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Laying performance and cost-benefits of feeding brown laying hens with raw or processed tropical sickle pod (*Senna obtusifolia*) seed meal based-diets

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Abstract. A feeding trial was conducted for 16 weeks to evaluate the effects and cost-benefits of feeding raw or processed *Senna obtusifolia* (*S. obtusifolia*) seed meal based-diets on the laying performance of ISA brown laying hens. Six experimental diets were compounded to contain 0% *S. obtusifolia* seed meal (T1) and 20% each of the raw, boiled, soaked, sprouted and fermented *S. obtusifolia* seed meals designated as T2, T3, T4, T5 and T6, respectively. One hundred and eighty (180) ISA brown laying hens aged 36 weeks were housed in battery cages (5 birds/0.95m²) and assigned to the six (6) dietary treatments in groups of thirty (30) birds in a completely randomized design. Each replicate cage contains 10 laying hens. Data were collected on feed intake, hen-day egg production (HDEP), hen-house egg production (HHEP), egg weight, egg mass, feed conversion ratio per egg mass, feed cost per kilogram, feed cost per egg mass and mortality. The results indicated that the group of laying hens fed raw *S. obtusifolia* seed meal based diet recorded the lowest HDEP (52.42%), egg weight (53.08g) and egg mass (2782.45g). Among the hens fed the processed *S. obtusifolia* seed meal based diets, the laying hens fed the fermented *S. obtusifolia* seed meal based diet indicated significantly ($p < 0.05$) better HDEP (64.05%), egg weight (58.45g) and egg mass (3743.72g). On economic grounds, the use of raw *S. obtusifolia* is not cost effective because feed cost per kilogram egg was relatively high (N317.47 or \$0.82) in the group of laying hens fed raw *S. obtusifolia* seed meal based diet. However, the processed *S. obtusifolia* seed meal based diets showed some economic advantage. In conclusion, 20% of fermented *S. obtusifolia* seed meal can be incorporated in the diets of laying hens with little or no depreciation in laying performance and economic-benefits.

Keywords: laying hens, laying performance, processed sickle pod, cost benefits

Introduction

Adequate intake of quality animal protein such as poultry meat and egg is among the efficient measures of handling malnutrition in Nigeria. FAO (1994) reported that the average Nigerian does not consume enough protein of animal origin which is more efficient than plant protein in providing the amino acids necessary for tissue development, repair and function. Poultry production has great potential for improving the animal protein intake of populace (Tuleun et al., 2008). Ijaiya et al. (2012) reported that commercial layer production is the most significant source of quality protein and income in Nigeria as compared with other livestock production activities. Despite this great socio-economic potential in the chicken industry, the high cost of conventional feed ingredients and poultry diets still remain a major problem of poultry production in Nigeria. This was further buttressed by Tuleun et al. (2008) who found that availability of high quality feed is constrained by the phenomenal increase in the cost of major ingredients which is due to competition from direct consumption of these materials by human beings. A way forward to address this problem is to harness the nutritional potentials of lesser-known legumes in the feeding of poultry. Tuleun et al. (2008) suggested the need to focus on the exploitation of lesser-known or non-traditional plant resources that are not subject to competition between man and livestock. In this context, *S. obtusifolia* seeds seem to be such an alternative feed resource. A study conducted by Augustine et al. (2017) revealed that pullets fed 20% of boiled and fermented *S. obtusifolia* seed meal based diets indicated better growth performance.

The chemical properties of the seed as revealed by Ingweye et al. (2010) and Augustine (2016) indicated that the seeds have good nutritional values (29.54 and 23.40% CP) as an alternative protein

source for domestic chickens. The authors further revealed that the seeds contain some toxic factors such as tannins, phytates, oxalates and saponins. These factors may be toxic when consumed by poultry. In view of the above, it has become necessary to subject the seeds to appropriate processing treatment(s) before they can be utilized as feedstuff for poultry. At the moment, base-line information on the best processing method(s) that will enhance optimal utilization of the seeds as feed ingredient for laying chickens seems to be very meager, hence the need to conduct more studies in order to bridge this information gap. It was in view of this that an experiment was conducted to investigate the laying performance and cost-benefits of ISA brown laying hens fed raw or processed tropical *Senna obtusifolia* seed meal based-diets.

Materials and methods

Study area

The research was conducted at the Poultry Unit of the Department of Animal Production Livestock Teaching and Research Farm, Adamawa State University, Mubi. Mubi is located between latitudes 9°30' and 11° North of the equator and longitudes 13° and 13°45' East of the Greenwich meridian. The temperature regime in Mubi area is warm to hot throughout the year. However, there is usually a slight cold period between November and February. There is a gradual increase in temperature from January to April. The minimum and maximum temperatures of the area are 18.1°C and 32.8°C. The mean annual rainfall ranges from 900 to 1050mm (Adebayo, 2004).

Experimental stock and their management

One hundred and eighty (180) ISA brown pullets were reared on

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deep litter system. The birds were vaccinated with Gumboro vaccines first and second doses (2 and 4 weeks), lasota (3 weeks), fowl pox (7 weeks) and Komorov (6 and 16 weeks). The birds were dewormed at 15 and 20 weeks using piperazine drug. The laying hens were managed on the deep litter using standard routine layer management practices until they are 34 weeks old and were thereafter transferred and adapted in battery cages (5 birds/0.95m²). Data collection commenced when the laying hens reached 36 weeks old. The experiment lasted for 16 weeks.

Experimental diets

Six (6) experimental layer diets were compounded to contain 0% *S. obtusifolia* seed meal (T1) and 20% each of the raw, boiled, soaked, sprouted and fermented *S. obtusifolia* seed meals designated as T2, T3, T4, T5 and T6, respectively. Diet T1 served as the positive control while diet T2 was the negative control. The composition of the experimental diets is presented in Table 1.

Table 1. Ingredient composition and calculated analysis of the experimental layers mash

Ingredients, %	Level of inclusion of each of the raw or processed SOSM					
	T1	T2	T3	T4	T5	T6
	0% SOSM	20% RSOSM	20% BSOSM	20% SKSOSM	20% SPSOSM	20% FSOSM
Maize	45.00	45.00	45.00	45.00	45.00	45.00
Roasted soya bean	16.00	7.00	7.00	7.00	7.00	7.00
SOSM	0.00	20.00	20.00	20.00	20.00	20.00
Fishmeal	2.10	2.10	2.10	2.10	2.10	2.10
GNC	8.00	8.00	8.00	8.00	8.00	8.00
Maize offal	18.00	7.00	7.00	7.00	7.00	7.00
Salt	0.35	0.35	0.35	0.35	0.35	0.35
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	7.00	7.00	7.00	7.00	7.00	7.00
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Premix	0.25	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated analysis						
Protein, %	17.08	17.13	17.01	16.49	17.06	17.63
Fibre, %	4.35	5.45	3.79	4.21	3.79	4.07
Methionine, %	0.48	0.67	0.55	0.60	0.65	0.67
Lysine, %	0.84	1.50	1.16	1.14	1.26	1.32
Calcium, %	3.75	3.76	3.77	3.76	3.77	3.78
Phosphorus, %	0.89	0.95	0.95	0.89	0.96	0.95
ME energy, MJ/kg	11.26	11.27	11.19	11.09	11.17	10.94

*Metabolizable energy (ME) was calculated according to the formula of Pauzenga (1985):

ME= 37 x % CP + 81 x % EE + 35.5 x % NFE; GNC = Groundnut cake; SOSM = *S. obtusifolis* seed meal;

RSOSM = Raw *S. obtusifolia* seed meal; BSOSM = Boiled *S. obtusifolia* seed meal;

SKSOSM = Soaked *S. obtusifolia* seed meal;

SPSOSM = Sprouted *S. obtusifolia* seed meal and FSOSM = Fermented *S. obtusifolia* seed meal.

Experimental design

One hundred and eighty (180) laying hens were assigned to the six (6) experimental diets in a group of thirty (30) hens each in battery cages in three replicates of 10 hens each in a completely randomized design (CRD).

Parameters measured

Feed intake: Feed was offered to each treatment group and the

quantity leftover the next morning was measured before supplying another feed. The quantity consumed for each day was obtained by subtracting initial quantity of feed offered from left-over feed.

Feed conversion ratio (FCR): It was computed as:

$$\text{FCR} = \frac{\text{Quantity of feed consumed (g)}}{\text{Total egg weight (g)}}$$

Hen-day egg production, hen house egg production and egg mass: These parameters were computed using the formula shown below:

$$\text{Hen-day egg production (\%)} = \frac{\text{Total no of eggs laid} \times 100}{\text{Total no of live hens}}$$

$$\text{Hen-housed egg production (\%)} = \frac{\text{Total no of eggs laid}}{\text{No of hens at start of experiment}} \times 100$$

$$\text{Egg mass (g)} = \text{Hen-day egg production} \times \text{egg weight.}$$

Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) of the completely randomized design using Statistix 8.0 (Statistix, 2003). Least Significant Difference (LSD) was used to separate the treatment means where significant differences occurred. Significant difference was considered at 5% level of probability.

Results and discussion

Laying Performance

The results of feed intake, laying performance, feed conversion ratio and mortality of laying hens fed raw or processed *S. obtusifolia* seed meal are presented in Table 2. The feed intake recorded in this study is higher than the values of 135-140g reported by Ganiyu (2005) for laying hens in the tropics. This might be attributed to feed that was wasted and not accounted for. Better feed utilization and laying performance were observed in the laying hens fed neutral diet (0% SOSM) followed by those laying hens fed 20% fermented *S. obtusifolia* seed meal based diet. The presence of anti-nutritional factors in the group of laying hens fed raw *S. obtusifolia* seed meal based diet might have led to the poor feed conversion ratio per egg mass, hen-day egg production and hen-house egg production. A similar observation was made by Gul et al. (2005) and Kaya et al. (2011) who fed raw vetch seed meal and 22% of raw *Vicia sativa* seed meal based diets to laying hens and observed poor feed conversion ratio per egg mass. Among the hens fed the processed *S. obtusifolia* seed meal based diets, those laying chickens fed fermented *S. obtusifolia* seed meal recorded better performance (feed conversion ratio per egg mass, hen-day egg production and hen-house egg production). This is an indication that fermentation was more effective in detoxifying the toxic components of the *S. obtusifolia* seeds. This finding is in agreement with the report of Engberg et al. (2009) who pointed out that fermentation was very effective in reducing the levels of anti-nutritional factors in diets. It was also reported that biologically active by-products present in fermented feed such as probiotic bacteria and lactic acid may exert beneficial effects on poultry through the modification of the gastrointestinal environment in a favourable manner (Wang et al., 2012). These might have been the reasons for better feed utilization and superior laying performance recorded in the group of laying hens fed fermented *S. obtusifolia* seed meal based-diet.

Egg weight and egg mass of the laying hens fed the experimental diets were significantly ($p < 0.05$) influenced by the different experimental diets. The laying chickens fed the raw seed meal based diet showed the least egg weight compared to other treatment groups which recorded similar egg weights and egg mass.

This may be attributed to the fact that anti-nutritional factors such as tannins and phytates present in the raw *S. obtusifolia* seed meal can form insoluble complex with protein consequently preventing the digestion and assimilation of nutrients hence reducing the protein required for egg production (Akanji and Ologhobo, 2007). Generally, the egg weights and egg mass from the hens fed the processed seed meal are very close to those fed the positive control diet (T1, 0% SOSM) which is an indication that the processing methods used have effectively reduced the level of the anti-nutritional factors and improved egg weight and egg mass. Similar findings were established by Laudadio and Tufarelli (2012) and Ragab et al. (2012) who fed chickens with processed *Pisum sativum* and *Lablab purpureus* seed meals. The egg weights obtained in this study were within the standard weight (53-63g) reported by European Council Directive (2006).

Hen-day egg production was significantly ($p < 0.05$) affected by the dietary treatments. Better performance was recorded in laying hens fed 0% SOSM and 20% fermented *S. obtusifolia* seed meal. The poor performance observed in the chickens fed 20% of the RSOSM may be attributed to the adverse effects of anti-nutritional factors present in the RSOSM. Fasuyi et al. (2007), observed that inclusion of processed pea seed meal in the diets of laying chickens resulted in an increased blood flow to the ovaries thereby leading to more ovarian follicular formation which ultimately increased egg production. This observation is in line with the outcome of this study suggesting that processing used had reduced the toxic components in *S. obtusifolia* seeds which positively affected the physiology of the laying chickens. The results of hen-day egg production (HDEP) obtained in this study are within the range (52.42-69.28%) reported by Sola et al. (2011) for laying chickens fed 20% *Adansonia digitata* seed meal but lower than the range (78.10-79.10%) established by Laudadio and Tufarelli (2012) for laying chickens fed processed pea seed meal. The HDEP of 64.05% recorded in the group of laying hens fed 20% fermented *S. obtusifolia* seed meal based diet is however lower than the 87% HDEP recommended by Ganiyu (2005). This was attributed to possible effect of residual anti-nutritional factors and lack of some feed additives such as enzymes and probiotics in the diets which may enhance nutrient utilization and improve egg production.

The results of hen-house egg production followed a similar trend as that of hen-day egg production. The low mortality rate recorded during the experimental period is an indication that laying hens can tolerate up to 20% of raw or processed *S. obtusifolia* seed meal in their diets.

Cost-benefits of feeding layers with processed *Senna obtusifolia* seed meal

The cost-benefits of feeding laying hens with processed *S. obtusifolia* seed meal is presented in Table 3. The result indicated that feed cost per kilogram of the diets was high in the control diet (0% SOSM), an indication that inclusion of *S. obtusifolia* seed meal can reduce the cost of feed. Similar observation was made by Kwari et al. (2009) and Ragab et al. (2012) who fed laying hens with processed sorrel and *Lablab purpureus* seed meal. However, feed cost per kilogram of the eggs was observed to be high in the group of the hens fed the raw *S. obtusifolia* seed meal based diets. This is an indication of the adverse effect of anti-nutritional factors on economic benefits of egg production.

Table 2. Laying performance of ISA brown hens fed raw or processed *Senna obtusifolia* seed meal based diets

Parameters	Level of inclusion of each of the raw or processed <i>S. obtusifolia</i> seed meal						SEM
	T1	T2	T3	T4	T5	T6	
	0%	20%	20%	20%	20%	20%	
	SOSM	RSOSM	BSOSM	SKSOSM	SPSOSM	FSOSM	
Daily feed intake, g/bird	187.5±9.22 ^a	180.2 ^b	180.17 ^b	180.0±14.0 ^b	183.3±5.02 ^b	188.9±18.1 ^a	11.26
Total feed intake, g	21001.1±10.2 ^a	20180.2±17.1 ^b	20179.0±11.2 ^b	20160.0±17.4 ^b	20533.0±12.4 ^b	21159.0±19.3 ^a	29.31
FCR/egg mass	2.98±0.71 ^c	5.44±1.87 ^a	4.28±1.44 ^b	4.32±1.04 ^b	4.27±0.93 ^a	3.78±1.07 ^c	0.15
HDEP, %	69.9±13.9 ^a	52.42±6.33 ^c	60.05±9.46 ^b	59.83±6.93 ^b	60.4±8.65 ^b	64.05±11.73 ^b	8.98
HHEP, %	67.9±5.09 ^a	51.16±7.91 ^c	60.02±6.78 ^b	59.61±7.91 ^b	57.59±15.43 ^b	62.75±15.91 ^b	1.67
Egg weight, g	59.96±8.95 ^a	53.08±10.24 ^c	58.88±6.04 ^b	58.96±10.31 ^b	58.26±4.32 ^b	58.45±4.75 ^b	1.28
Egg mass, g	3489.4±12.7 ^a	2782.5±16.9 ^c	3535.7±25.2 ^b	3533.8±19.9 ^b	3518.3±16.2 ^d	3743.7±19.7 ^{ab}	13.71
Mortality, number	1.00	1.00	0.00	0.00	2.00	1.00	-

a, b, c = Means in the same row with different superscripts are significantly different ($p < 0.05$); * = Significant at 5% level of probability; SEM = Standard error of the means; FCR = Feed conversion ratio; HDEP = Hen-day egg production; HHEP = Hen-house egg production; RSOSM = Raw *S. obtusifolia* seed meal; BSOSM = Boiled *S. obtusifolia* seed meal; SKSOSM = Soaked *S. obtusifolia* seed meal; SPSOSM = Sprouted *S. obtusifolia* seed meal; FSOSM = Fermented *S. obtusifolia* seed meal.

Table 3. Cost-benefit of feeding laying hens with processed *Senna obtusifolia* seed meal based diets

Parameters	Level of inclusion of each of the raw or processed <i>S. obtusifolia</i> seed meal						SEM
	T1	T2	T3	T4	T5	T6	
	0%	20%	20%	20%	20%	20%	
	SOSM	RSOSM	BSOSM	SKSOSM	SPSOSM	FSOSM	
Total feed intake, kg	21.00±4.77 ^a	20.18±7.18 ^b	20.17±9.22 ^b	20.16±4.02 ^b	20.53±10.82 ^b	21.16±6.90 ^a	0.029
Egg weight, g	59.96±10.02 ^a	53.08±4.90 ^c	58.88±8.01 ^b	58.96±5.11 ^b	58.26±3.87 ^b	58.45±7.12 ^b	1.28
FCR/egg mass	2.98±0.78 ^d	5.44±1.66 ^a	4.28±0.52 ^b	4.32±1.19 ^b	4.28±0.95 ^b	3.78±2.07 ^c	0.15
HDEP, %	69.28±9.23 ^a	52.42±2.33 ^d	60.05±15.88 ^c	59.83±7.91 ^c	60.39±10.20 ^c	64.05±6.85 ^b	8.98
Feed cost, N/kg	70.84 (0.19)	58.36 (0.56)	60.31 (0.17)	60.11 (0.17)	59.52 (0.16)	63.16 (0.17)	-
TF cost, N	1487.64 (4.13)	1177.70 (3.27)	1216.45 (3.38)	1211.82 (3.37)	1221.95 (3.39)	61355.30 (3.7)	-
Feed cost/kg egg, N	210.03 (0.58)	317.47 (0.88)	258.13 (0.72)	259.67 (0.72)	254.67 (0.71)	238.75 (0.66)	-

a, b, c, d = Means in the same row with different superscripts are significantly different ($P < 0.05$); * = Significant at 5% level of probability; Values in parenthesis are in Dollars (\$); 1 Naira is equivalent to 360 USD; SEM = Standard error of the means; FCR = Feed conversion ratio; HDEP = Hen day egg production; TF = Total feed cost; RSOSM = Raw *S. obtusifolia* Seed meal; BSOSM = Boiled *S. obtusifolia* Seed meal; SkSOSM = Soaked *S. obtusifolia* Seed meal; SPSOSM = Sprouted *S. obtusifolia* Seed meal; FSOSM = Fermented *S. obtusifolia* Seed meal.

Conclusion

The findings of this study revealed that processing *Senna obtusifolia* (boiled, soaked, sprouted and fermented) before incorporation in the diets of laying hens has beneficial effects in improving the laying performance of ISA brown laying hens. The results further revealed that the group of laying hens fed the fermented *S. obtusifolia* seed meal based diets showed better laying and economic performance compared to the layers fed other processed *S. obtusifolia* seed meal based diets. Even though the control or standard diet gave the best result, the group of layers fed the fermented *S. obtusifolia* seed meal base-diet indicated laying

performance and economic benefits that are very close to the group of the layers fed the control diet (standard diet). Fermented *S. obtusifolia* seed meal therefore had the weakest negative effects on egg laying performance and more economic benefits compared to the other processed *S. obtusifolia* seed meals.

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References

- Adebayo AA**, 2004. Mubi region a geographical synthesis paraclete publishers, Yola, Nigeria p.133.
- Akanji AM and Ologhobo AD**, 2007. Effect of some raw tropical legume seeds on egg quality and laying performance of exotic hens. American-Eurasian Journal of Agriculture and Environmental Sciences, 2, 648-654.
- Augustine C**, 2016. Evaluation of sickle pod (*Senna obtusifolia*) seed meal as source of protein for domestic chickens. Thesis for PhD, Department of Animal Science, University of Maiduguri, Borno State, Nigeria.
- Augustine C, Kwari ID, Igwebuike JU, Adamu SB, Doma UD and Medugu CI**, 2017. Performance of growing pullets fed processed sickle pod (*Senna obtusifolia*) seed meal. In: Proceedings of the 6th Animal Science Association of Nigeria and Nigerian Institute of Animal Science Joint Annual Meeting, September 10-14th, 2017, Abuja, Nigeria, pp. 522-526.
- Engberg RM, Hammersoj M, Johnson NF, Abousekken MS, Steinfeldt S and Jensen BB**, 2009. Fermented feed for laying hens: Effects on egg production, egg quality plumage condition composition and activity of the intestinal microflora. British Poultry Science, 50(2): 228-239.
- European Council Directive**, 2006. Certain marketing standards for egg grade EC 2295/2003, Brussel, Belgium.
- FAO**, 1994. The state of food and Agricultural series No 27. FAQ/UN, Rome. <http://www.FAO.org/docrep/t4450e/T445E00.htm>.
- Fasuyi AO, Dairo FSA and Olujimi OT**, 2007. Protein supplementary quality of vegetable leaf meal (*Amaranthus cruentus*) in the diets of laying hens: egg quality performance, egg quality and haematological implication. Journal of Food Agriculture and Environment, 5, 294 -300.
- Ganiyu O**, 2005. Poultry Care. A complete guide to chicken production. Ganob and Associate Limited Ibadan, Nigeria, p. 96.
- Gui M, Yoruk MA, Hayirli A, Turgut L and Karaoglu M**, 2005. Effects of additives on laying performance and egg quality of hens fed high level of common vetch seed (*Vicia sativum*) during peak period. Journal of Applied Poultry Research, 14, 217 - 225.
- Ijaiya AT, Egena SSA and Omohain D**, 2012. Egg production of Japanese quails (*Coturnix coturnix japonica*) fed dietary levels of fermented cassava (*Manihot spp.*) peal meal. In: Proceeding of 17th Annual Conference of Animal Science Association of Nigeria (ASAN) Abuja, Nigeria, pp. 377-380.
- Ingweye JN, Kalio GA, Ubua JA and Umoren EP**, 2010. Nutritional evaluation of wild sickle pod (*Senna obtusifolia*) seeds from Obanliku, South - Eastern, Nigeria. American Journal of Food Technology, 5, 1-12.
- Kaya H, Ceiebi S, Macit M and Geyikoigu F**, 2011. The effects of raw and physically processed common Vetch seed (*Vicia sativa*) on laying performance, egg quality, metabolic parameters and liver histopathology of laying hens. Asian-Australasian Journal of Animal Science, 24, 10, 1425-1434.
- Kwari ID**, 2009. Evaluation of sorrel (*Hibiscus sabbdariffa*) seed meal as an alternative protein source in the diet of domestic chickens. Thesis for PhD, Department of Animal Science, University of Maiduguri, Maiduguri, Borno State, Nigeria.
- Laudadio V and Tufarelli V**, 2012. Effect of treated field pea (*Pisum sativum L. cv spirale*) as substitute for soya beans extracted meal in wheat middlings-based diet on egg production and quality of early laying brown hens. Arch. Geflugelk, 76, 1, 1 - 5.
- Paузenga U**, 1985. Feeding parent stock. Zootechnia International, 22- 25.
- Ragab HI, Abdel ati KA, Kijora C and Ibrahim S**, 2012. Effect of different levels of the processed *Lablab purpureus* seeds on laying performance, egg quality and serum parameters. International Journal of Poultry Science, 11, 131-137.
- Sola- Ojo FE, Bolus SA and Usman TO**, 2011. Performance evaluation of layers fed baobab (*Adansonia digitata*) seed-meal based diets. Journal of Applied Agricultural Research, 3, 113-122.
- Statistix**, 2003. Statistix for windows manual. Analytical Software. Version 8.0.
- Tuleun CD, Carew SN and Ajiji I**, 2008. Feeding value of velvet bean (*Mucuna utilis*) for laying hens. Livestock Research for Rural Development, 20, 81, <http://www.Irrd2015/tule2008l.htm> retrieved 7 August, 2013.
- Wang LC, Weng C, Jiang ZY and Zhou YM**, 2012. Evaluation of partial replacement of high- protein feedstuffs with fermented soybean meal in broiler diets. Journal of Applied Poultry Research, 21, 849-855.

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Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows, IXth International Conference on Production Diseases in Farm Animals, September 11-14, Berlin, Germany.

Thesis:

Hristova D, 2013. Investigation on genetic diversity in local sheep breeds using DNA markers. Thesis for PhD, Trakia University, Stara Zagora, Bulgaria, (Bg).

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