Sustaining poultry production with alternative protein sources

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Why we feed animals?

To turn things we cannot eat to something we can

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What do chickens eat in Australia ?

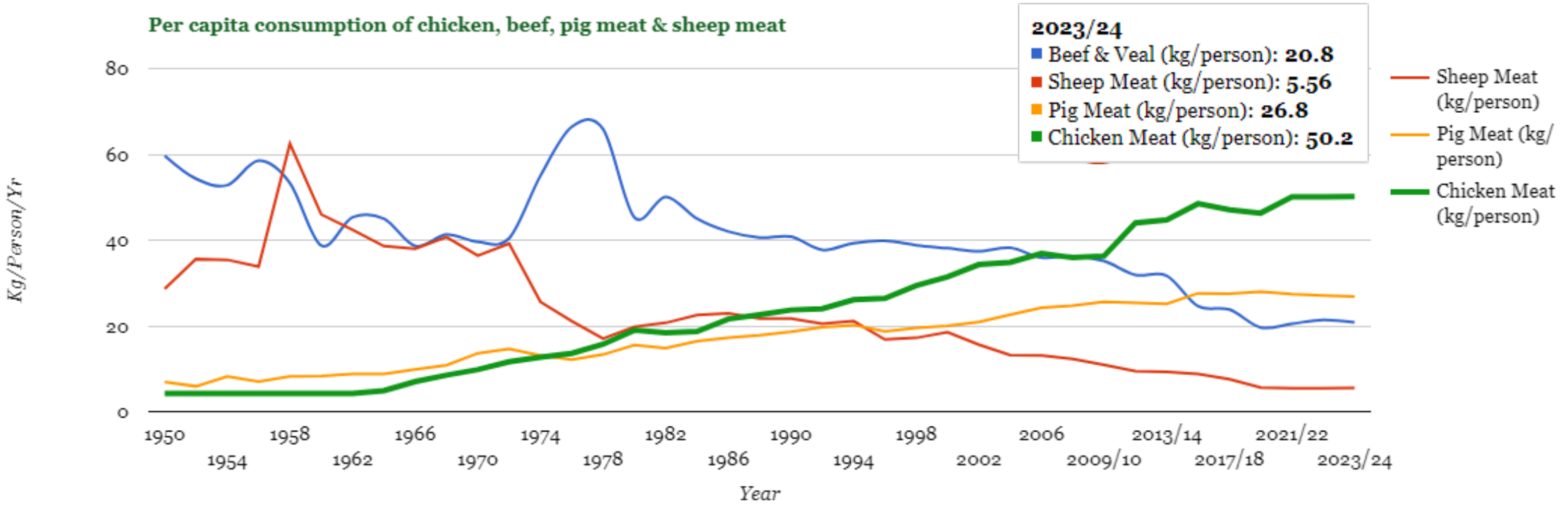
- Wheat-based diets (60% grains) with whole grain
- Sometimes blend in sorghum, barley, triticale
- SBM (~22%, South America)
- Canola meal, cottonseed meal, meat and bone meal, blood meal, protein isolates, legumes
- Full fat canola seed
- Wheat/rice bran
- Tallow (animal fat) (before and after pelleting), kitchen waste oil
- Trace minerals/vitamins, feed enzymes

There is no human-animal food competition in conventional system production, we use by-products or grains rejected for human consumption

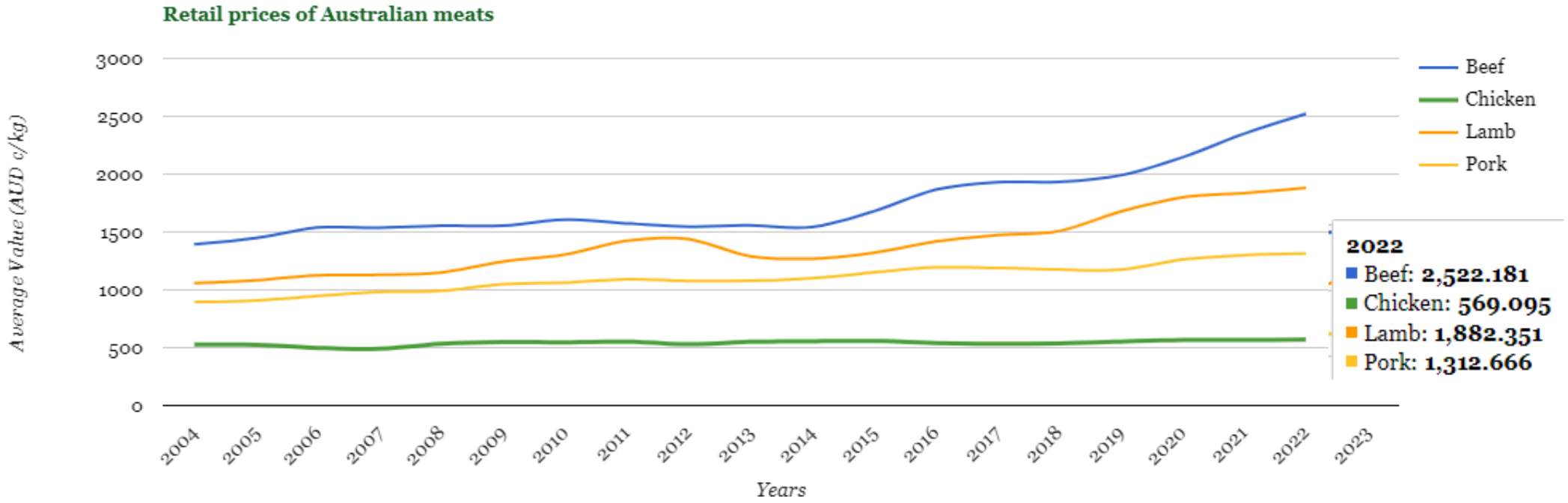
Why chickens need nutritionists?
Because they eat better than we do

- Apparent metabolizable energy
- Amino acids (ileal digestible) – Lys, Met, Thr, Val, Ile, Trp, His, Arg, Gly
- Ca, P (non-phytate + phytate)
- Na, K, Cl
- Linoleic acid
- Non-starch polysaccharides
- Vitamin and trace minerals

Why chickens?



Australian chicken meat federation


Retail prices of Australian meats
Average Value (AUD c/kg)
3000
2500
2000
1500
1000
500
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Years
Beef
Chicken
Lamb
Pork
2022
Beef: 2,522.181
Chicken: 569.095
Lamb: 1,882.351
Pork: 1,312.666

- Genetics
- Vaccine and biosecurity
- Nutrition

https://www.chicken.org.au/

Soybean meal (SBM) – Australian perspective

- Demand of chicken-meat continues to grow (by 60%) due to population growth by 2050.

- All our SBM is imported (AUD$750 = USD$544 = Euro €469/Tonne)

- Two ways to replace SBM

Local protein meals (10-15% canola product)

Crystalline or synthetic amino acids

Broiler feeding study at Camden

Objective:

To completely replace SBM by the combination of supplemental amino acids and canola meal (solvent) without compromising growth performance

Three treatments (all 13.0 MJ/kg):

- 1A - standard (210 g/kg crude protein)
- 2B - low protein diet (190 g/kg crude protein), no canola meal
- 7G - low protein diet (190 g/kg crude protein), 150 g/kg canola meal

Table 2. Composition of experimental diets.

Item (g/kg)	1A	2B	3C	4D	5E	6F	7G
Wheat (156 g/kg)	738	844	737	755	796	739	617
Maize starch	10.8	-	103	-	-	68.1	100
Canola meal (386 g/kg)	-	-	-	-	-	-	150
Soybean meal (505 g/kg)	156	37.4	-	150	56.8	-	-
d,l – Methionine	2.71	3.60	4.59	2.70	3.61	4.58	3.10
Glycine	0.01	3.54	6.19	0.08	3.31	6.17	2.79
l-Arginine	2.29	5.83	7.78	2.41	5.44	7.77	5.42
l-Histidine	-	0.62	1.39	-	0.54	1.38	0.41
l-Isoleucine	0.89	2.77	4.06	0.94	2.62	4.05	2.78
l-Leucine	-	3.08	5.32	0.07	2.86	5.30	2.92
l-Lysine HCl	5.64	9.32	11.0	5.80	8.84	11.03	8.15
l-Phenylalanine	0.84	4.62	6.96	0.96	4.26	6.95	4.84
l-Threonine	2.67	4.23	5.22	2.72	4.09	5.22	3.72
l-Tryptophan	-	0.33	0.71	-	0.28	0.71	0.22
l-Valine	1.26	3.14	4.56	1.30	3.02	4.55	2.81
Soy oil	28.9	15.0	15.0	15.00	15.0	15.0	36.8
Limestone	14.4	14.9	14.9	14.4	14.7	14.9	13.3
Monocalcium P	6.40	7.32	8.24	6.40	7.32	8.25	4.30
Potassium carbonate	0.82	5.09	7.12	1.00	4.54	7.11	4.54
Sodium bicarbonate	4.28	4.31	4.40	4.27	4.32	4.40	3.62
Vit–min premix[1]	2.20	2.20	2.20	2.20	2.20	2.20	2.20
Choline Cl (60%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phytase[2]	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Xylanase[3]	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Celite	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Inert filler (sand)	-	6.93	28.8	13.2	39.0	62.3	9.85
Total NPBAA	15.1	39.0	55.4	15.7	36.9	55.3	35.4

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Nutritionally equivalent diets

Table 3. Nutrient specifications of experimental diets (as-is basis).

Nutrient (g/kg)	1A	2B	3C	4D	5E	6F	7G
Dry matter	912	916	929	911	918	929	924
AME, MJ/kg	13.0	13.0	13.0	12.5	12.5	12.5	13.0
Crude protein	210	190	170	210	190	170	190
Starch	471	526	560	471	495	526	482
Lysine[1]	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Methionine	5.13	5.52	6.05	5.12	5.55	6.04	5.33
TSAA	8.14	8.14	8.14	8.14	8.14	8.14	8.14
Threonine	7.70	7.70	7.70	7.70	7.70	7.70	7.70
Valine	8.69	8.69	8.69	8.69	8.69	8.69	8.69
Isoleucine	7.59	7.59	7.59	7.59	7.59	7.59	7.59
Leucine	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Arginine	12.1	12.1	12.1	12.1	12.1	12.1	12.1
Histidine	4.06	3.63	3.63	4.04	3.63	3.63	3.63
Tryptophan	2.00	1.76	1.76	1.99	1.76	1.76	1.76
$Glycine_{equivalent}$[2]	12.3	12.9	13.3	12.3	12.8	13.3	12.3
Phenylalanine	8.19	6.13	4.61	8.15	6.27	4.62	5.86
Phe + tyrosine	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Calcium	8.70	8.70	8.70	8.70	8.70	8.70	8.70
Available P	4.35	4.35	4.35	4.35	4.35	4.35	4.35
Crude fiber	15.4	14.4	12.0	15.5	14.0	11.9	25.5
Crude fat	46.2	33.0	30.3	32.8	32.3	30.3	54.7
DEB[3]	210	210	210	210	210	210	210

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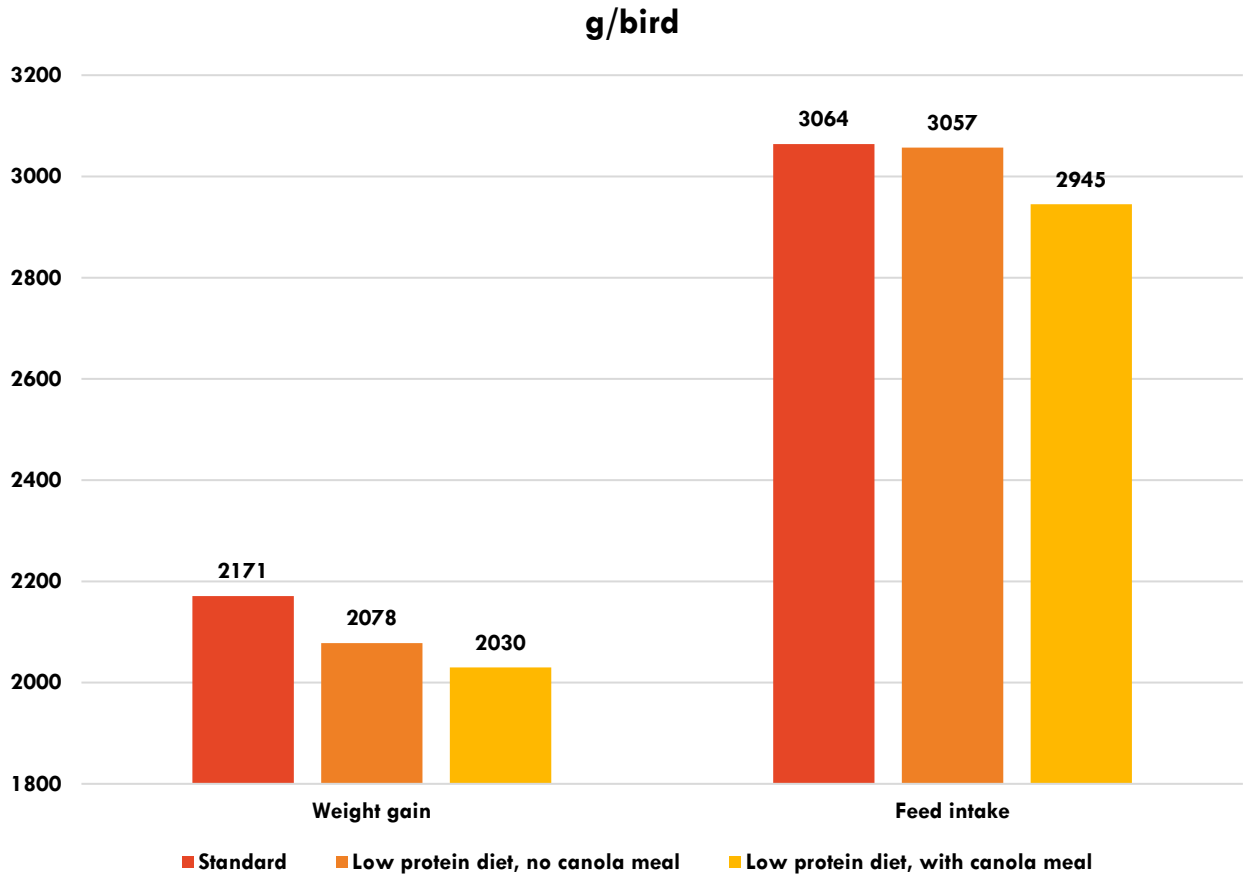
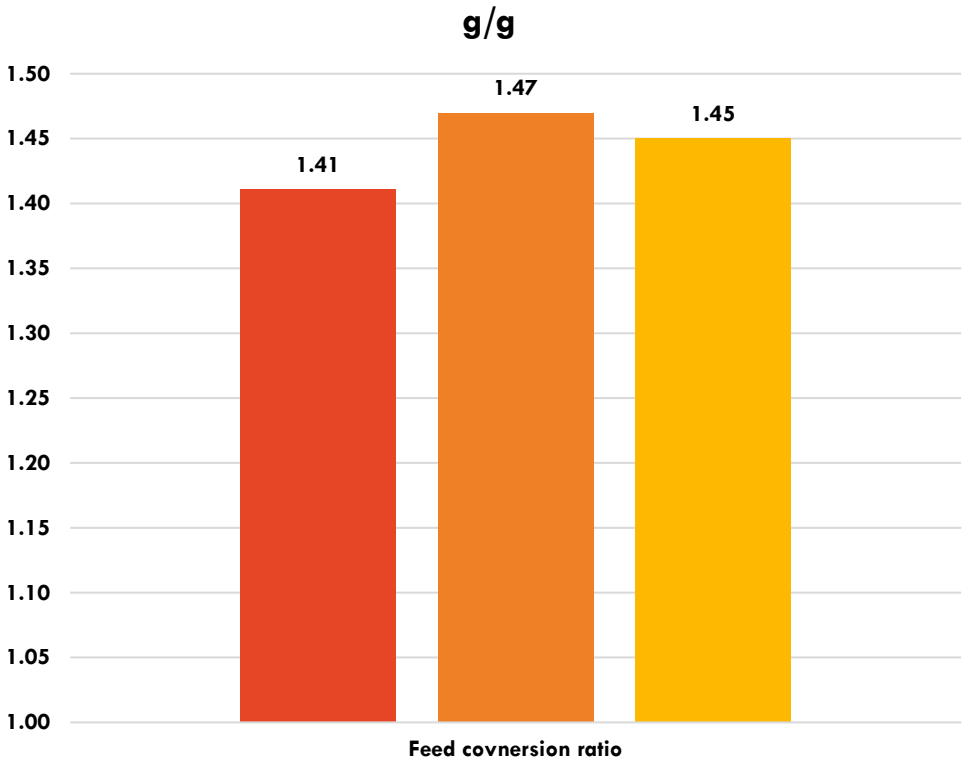
14-36 days post-hatch growth performance





- No significant difference in FCR compared to the standard diet
- No significant difference between the two low protein diets and the diet containing canola meal would be more economical

Limitations

- High protein wheat was used in iso-nitrogenous diets, hence lower SBM inclusion in the control diet (156 g/kg)
- Less than normal SBM inclusion
- Wheat inclusion is higher than 'normal' diets

Least cost- feed formulation:
The least cost combination of the ingredients to satisfy all nutritional requirements

Worth noting the economics of solvent and expeller meals
- Expensive SBM and cheaper grains – solvent better value
- Expensive grains and cheaper SBM – expeller better value

Opportunity - How to increase volume and premium

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Seek collaboration with canola breeders/processers to

Reduce our dependency of imported SBM by increasing inclusion rate of canola product (both seed and meal) by

- Improving its amino acid digestibility (breeding and processing conditions)
- Reducing antinutritive factors (GLS, NSPs)
- Fat utilisation?

Ongoing research

- Determine the highest inclusion of canola product in broiler chickens (different age)
- Feed enzyme solutions

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