Consequences of contrasting feed efficiency as lamb on later ewe performance

De Barbieri I, Ferreira G, Ramos Z, Navajas EA, Ciappesoni G
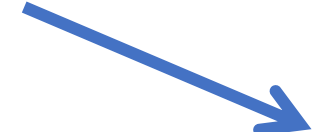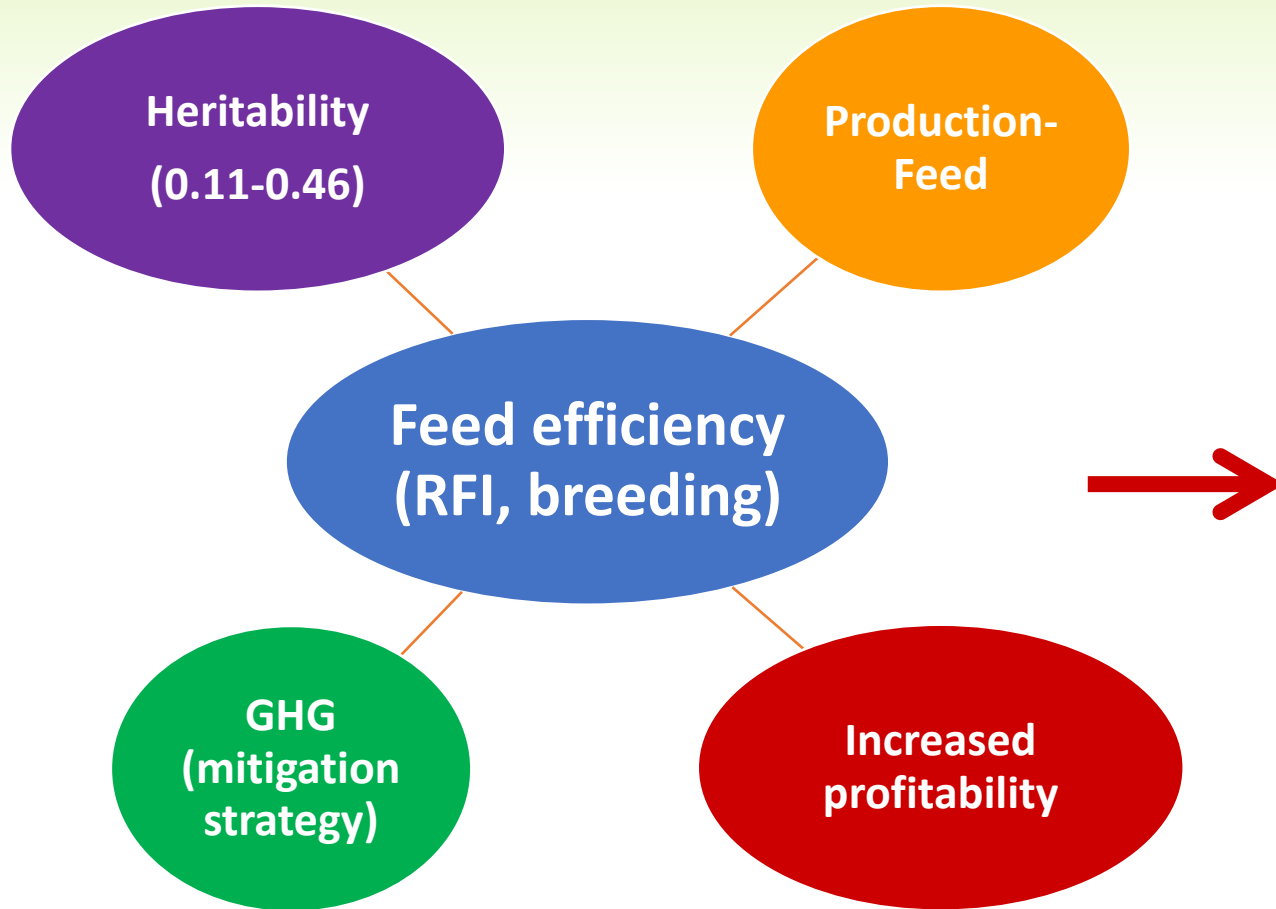
EAAP 2022, Session 68

RUMIAR

GrassToGas

iNiA
URUGUAY

Smarter

Background

More efficient sheep:

Less *in vivo* backfat (Zhang et al., 2017)(Lines et al., 2014) **(body reserves, resilience)**

No differences in backfat or fleece weight (Redden et al., 2014)

Under restricted intake no differences on DMI, and better BW, ADG, less fat (Redden et al., 2014)

(Beef cattle) Similar/less reproduction (calving rate) (Arthur et al., 2014)

Uruguay
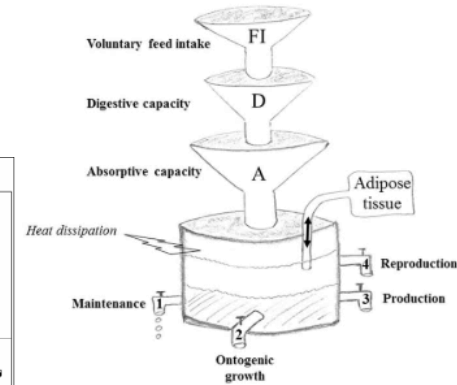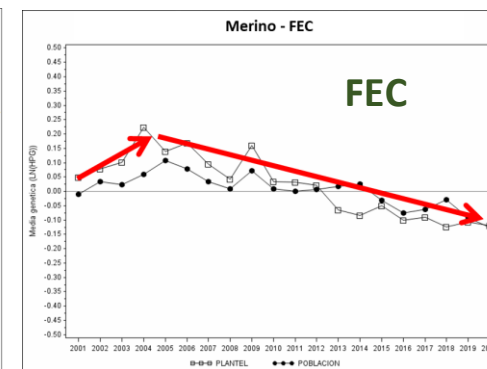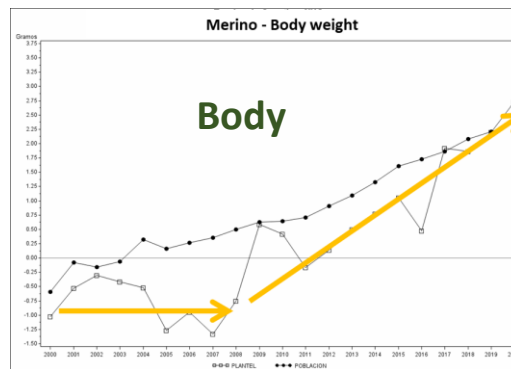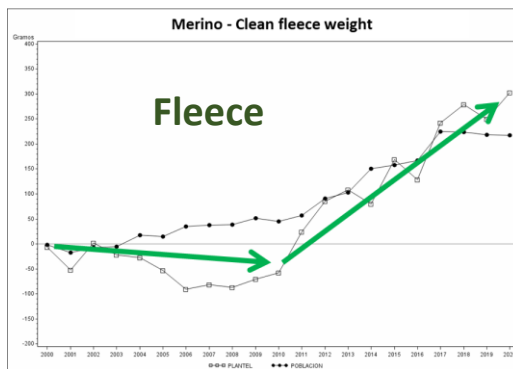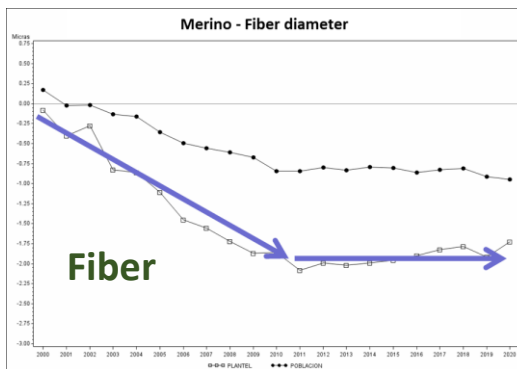
Huber 2017, Rauw et al, 2008

Hypothesis: More efficient ewes would present poorer reproductive performance under semi extensive grazing systems

Objective: To evaluate the productive and reproductive performance of ewes with contrasting RFI measured as lamb in their first year of life

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Material and methods

- 261 Merino ewes, two cohorts (2018-2019)
- Belong to the Merino genetic information nucleus, managed as a single flock (except late gestation and lambing) under commercial conditions (outdoors, native grasslands)
- Events:

Birth	Weaning	RFI	Shearing		Mating	Shearing	Lambing	Weaning
Months old	3-4	9-12	13		18	21	24	27-28

- Residual feed intake (details next) - fixed effect
- Body weight, body condition score
- Fleece weight, fibre diameter
- Fertility (pregnant ewe/mated ewe)
- Prolificacy (scanned foetuses/pregnant ewe)
- Lambing percentage (scanned foetuses/mated ewe)
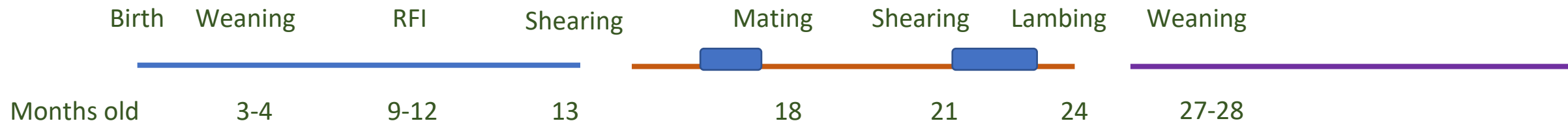- Lamb production (kg of lamb weaned/ewe mated)

Smarter

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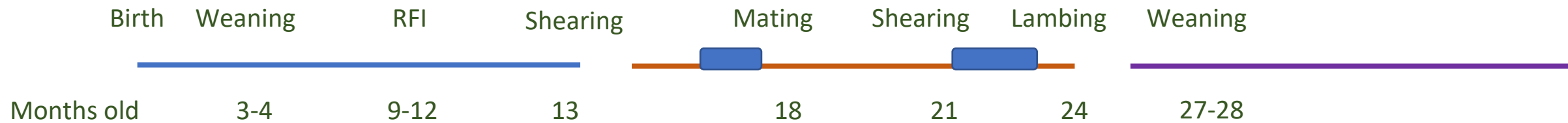
- Body weight, body condition score
- Fleece weight, fibre diameter
- Lamb production (kg of lamb weaned/ewe mated)

  → **GLM: RFI group, year, pregnancy rank (> scan)**

- Fertility (pregnant ewe/mated ewe)

  → **Some model, binomial distribution**

- Prolificacy (scanned foetuses/pregnant ewe)
- Lambing percentage (scanned foetuses/mated ewes)

  → **Some model, poison distribution**

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Material and methods — RFI test

Evaluation period

Adaptation period

Day 1 Day 2 Day 3 Day 7 Day 14 **Start** Day 56 **End**

Entry in the pens

Deworming with the effective active principle

Electronic tag placed

Supply of food* in the collective feeder

Arrival of animals on INIA's Experimental Unit La Magnolia

Food

Tag identification and infrared presence sensor

Streaming **event** for central computer

Visit and/or feed intake

Load cells to measure feed intake

Data Center

Streaming body weight per visit

Water — **Water**

Tag identification and infrared presence sensor

Load cells to measure body weight

END TRIAL

Daily BW, Feed intake

REA - BF

RFI model: age, pen-trial, average daily gain, mean metabolic body weight

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Material and methods - Results

Australian Merino

RFI Group ■ 25% High Eff ● 25% Low Eff. △ Medium ─── Regression

= REA / FAT
= BW gain/ BW
= BCS
= Fleece weight (4,1 kg), fibre diameter (14,9 μm)
≠ Feed intake, CH_4 emission, Behaviour
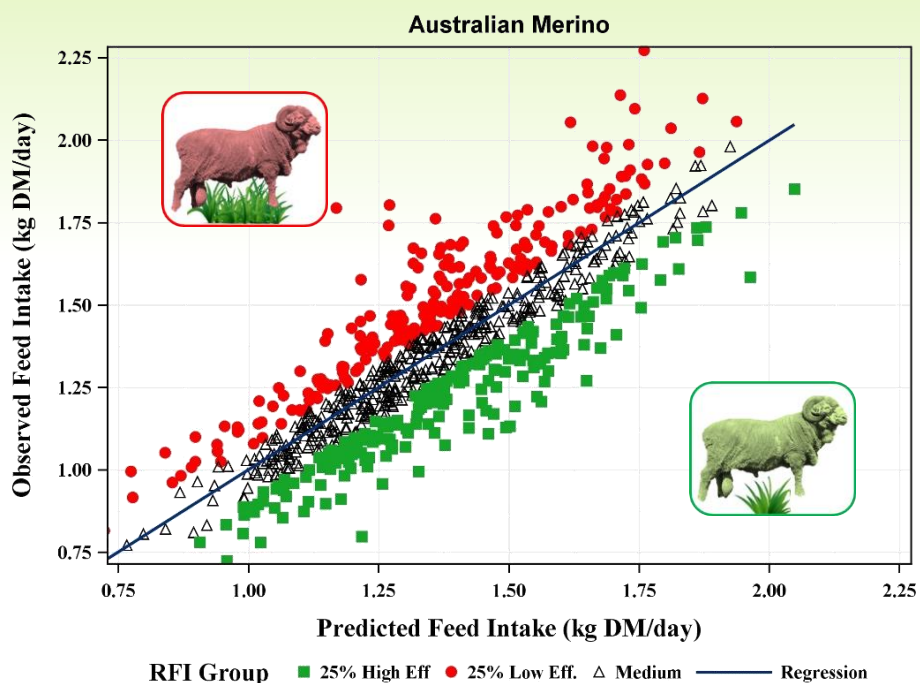
	High ef	se	Med.	se	Low ef	se
Feed intake (kgDM/d)	1.17 c	0.02	1.24 b	0.01	1.38 a	0.02
Visits to eat (n)	49 c	1.8	58 b	1.2	69 a	1.8
Visits to drink (n)	5.6 b	0.2	5.9 ab	0.1	6.2 a	0.2
Rib eye area (cm^2)						
Backfat (mm)						
Bodyweight gain (g/d)						
Metabolic bodyweight (kg)						
Methane (g/d)						

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Material and methods - Results

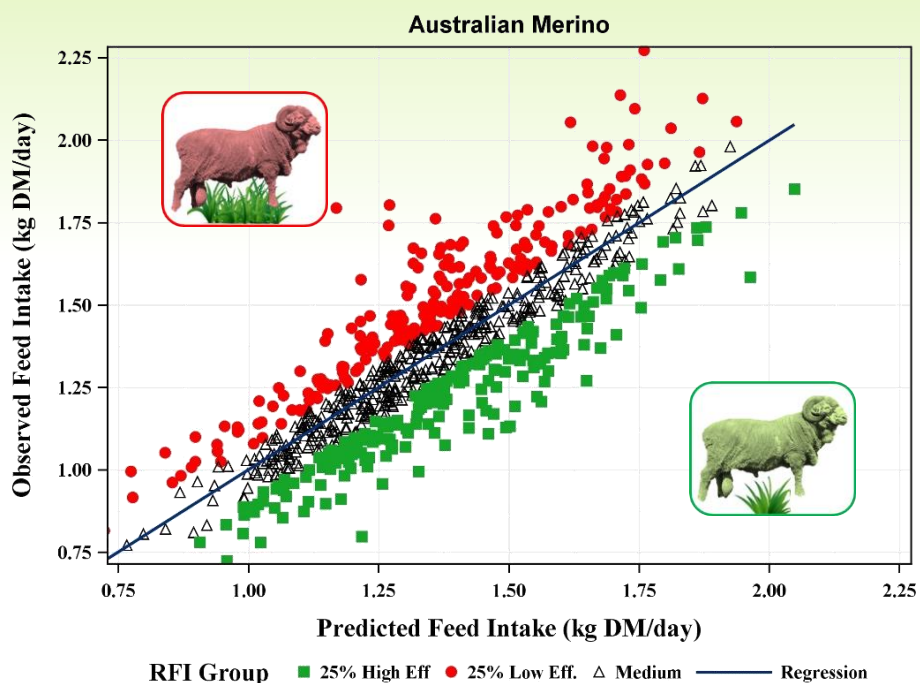Australian Merino

RFI Group ▪ 25% High Eff. ● 25% Low Eff. △ Medium — Regression

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Visits to drink (n)	5.6 b	0.2	5.9 ab	0.1	6.2 a	0.2
Rib eye area (cm²)	7.4	0.2	7.3	0.1	7.2	0.2
Backfat (mm)	2.1	0.1	2.2	0.1	2.3	0.1
Bodyweight gain (g/d)	172	4.7	164	3.1	162	4.8
Metabolic bodyweight (kg)	15.9	0.2	15.5	0.1	15.7	0.2
Methane (g/d)	22.3	0.6	22.1	0.4	23.5	0.6

Redden et al. (2014) Zhang et al. (2017) Lima et al. (2019)
Tortereau et al. (2019) Muir et al. (2020)

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Results

Body weight (kg)		High eff	se	Medium	se	Low eff	se
Body weight (kg)	Mating						
	Prepartum						
	Weaning						
Body condition score	Mating						
	Prepartum						
	Weaning						
Fleece weight (kg)(<365 d)							
Fibre diameter (µm)							
Staple length (cm)							

	High	se	Med.	se	Low	se
Fertility (pregnant/mated)						
Prolificacy (foetuses/pregnant)						
Lambing (lambs/mated)						
Lamb (kg weaned/mated ewe)						
Lamb (kg weaned/lambed ewe)						

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Results

Body weight (kg)		High eff	se	Medium	se	Low eff	se
Body weight (kg)	Mating	**45.7**	0.6	**44.2**	0.4	**44.3**	0.6
	Prepartum	**46.9**	0.6	**45.9**	0.5	**46.0**	0.7
	Weaning	**49.8**	0.7	**49.3**	0.6	**49.8**	0.7
Body condition score	Mating						
	Prepartum						
	Weaning						
Fleece weight (kg)(<365 d)							
Fibre diameter (µm)							
Staple length (cm)							

	High	se	Med.	se	Low	se
Fertility (pregnant/mated)						
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Smarter

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	Weaning	**49.8**	0.7	**49.3**	0.6	**49.8**	0.7
Body condition score	**Mating**	**3.1**	0.04	**3.1**	0.03	**3.0**	0.04
	Prepartum	**2.8**	0.05	**2.7**	0.04	**2.7**	0.06
	Weaning	**2.8**	0.04	**2.8**	0.03	**2.8**	0.04
Fleece weight (kg)(<365 d)							
Fibre diameter (µm)							
Staple length (cm)							

	High	se	Med.	se	Low	se
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Smarter

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Body condition score	Mating	3.1	0.04	3.1	0.03	3.0	0.04
	Prepartum	2.8	0.05	2.7	0.04	2.7	0.06
	Weaning	2.8	0.04	2.8	0.03	2.8	0.04
Fleece weight (kg)(<365 d)		2.80	0.04	2.84	0.03	2.82	0.04
Fibre diameter (µm)		15.5	0.1	15.6	0.1	15.7	0.1
Staple length (cm)		7.9	0.1	7.9	0.1	8.0	0.1

	High	se	Med.	se	Low	se
Fertility (pregnant/mated)						
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Smarter

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Fibre diameter (μm)		15.5	0.1	15.6	0.1	15.7	0.1
Staple length (cm)		7.9	0.1	7.9	0.1	8.0	0.1

	High	se	Med.	se	Low	se
Fertility (pregnant/mated)	0.91	0.04	0.84	0.03	0.79	0.05
Prolificacy (foetuses/pregnant)	1.21	0.14	1.10	0.10	1.10	0.15
Lambing (lambs/mated)	1.10	0.13	0.92	0.08	0.87	0.12
Lamb (kg weaned/mated ewe)						
Lamb (kg weaned/lambed ewe)						

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Results

Body weight (kg)		High eff	se	Medium	se	Low eff	se
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Prolificacy (foetuses/pregnant)	1.21	0.14	1.10	0.10	1.10	0.15
Lambing (lambs/mated)	1.10	0.13	0.92	0.08	0.87	0.12
Lamb (kg weaned/mated ewe)	20.9	1.0	18.8	0.8	19.1	1.0
Lamb (kg weaned/lambed ewe)	30.6	1.2	28.3	1.1	28.6	1.3

✓ BW, FW, FD, BCS

✓ Fert, Prolif, Lambing, kg lamb/ewe

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Discussion

Native grasslands:

- Variation in **quantity** (30-50% CV on seasonal pasture growth) (Berretta y Bemhaja, 1998)
- Variation in **quality**: CP (6-15%), DMD (50-61%), ME (1.8-2.2 Mcal/kgDM) (Berretta et al. 2000)

Huber 2017, Rauw et al, 2008

There is a potential restriction on intake (¿?) (Grazfeed, Freer et al, 1997)

Body condition score ~ 3

Feed intake is correlated among ages (Paganoni et al, 2018; Muir et al., 2020)

Under restricted intake, no differences FI between RFI groups, better performance for low RFI, lower maintenance requirements, higher efficiency in the use of energy... (Redden et al., 2013; Cantalapiedra Hijar et al., 2018)

No detected effect (restricted intake, restriction to potential reproduction)
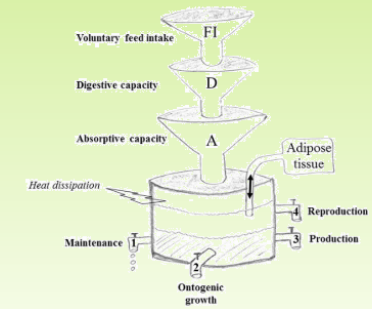
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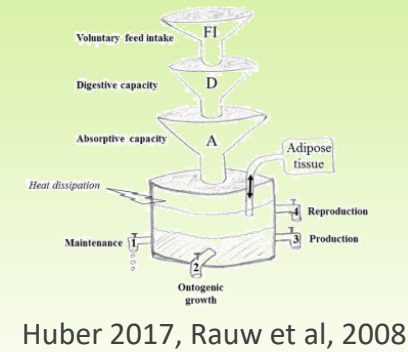
There is a potential restriction on intake (¿?) (Grazfeed, Freer et al, 1997) ⟶ **Supplementation + High Q/Q pastures**

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Feed intake is correlated among ages (Paganoni et al, 2018; Muir et al., 2020)

Under restricted intake, no differences FI between RFI groups, better performance for low RFI, lower maintenance requirements, higher efficiency in the use of energy... (Redden et al., 2013; Cantalapiedra Hijar et al., 2018)

Improved environment can mask resilience/plasticity (Huber 2017)

No detected effect (restricted intake, restriction to potential reproduction)

Improved targeted nutrition can mask a potential trade-off between feed efficiency and reproduction

No effect of RFI group on reproduction (similar Fat, BCS), in sheep selected for wool for >20 years when grazing

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Final comments

- **Preliminary results:**
    - **Hogget performance would not be negatively affected by producing with more FE sheep, in semi extensive grazing conditions**

- **Further studies are recommended, including:**
    - **Larger data sets**
    - **Lifetime evaluation, repeated measures, different ages**
    - **Better characterization of pastures and nutrition, and adult ewe intake**
    - **RFI, CH_4 and DMI estimated in grazing animals**

- **Genetic parameters**

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