WHITE PAPER – SUMMARY OF RESEARCH INTO PAPS IN POULTRY DIETS

Introduction

Processed Animal Proteins (PAPs) have been banned from diets of farmed animals in the EU for approximately 20 years. During this time processing techniques for animal proteins have changed and improved. Consequently, the specifications of products in feedstuff tables do not accurately represent the composition and quality of available PAPs.

Amendments to the feed ban are currently under scrutiny and likely to come into effect in late 2021. The amendments will permit the feeding of porcine PAPs to poultry and poultry PAPs to pigs. This white paper summarises research and nutritional information for the use of porcine PAPs in poultry feed.

Overview of research

Wageningen Livestock Research in cooperation with the European Fat Processors and Renderers Association (EFPRA) has conducted studies to provide up to date information on the nutritional content of PAPs.

A 2010 study assessed digestibility and overall performance when four types of PAP were incorporated into the diet of laying hens. All the digestibility values were evaluated with the faecal digestibility protocol.

A 2018 study assessed digestibility and overall performance when two types of PAP were incorporated into the diet of broilers. In this study the total tract digestibility of proximate components and the ileal phosphorus, calcium and amino acid digestibility were measured.

2010 Trials with laying hens

Trial design

- 4 types of PAP tested; 40%, 50%, 58% and 60% protein in the diet of laying hens.
- PAP-50 produced using EU processing method 7, PAP-40, PAP-58 and PAP-60 from method 1. (See EU. No. 1069/2009, see appendix 7)
- PAP-40 and PAP-50 had higher bone content (<55% crude protein >4.4% phosphorous)
- Faecal digestibility protocol was used.

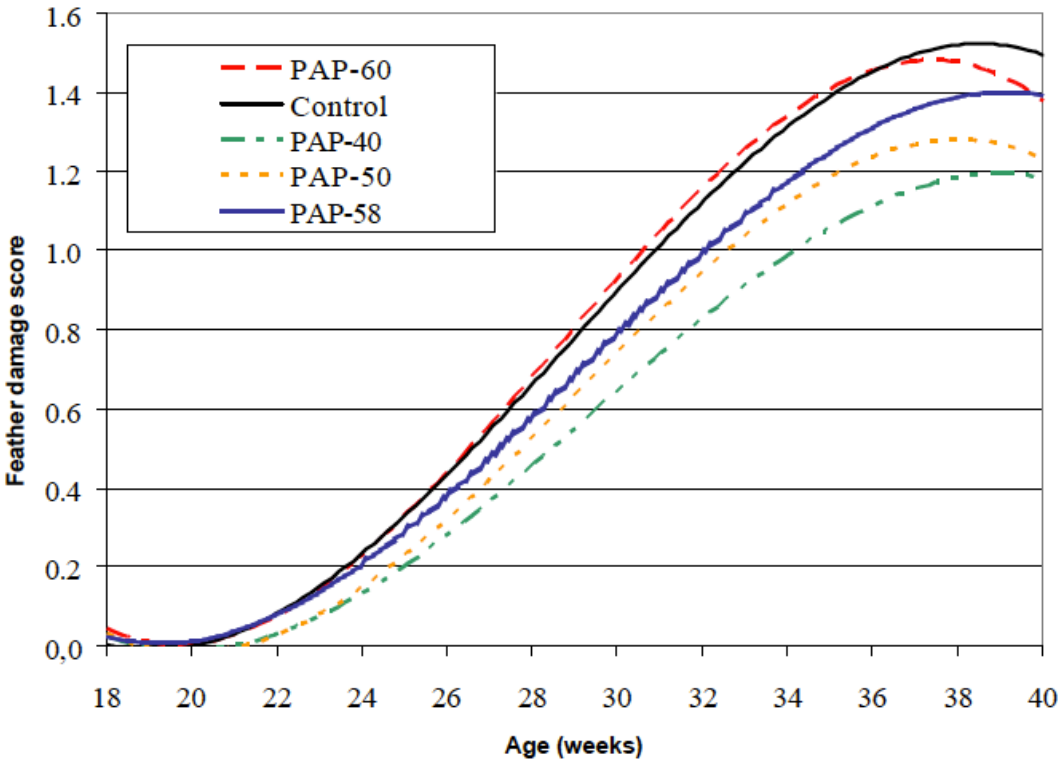
Nutritional results

- Digestibility coefficients for crude protein of the PAP were not affected by ash content (P = 0.739).
- Lower cysteine digestibility in PAP-40 (41%), PAP-58 (65%) and PAP-60 (55%) compared to PAP-50 (88%).
- This may be linked to higher pressures used in EU processing method 1. Shirley and Parsons (2000) showed that true digestibility values of most amino acids, particularly of cysteine and lysine, were significantly decreased with increasing pressures.

Layer performance

- Laying hen performance differed between treatments, being most favorable for the treatment with a medium protein level (PAP-50) and the least for the PAP with the lowest protein level (PAP-40).
- Differences in laying hen performance seemed to be partially related to differences in feed intake and corresponding amino acid intake.
- Supplementation with PAPs did not generally reduce feather pecking behavior.
- Nevertheless, for PAPs with lower protein levels (PAP-40 & PAP-50) hens showed a delay in the development of feather damage and, simultaneously, an increase in litter condition, foraging and walking behavior, and floor pecks compared to hens fed PAP-60. These shifts seemed to be partly related to the intake of digestible glycine, available phosphorus, calcium, potassium, and sodium.

Chart 1: Development of feather damage, ranging from 0 (intact plumage) to 5 (fully denuded area) per treatment over time, fitted by polynomial functions.



2018 trials with broilers

Trial design

- Trial investigated substitution of a proportion of soybean meal with two different porcine PAPs.
- PAP-1 was made using EU processing method 1, PAP-2 from method 7 (EU. No. 1069/2009, see appendix 7)
- Intestinal health, litter quality, footpad lesions and bone quality in broiler chickens from 0 – 42 days were evaluated.
- The performance study was followed up by a study in which the total tract digestibility of proximate components and ileal (pre-caecal) phosphorus, calcium and amino acid digestibility were evaluated.
- Pre-caecal digestibility protocol was applied.

Nutritional results

- PAP-2 had a significantly higher pre-caecal dry matter and crude protein digestibility than PAP-1
- Phosphorous and Calcium digestibility of PAP-2 was significantly lower.
- No differences were found in the total amino acid digestibility and the pre-caecal amino digestibility.
- Apparent ileal digestibility of LYS, THR, ILE, ARG, PHE, HIS did not differ between PAP-1 and PAP-2.
- Apparent ileal digestibility of MET and TRP of PAP-2 were significantly higher than of PAP-1 while, CYS and PHE tended to be higher.
- PAP-2 had a higher faecal dry matter (DM), organic matter (OM), and ash digestibility, but a distinctly lower crude fat digestibility compared with PAP-1.
- Differences in protein digestibility between PAPs may be related to the applied processing methods.
- Dietary Phosphorus (P) contents in the current study might not be optimal for determining pre-caecal P digestibility of the involved PAPs, and more studies are required to validate the observed P digestibility of the current study.
- It is recommended, once the ban on the use of animal proteins in broiler diets ends, to critically consider the present PAP table values for broilers.

Broiler performance

- Both types of PAP tested can be considered as suitable replacers of SBM in broiler diets.
- They can replace dietary soybean meal by one of the tested PAPs, while maintaining performance results, litter quality, footpad lesions, gait, bone quality and intestinal health of male broilers.

Guidance for application of the results in the matrix for linear programming

		Results from broiler trials			Results from layer trials			
EU Processing method[1]		1	7		7	1	1	1
		PAP-1	**PAP-2**		**PAP-50**	**PAP-60**	**PAP-40**	**PAP-58**
Nutrients								
Dry matter	g/kg	946	948		978	964	969	975
Crude protein (CP)	g/kg	609	601		558	617	417	597
Crude ash	g/kg	121	233		336	183	437	252
Crude fat	g/kg	144	101		96	117	99	118
Crude fibre	g/kg	40	16					
Residue by difference		72	13		-12.7	48	15,8	8.5
Calcium	g/kg	28.3	78		116	52	160.5	82.2
Phosphorus	g/kg	19.3	41.9		58.6	29.5	77.3	42.1
Magnesium	g/kg	2.2	2,3		2.6	2.2	3.6	2.3
Sodium	g/kg	6.9	7		6	6.9	7	7
Potassium	g/kg	7.6	5.8		4.3	7.6	4	5.8
Chloride	g/kg	7	7		7	7	7	7
Apparent Total Tract Digestibility (ATTD)[2]								
ATTD dry matter	%	54.5	65.6		55.74	64.28	38.42	52.63
ATTD org. matter	%	55	67.1		64.63	61.33	47.1	53.65
ATTD crude fat	%	86.5	67.4		81.2	97.2	79.65	94.49
ATTD ash	%	42.3	52.2		50.23	106.9	31.05	67.14
ATTD CP					90.06	83.37	81.43	85.26
ATTD GE					66.61	65.44	55.95	62.01
Pre-caecal Digestibility Coefficient (PCDC)								
PCDC Crude protein	%	60.9	68.8					
PCDC phosphorus	%	56.4	49.9		56.4	56.4	56.4	56.4
PCDC Calcium	%	48.8	40.3					
Apparent Metabolisable Energy								
AME broiler		11.88	10.49		11.63	13.20	8.88	13.05
AME layer		12.99	11.32		12.54	14.33	9.64	14.16
Digestibility P, g/kg[3]		10.9	20.9		33.1	16.6	43.6	23.7
Amino Acids (AA) g in 100 g CP								
LYS		5.56	5.02		5.54	5.27	4.73	4.93
MET		1.61	1.35		1.52	1.51	1.18	1.37
CYS		0.56	0.79		0.66	0.86	0.36	0.45
M+C		2.17	2.14		2.19	2.37	1.51	1.83
THR		3.39	3.35		3.12	3.36	2.74	3.03

		Broiler trials			Layer trials			
		1	7		7	1	1	1
		PAP-1	**PAP-2**		**PAP-50**	**PAP-60**	**PAP-40**	**PAP-58**
TRP		0.95	0.77		0.72	0.83	0.50	0.70
ILE		3.29	3.12		2.74	2.97	2.33	2.85
ARG		6.08	6.79		6.84	6.11	6.79	6.52
PHE		3.52	3.25		3.21	3.26	3.00	3.25
HIS		2.63	2.30		1.94	1.83	1.49	1.78
LEU		6.39	6.45		5.95	6.32	5.23	6.05
TYR		2.71	2.72		2.15	2.51	1.58	2.31
VAL		4.61	4.42		4.01	4.41	3.79	4.16
ALA		6.95	6.61		7.31	6.74	7.99	7.38
ASP		7.36	7.16		7.53	7.36	6.84	7.31
GLU		11.47	12.38		12.35	12.44	11.92	12.47
GLY		10.45	10.63		12.97	10.98	15.76	12.77
PRO		6.90	6.65		8.24	6.74	8.66	8.16
SER		3.64	4.28		3.62	3.84	3.55	3.57
Sum AA in 100 g CP		88.1	88.1		90.4	87.3	88.4	89.1
Ileal Digestible AA, g/kg fresh product								
LYS		24.1	20.9		25.4	25.2	13.8	21.4
MET		6.8	6.8		6.6	6.9	3.3	5.9
CYS		0.7	1.4		2.9	2.6	0.6	1.6
M+C		7.5	8.1		9.5	9.5	3.9	7.5
THR		12.4	13.2		13.3	14.8	7.0	12.7
TRP		3.2	3.0		3.3	3.3	1.3	2.7
ILE		13.2	13.3		12.1	12.6	5.9	11.8
ARG		28.9	31.1		32.4	29.7	22.2	32.0
PHE		14.8	15.1		14.6	14.8	8.6	14.0
HIS		11.6	10.4		9.0	8.5	4.3	7.9
LEU		27.3	29.4		26.8	27.7	14.6	25.8
TYR		11.1	11.9		10.0	11.1	4.3	9.7
VAL		19.1	18.9		17.9	18.8	10.2	17.1
ALA		30.4	30.0		30.5	27.4	20.5	28.1
ASP		15.4	18.6		32.6	30.8	16.3	27.5
GLU		44.7	50.6		56.2	57.0	35.3	54.4
GLY		61.1	70.8		44.4	37.4	36.7	40.3
PRO		27.6	26.6		37.7	31.8	26.5	37.6
SER		11.3	14.8		16.5	17.2	10.4	16.0
Sum AA		363.6	387.0		392.1	377.5	241.8	366.4
Sum Ileal Digestible AA / CP content		59.7	64.4		70.3	61.2	58.0	61.4

Notes on the table

- [1] EU processing method no.1 is currently obligatory for mammalian processed animal proteins.
- [2] To compare the 2 trials, the data from the layer trial were corrected with a factor of 90% to calculate ileal from total tract digestibility.
- [3] The digestibility P for PAP-50, PAP-60, PAP-40 and PAP-58 has been estimated from the PAP1 data.

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