



Use of Rendered Products in Poultry Feed

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High Quality Protein and Energy Sources

- World is deficient in protein
- Needs for animal products continue to increase both with population and with affluence
- While there have been issues in the past, use in the US and elsewhere is heavy
- Given the paucity of protein sources, rendered product use makes sense
- One of the early practitioners of recycled product use



Introduction: Rendered proteins and fats

- Long history worldwide of use of animal proteins and rendered fats in the poultry industry.
- Products currently being utilized include meat meals from ruminant, swine and poultry, blood meals, fats, feather meal.
- Variety of use, broilers, turkeys, pigs, less use layers.
- Provide nutrients needed at competitive prices
- Animal protein sources may improve performance parameters over corn-soya diets
- While each product has different nutrient contents and potential values, most are excellent sources of high quality protein, highly available phosphorus and other minerals.



Goals

- Provide an overview of the products
- Methods and Limitations on their use
- Economics of their use
- Current concepts in nutrition



Available products

Ruminant/porcine meat meals

- Products from non-edible portion of cattle/pig processing
- Products may vary based on input materials, proportion of bone
- Utilized in the US poultry industry as a protein/AA, calcium and phosphorus source
- Inclusion levels typically limited by price
- 10% of high quality product would be fine
- Can be used in combination with other by-products
- Typically 50-54% CP, 10% fat, 5% avail P



Available products

Poultry By-product meal:

- By-product of the poultry processing industry
- Consist of the offal and other inedible parts of the chicken
- Differentiation of the products is protein/ash content.
- High ash content less desirable, lower price
- Pet food grade significantly more expensive, now used in aqua feeds
- Inclusion of the product is primarily limited by ash content, but may be something around 10% again.
- 55-64% CP, 10-14% fat, 3-5% avail P



Available products

Blood meal:

- Blood has foreign material removed followed by a drying process from the blood collected in slaughter plants
- The more sophisticated the drying process, in general the better the product produced, spray drying is generally considered superior
- Blood meal is generally not used in high concentration due to its poor amino acid balance
- May be used as an attractant in some aqua feeds
- Constraints would be at 1-2% of the total ration in poultry, perhaps more in aqua, used as a by-pass protein, blends
- 80-88%CP, 1% fat, 0.3% P



Available products

Poultry Feather meal:

- Feather meal is the ground and hydrolyzed feather from chicken and turkey processing
- Considered to be low in digestibility and with a poor amino acid balance and is thus not heavily used in the poultry industry
- It is generally economically priced, but will normally be used at 1-3% of the ration
- May be utilized in ruminant rations as a by-pass protein, 3% addition improves milk yield in higher producing dairy cattle, used in blends
- 80% CP, 7% fat, 0.5% P



Available products

Blended meals:

- Several commercial blends are available as well as the ability to have products custom blended to customer specifications
- Some products were designed specifically as a replacement for fishmeal for instance
- May increase costs, useful if storage space is lacking or need to simulate fish meal
- Blends were more heavily utilized in the past, before computer formulation, digestible amino acids
- Still have a place in international markets



Use of animal proteins in feed

- 1. Gather info on your current feeds
- 2. Gather info and pricing on potential products
- 3. Run formulas with products and available prices to determine the feed value in your rations
- 4. Look at use of several products



Comparison of diets with added MBM at different prices/levels

Level of MBM	Relative Price of MBM	Price of Broiler starter/ ton in USD
0%	NA	322.72
5%	100% of soya	319.39
10%	100%	316.20
5%	110%	321.39
9.8	110%	320.12
5%	90%	317.39
10%	90%	312.23





Additions of MBM and PBM

MBM Level	PBM Level	Relative price of Prod.	Price of Broiler starter / ton in USD
0%	0%	NA	322.72
5%	5%	100%	313.77
3.8%	10%	100%	308.91
5%	5%	110%	317.77
3.8%	10%	110%	314.45
5%	5%	90%	302.90
3.8%	10%	90%	294.65



Rendered fat use

- Feeding of fat in poultry and pig rations has a long history in the US and the world.
- Fats are generally included at 1-8% of ration
- Benefits:  Energy,  Feed efficiency
- Concerns: ME, sources, rancidity



Understanding energy use

Maintenance energy

Energy for
production

+/-

Changes in
energy





Response of broilers to different energy levels

- Greatest benefit seen at low energy as maintenance costs do not change
- Allows for increased energy going primarily to growth
- At higher energy levels growth rate will plateau and less benefit
- Looks like changing genetics have resulted in decreased energy needs
- Turkeys still respond to fat additions quite nicely



Types of fat Available for Use in Rations

- **Tallow: saturated source, used for soap manufacture traditionally**
- **Poultry fat: less saturated, probably source of choice for poultry, but frequently less available**
- **Fish oil: less saturated, other purported benefits, very expensive**
- **Vegetable oils: soy oil, etc, generally good source, expensive**
- **Yellow grease: generally cost effective if available, generally comparable to soy oil**



Response of broiler breeders to added fat

- | | Added Fat % | | | |
|----------------------------|--------------------|------------|------------|------------|
| Production variable | 0 | 2 | 4* | 6 |
| Eggs/hen | 131 | 156 | 162 | 159 |
| Feed/dozen (kg) | 4.1 | 3.5 | 3.3 | 3 |
| Chicks/hen | 105 | 121 | 132 | 125 |
- ***Authors recommended 4% level as close to optimum.**
 - **Body weight was increased with each increment of fat.**



Yellow grease

- Yellow grease is the reprocessed cooking grease from restaurants
- Vegetable oil based product
- Performance is similar to vegetable oil products
- Generally cheapest acceptable source of oil



**Means for Broiler Gain for the 3, 5, and 7 Week
Growth Period**

Fat Source	0-3 Week (kg/bird/phase)	0-5 Week (kg/bird/phase)	0-7 Week (kg/bird/phase)
Soybean Oil	0.77	1.92	2.85
Yellow Grease	0.76	1.96	2.95
Poultry Fat	0.76	1.93	2.92
Tallow	0.75	1.92	2.99
HAPVA	0.74	1.89	2.96
Lard	0.75	1.88	2.97
Palm Oil	0.75	1.95	2.94



**Means for the Adjusted Feed:Gain Ratios per Bird for the
3, 5 and 7 Week Growth Period**

Fat Source	0-3 Week (kg:kg)	0-5 Week (kg:kg)	0-7 Week (kg:kg)
Soybean Oil	1.38	1.60	1.87
Yellow Grease	1.38	1.56	1.85
Poultry Fat	1.38	1.58	1.85
Tallow	1.40	1.61	1.83
HAPVA	1.42	1.63	1.86
Lard	1.40	1.52	1.77
Palm Oil	1.42	1.56	1.88



Current Concepts: Calorie Cost to Determine Energy Levels

Diet Energy (kcal/kg)	Cost/ton (US\$)	Calorie cost(\$/mcal)	Fat added(%)
2900	246.24	84.90	0
3000	252.14	84.07	1****
3100	262.82	84.78	3.3*****
3200	273.46	85.45	5.5
3300	282.10	85.48	7.7
3400	294.76	86.69	10

****Given the prices used in this scenario, one would choose between the 3000-3100 kcal/kg ration as the most cost effective. In many cases, more fat will help performance so some would feed more than the 1% level seen in this scenario.



Current Concepts: Enhanced Computer Formulation

- Need proper training
- Move towards nutrient provision vs ingredient based formulation
- Avoid overfeeding
- High cost nutrients/ingredients should be formulated individually
- Increase the number of ingredients, pure ingredients
- Limit constraints during initial formulation



Current Concepts: Enhanced Computer Formulation

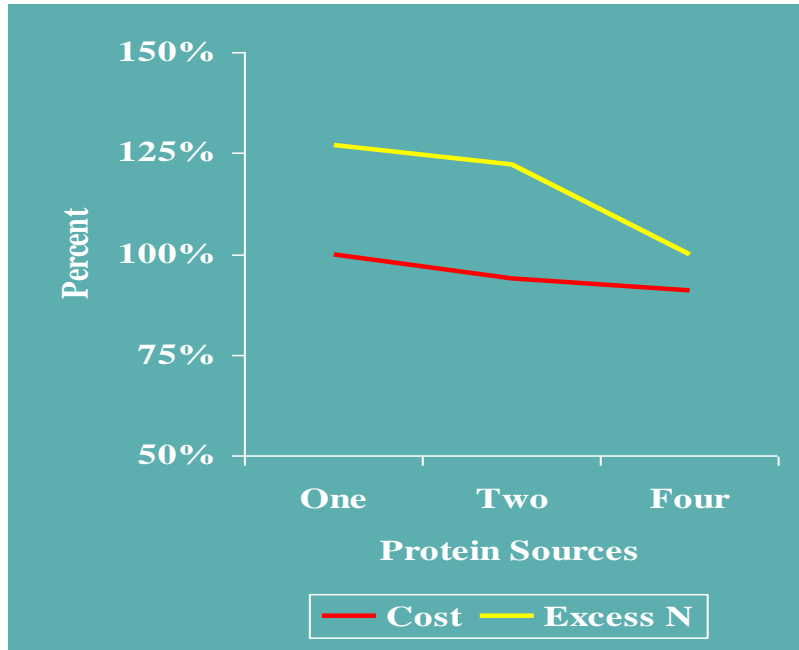
- Look for pressure on the matrix
- Use digestible AA, remove protein constraints, formulate on a digestible AA basis



An example: removing DL-methionine from a 20% protein diet

	w/ DL-met	w/o DL-met
Protein	20%	28.9%
Soybean meal	17.5%	42.9%
Corn	58%	30.4%
DDGS	10%	10%
Meat & bone meal	7.3%	6.7%
DL-methionine	0.185%	0%
Cost	\$310.48	\$353.76
	-14%	

Increasing the number of protein sources available to the formula results in:



- Easier formulation
- Lower formula cost
- Improved nutrient balance
- Decreased nutrient excesses

From R. Hamilton



Current concepts in poultry nutrition: Ideal Protein

- Ideal protein is the exact balance of amino acids needed by the bird
- Based on digestible amino acid (AA) levels
- Based on lysine at 100% of the requirement and other AA
- For example if lysine req = 1.00% (100%) and Meth+Cys req = .72%, then the ratio is 72%
- All AA have a ratio to lysine which generally stays similar
- May change over growth periods in turkeys for instance



Table 5. Feed cost comparison between diets fed from 0-21 weeks of age (Prices per US ton)

Treatment	Time period fed (wks)						
	0-3	3-6	6-9	9-12	12-15	15-18	18-21
Agristats	311.76	308.12	289.05	278.26	266.59	249.96	240.55
Ideal diet	291.98	283.36	270.63	258.15	243.18	236.25	227.51
Ideal +5%	298.54	289.92	276.30	262.89	247.70	240.51	231.33
Ideal +10%	305.40	295.44	282.06	264.97	251.00	243.86	234.76



Table 4. Body weight gain and feed efficiency from 3 to 21 weeks of age.

<i>Trt</i>	Gain (kg)							FE (kg:kg)						
	3	6	9	12	15	18	21	3	6	9	12	15	18	21
1	.36	1.86	4.51	7.52	11.3	14.18	19.39	2.15	1.66	1.83	2.07	2.34	2.60	2.70
2	.36	1.86	4.47	7.45	11.26	14.07	19.18	1.95	1.70	1.84	2.12	2.32	2.62	2.70
3	.35	1.83	4.40	7.34	11.08	14.44	19.22	1.97	1.64	1.82	2.08	2.34	2.59	2.68
4	.36	1.87	4.52	7.52	11.23	14.56	19.42	2.06	1.67	1.82	2.08	2.29	2.68	2.75
SE	.03	.006	.09	.16	.21	.28	.24	.07	.02	.01	.02	.03	.08	.06
P value	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05	>.05

Different letters indicate significantly different means



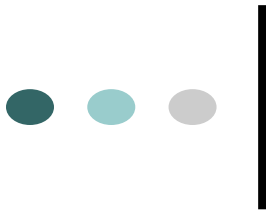
Current concepts: Pressure on the Matrix

- When the computer has exactly the minimum or maximum amounts, there is pressure on the matrix
- Means that the computer would like more or less of that ingredient
- Example: Company X has a maximum constraint of 3% on MBM and pressure was seen at inclusion 3.00%
- Removing that constraint resulted in a diet with ~4% MBM (perfectly fine) and would have saved company X ~\$10 million



Summary

- Animal by-product feeds are a positive in poultry rations
- Long history of use and safety in the US and worldwide
- Overall fat additions to broiler rations can be a positive addition to the feeding programs worldwide
- Using advanced formulation techniques can be a cost savings
- High quality at the lowest cost is always the goal



Questions?

