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Effect of low-fiber sunflower meal and phytase on broiler chicks' performance and meat quality

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Context

High costs of conventional protein feed sources including soybean meal (SBM) generated the need for finding other alternatives. Utilizing agro-industry by-products as inexpensive alternatives in poultry nutrition is of an ongoing interest for both nutritionists and poultry producers. Sunflower (SFM; *Helianthus annus* L.) is high oil-yielding seed crop cultivated worldwide, that adapts very well to a wide range of climatic and soil conditions. SFM a by-product of sunflower oil extraction, is important as a source of vegetable protein and fiber for humans and animals. SFM contains low antinutritional compounds and it is more resistant to contaminants, compared to SBM [3]. Nevertheless, the use of SFM in poultry diet is limited by variations in its chemical composition and the two main components restricting its use are high fiber and low lysine contents

Phosphorus (P) is the third most expensive nutrient in poultry diets after energy and protein. Phytic acid (*myo*-inositol hexaphosphate) is an important plant P storage form and accounts for 50 to 80% of total P present in plant seeds commonly used in livestock animal feeds. However, phytate-P has low bioavailability and is underutilized due to the lack of endogenous phytate degrading enzymes in nonruminant livestock, including poultry. In-feed administration of microbial phytases to improve digestibility of phytic acid is widely used in the production of poultry and other livestock.

Objective

The objective of this study was to evaluate in chicks' diet an appropriate inclusion level of low-fiber SFM as an alternative protein source instead of SBM with or without microbial phytase supplementation on the productive performance, carcass traits and meat quality of broilers.

Material and methods

Birds:

- 800 one-day old broiler chicks (Cobb 500) of mixed sexes, randomly divided and individualy weighed (43,4± 0.23 g/chick and distributed in 8 treatment groups.
- Each treatment was subdivided in 5 replicates of 20 chicks. The chicks were kept in pens on litter (wood shavings) in a shelter, under managerial , hygienic and controlled enviromental conditions, during 42 days. Medical care and vaccination s were performed under the supervision of a veterinarian. Fed *ad libitum* with constant water access.

Treatments:

- The diets were arranged in a 4 × 2 factorial design, with the variable being low-fiber SFM substituted for SBM at four levels (0%, 25%, 50% and 75%, respectively) and enzyme (Axtra® PHY 5000 L) supplementation at two levels (0 and 0.2 g/kg diet, respectively).

Statistical analysis:

Performed by using GLM procedure of SPSS/IBM software (version 20 Inc. Chicago, IL, USA). Levels of SFM, enzyme and their interactions were included in the statistical model. Effects were considered statistically significant at $P<0.05$. Post hoc multiple comparisons was performed by Tukey test.

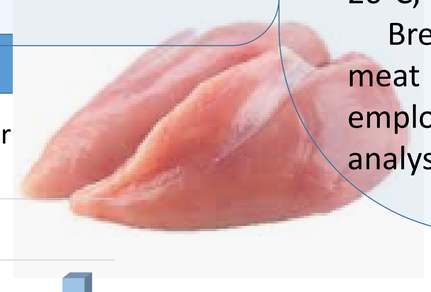
Parameters and methods:

- Nutrient composition of low-fiber SFM, analysed in duplicate for its content in: dry matter, crude protein (N x 6,25), ether extract and ash. Amino acids (excluding tryptophan) were analysed by HPLC (Thermo Finnigan, MA, USA).
- Body weight gain (BWG), Feed intake (FI) and feed convertion rate (FCR) were calculated.
- Carcass yield: Carcass weight, relative weights of edible organs and relative abdominal fat.

Breast meat quality attributes and carcass traits

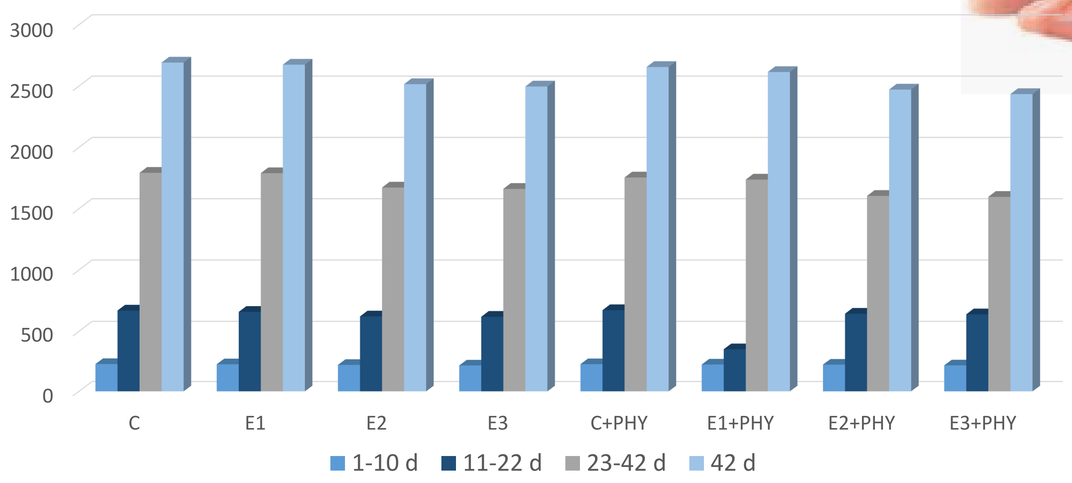
At 42 days of age, 3 chicks per replicate pen were slaughtered (by severing right carotid artery),. Breast meat samples (right side *pectoralis superiors)* were kept in individual zip lock bags at freezer under temperature equal to -20°C, until analysis.

Breast meat quality attributes: meat pH (HACH HQ30D portable pH-meter), meat colour (Minolta CR-400 Chroma meter, Minolta, Osaka, Japan) by employing CIE scale and meat texture profile and meat hardness (Texture analyser TVT 6700 Pekin Elmer, Hägersten, Sweden).

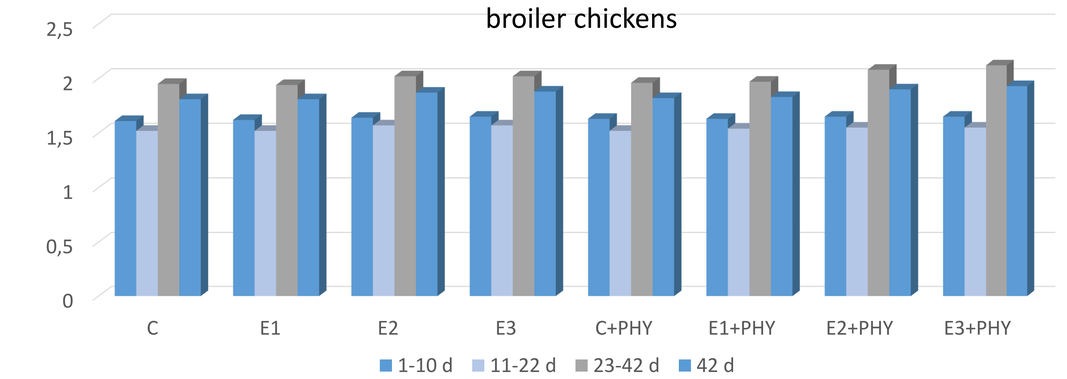


Results

Dietary low-fiber SFM level and phytase addition on BWG of broiler chickens



Dietary low-fiber SFM level and phytase addition on FCR (g/g) of broiler chickens



Effects of dietary SFM levels and phytase addition on breast meat quality of broiler chickens[1]

Treatments	SFM (%)	Phytase[2] (g/ kg diet)	Texture profile analysis						pH	Lightness (L*)	Redness (a*)	Yellowness (b*)
			Hardness (N)	Springiness (mm)	Resilience[5]	Cohesiveness[6] (%)	Gumminess[7]	Chewiness[8]				
1[3]	0	0	2,240	1.000	2.41	0.37	828.87	828.98	6.04	46.90	3.55	14.07
2	25	0	2,292	0.997	1.98	0.36	824.44	822.95	5.98	48.93	3.31	13.32
3	50	0	2,208	0.996	2.55	0.41	905.22	901.46	5.98	48.59	3.46	12.66
4	75	0	2,304	0.998	2.18	0.42	868.18	865.97	6.08	47.49	3.40	13.34
5	0	0.2	2,273	0.999	2.20	0.36	838.39	837.50	5.98	47.15	3.24	13.53
6	25	0.2	2,296	0.999	2.68	0.38	872.48	871.76	5.91	49.76	3.18	14.02
7	50	0.2	2,285	0.997	2.44	0.42	859.54	856.90	5.99	49.05	3.33	13.42
8	75	0.2	2,290	0.999	2.56	0.38	870.60	869.84	5.99	49.46	3.44	14.22
SEM			145.1	0.05	0.09	0.07	82.2	77.5	0.33	8.8	0.19	0.54
Main effects[4]												
Level (L)												
0			2,256	0.999	2.30	0.36	833.70	833.54	6.00	47.05	3.39	13.97
25			2,294	0.998	2.33	0.37	848.35	847.66	5.94	48.82	3.25	13.70
50			2,246	0.997	2.50	0.41	882.32	879.27	5.98	48.87	3.39	13.03
75			2,297	0.999	2.37	0.40	869.44	867.95	6.03	48.46	3.42	13.77
Phytase (PHY)												
No			2,261	0.900	2.28	0.39	856.70	855.22	6.02	47.98	3.43	13.35
Yes			2,286	0.999	2.47	0.39	860.33	858.90	5.97	48.84	3.32	13.80
P-value												
L effect			0.233	0.505	0.086[T]	0.174	0.128	0.143	0.445	0.230	0.095[T]	0.125
PHY effect			0.346	0.123	0.105	0.826	0.885	0.556	0.673	0.764	0.225	0.473
L x PHY effect			0.562	0.586	0.227	0.368	0.395	0.329	0.524	0.565	0.268	0.544

[a,b] Means in columns with no common superscript differ significantly ($P < 0.05$).
[1]Data are means of 15 broilers for each treatment.
[2]Axtra® PHY 5000 L (1000 FTU/kg feed).
[3]Control group
[4]Data were analysed as 4 × 2 factorial arrangement.
[5] Area during the withdrawal of the first compression / Area of the first compression; [6]Area under second curve/ Area under first curve; [7]Hardness × Cohesiveness; [8]Hardness × Springiness × Cohesiveness.

Conclusions

Replacement of SBM in broiler chickens diets with low-fiber SFM at levels less than 25% resulted in similar growth performance, carcass traits and meat quality during the overall experiment period. In addition, quality of the different types of breast meat studied were similar. Phytase had no favourable effect on BWG, FI and FCR. Further studies are required to evaluate the impacts of low-fiber SFM inclusion in broiler chicken diets. It is concluded that the diets with low-fiber SFM levels up to 25% led to growth performance and meat quality comparable with diet contained SBM.

Acknowledgements

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