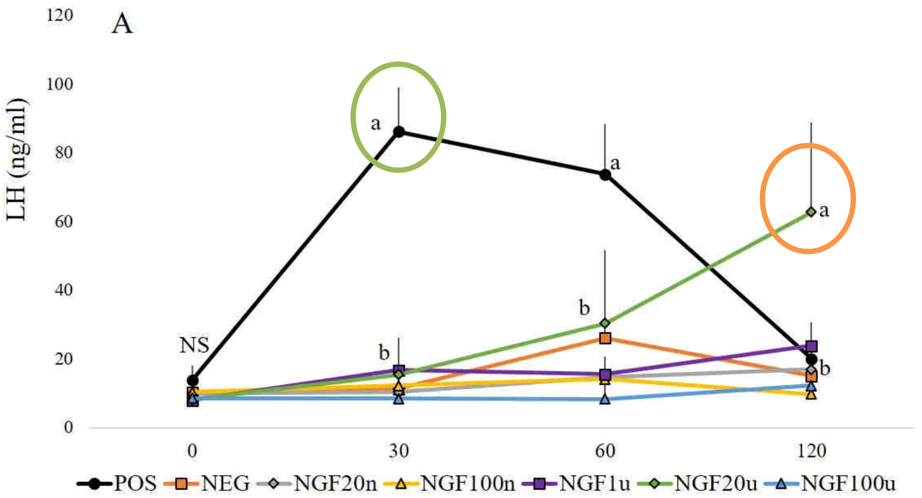


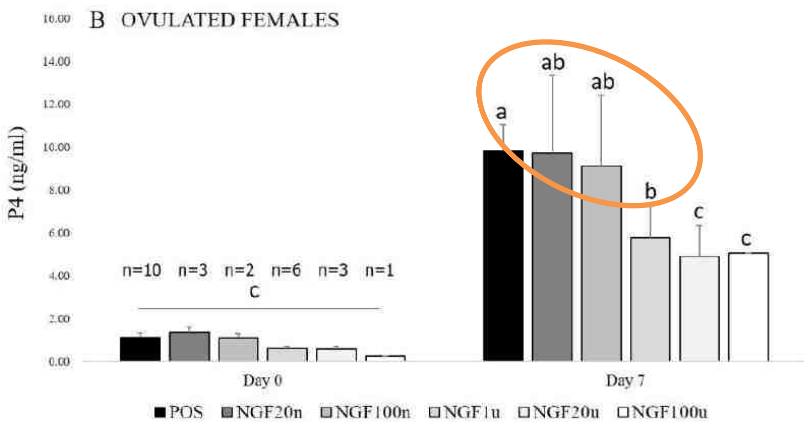
Use of nerve growth factor (NGF) for ovulation induction



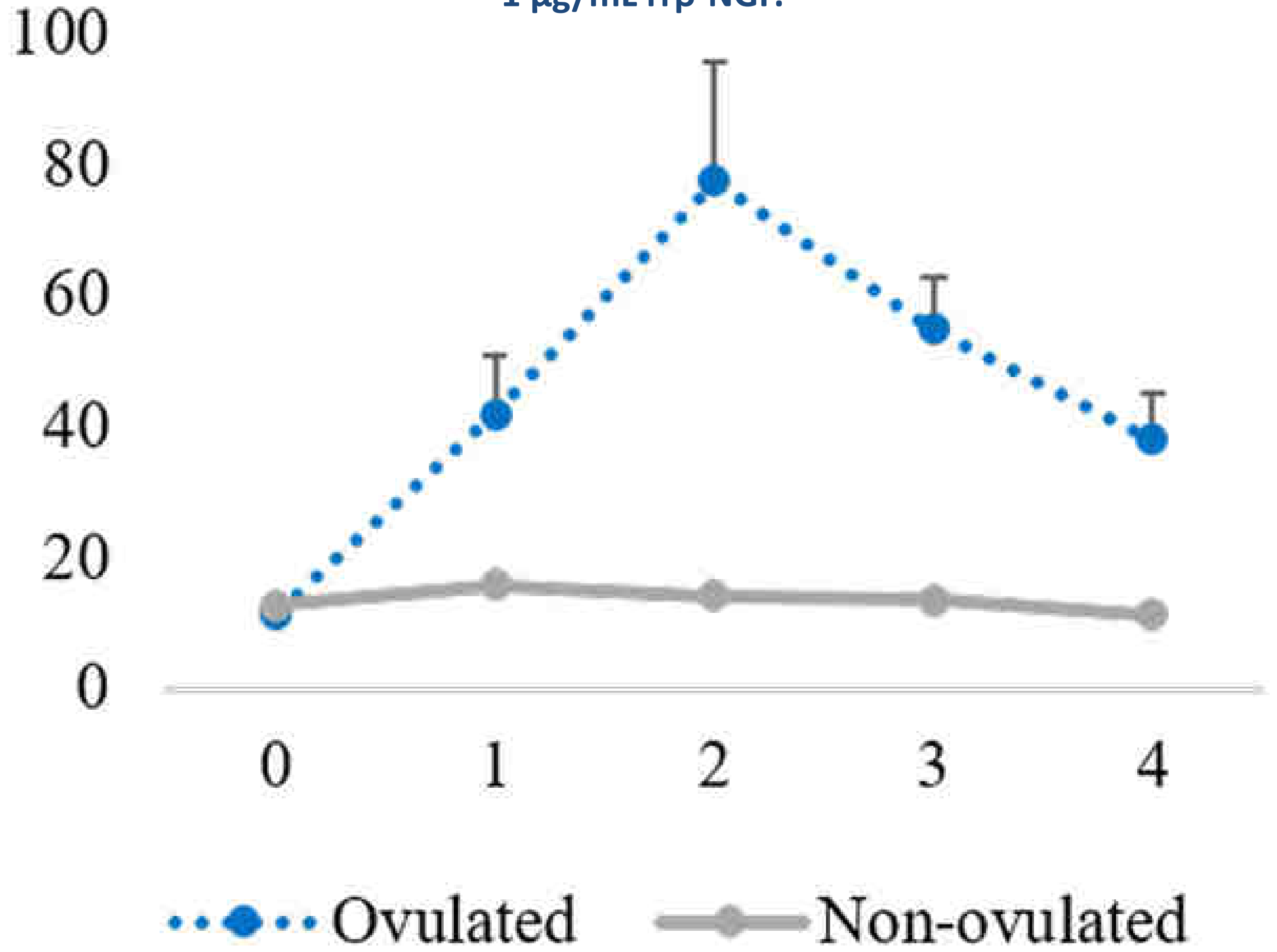


number of born alive
11.5±0.5





LH concentration assessed during 4 h after AI, in ovulating and non-ovulating females treated with 1 µg/mL rrβ-NGF.



Sanchez-Rodriguez A, Abad P, Arias-Alvarez M, Rebollar PG, Bautista JM, et al. (2019) Recombinant rabbit beta nerve growth factor production and its biological effects on sperm and ovulation in rabbits. PLOS ONE 14(7): e0219780. https://doi.org/10.1371/journal.pone.0219780
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0219780

Use of nerve growth factor (NGF) for ovulation induction

Mores studies should be done to improve the use of NGF in the seminal dose to replace hormonal treatments administered by intramuscular via

https://universoabierto.org/

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